Oral Health Beliefs as Predictors of Behavior:
Formative Research for Oral Health Campaigns in South Africa

A dissertation presented to
the faculty of
the Scripps College of Communication of Ohio University

In partial fulfillment
of the requirements for the degree
Doctor of Philosophy

Stellina M. Aubuchon Chapman

December 2013

© 2013 Stellina M. Aubuchon Chapman. All Rights Reserved
This dissertation titled

Oral Health Beliefs as Predictors of Behavior:
Formative Research for Oral Health Campaigns in South Africa

by

STELLINA M. AUBUCHON CHAPMAN

has been approved for
the School of Communication Studies
and the Scripps College of Communications by

Benjamin R. Bates
Associate Professor of Communication Studies

Amy E. Chadwick
Assistant Professor of Communication Studies

Scott Titsworth
Dean, Scripps College of Communication
CHAPMAN, STELLINA M.A., Ph.D., December 2013, Communication Studies

Oral Health Beliefs as Predictors of Behavior: Formative Research for Oral Health Campaigns in South Africa

Director of Dissertation: Benjamin R. Bates

Worldwide, oral diseases (e.g., cavities, gum diseases, etc.) are major public health problems. Research has shown that individuals’ beliefs and perceptions can influence behavior. Identifying individuals’ beliefs and perceptions that influence oral hygiene behaviors may pave the way towards understanding these oral health and hygiene behaviors. Little is known about South Africans’ oral hygiene behaviors and their cultural beliefs that surround these behaviors. Most available research on oral hygiene in developing countries relates to behaviors from the Western dental system. Thus there is a gap in data on the South African population regarding the oral health beliefs that surround both their indigenous and adopted Western behaviors. This dissertation research sought to validate the use of an Oral Health Beliefs Survey (OHBS) that assesses South Africans’ oral health and hygiene beliefs within the constructs of the health belief model (HBM). Additionally, this study examines individual level variables to determine whether HBM constructs are associated with oral health and hygiene behaviors of South Africans. This exploratory study is the first step at establishing a framework for understanding current perceptions about oral health and hygiene in South Africa, as well as determining what factor(s) influence(s) the ability to practice healthier oral health behaviors. Findings from this study will be helpful in guiding future research and health communication campaigns on oral health and hygiene in South Africa.
Suggestions for future researchers include taking either a structure-centered or culture-centered approach to uncover how culture shapes oral health-related beliefs and behaviors.
ACKNOWLEDGMENTS

As the end of my dissertation research draws near, I am filled with many emotions. I think back to before I began the doctoral program at Ohio University. I hear my parents telling me to enjoy the process because while it might seem like a long road ahead of me, the time will fly by. Once again, my parents were right; time has surely flown by.

I have so many people to thank for my helping me get to the point where I am today; more people than I can express in this acknowledgement section. The past three years of my doctoral career have provided me with the opportunities to learn and grow from some of the most accomplished professors in the communication, health, and education fields. Words cannot express the amount of sincere gratitude that I have for all the teachers who have influenced and supported my educational journey. To my dissertation committee members who inspired and challenged me through the dissertation process: Drs. Benjamin Bates, Amy Chadwick, Yea-Wen Chen, Yegan Pillay, and Jen Nickelson, in your own unique ways, each of you have influenced my doctoral study.

As a graduate student, it is common to feel that you are not always in control of your educational path or your research endeavors. At times of uncertainty and doubt, Dr. Bates always knew what to say or do to give me the confidence I needed. He always has the best interest of his students in mind and under his wing, I know I received the best advice, guidance, support, and teachings possible. Dr. Bates also has helped me to understand what it means to “celebrate knowledge” as I have grown and transitioned through each stage of my doctoral career; sometimes it is the small things that educators do that make largest impacts on their students’ lives and careers. I will always look up to
and admire Dr. Bates for his honest feedback and empowering advising style. You supported my ambition to extend my research to the international community, allowing me to take on an online class so that I could learn how to evolve with the new-found trends of education, as well as grow as a researcher in a new environment abroad. Thank you Dr. Bates, my advisor and dissertation chair, for believing in me, for supporting my each and every career move, and for helping me learn from my mistakes; because of you, I feel confident that I can and will succeed in any work or research environment.

I owe my statistical training to both Drs. Chadwick and Nickelson. First, Dr. Chadwick, my co-advisor and mentor, you have pushed me to learn and explore data. It was the year that I spent as your research assistant that I really began to love evaluating data. From your campaigns class, my independent teaching seminars in health communication, and our weekly research meetings, I always walked away knowing I learned a lot and I could always apply this new knowledge to my research and teachings. Thank you for always pushing me to discover new ways to look at the data and for encouraging me to follow my career dreams in campaign work. Dr. Nickelson, we have been a team for quite a while now! From the time you began to mentor me on ways to improve my thesis research and expand these ideas to higher levels. I knew you must be a part of my dissertation research. You have so much to offer in terms of knowledge and guidance, as well as emotional encouragement. Your excitement for research is contagious and motivates me to never stop learning. You showed me how I could branch out from health education/health promotion and extend this knowledge to the health communication arena. I am forever fortunate to have you as a mentor and friend.
Drs. Chen and Pillay, I must thank both of you for my knowledge of culture and for helping me refine my research instrument for use in South Africa. Dr. Chen, your passion to motivate and educate students taught me to use a critical lens in the beginning stages of my research. I am fortunate to have taken your cultural communication course and I am constantly gauging my reflexivity both during and after my study. Dr. Pillay, we sure did have fun in South Africa. My experiences abroad under your direction were both rewarding and unforgettable—from learning the culture and communication practices among different communities of people, as well as the history and educational systems in South Africa. Not many students can say they have international research experience for their dissertation and I am fortunate that you allowed me the opportunity to grow and learn in a country that I now hold dear to my heart. I have you, the School of Communication Studies, and the Patton College of Education to thank for these opportunities.

In addition to my committee, I also want to extend my sincere gratitude to the Nelson Mandela Metropolitan University campus in South Africa: Thank you for your ongoing support and encouragement during my studies in Port Elizabeth. Uncertainty comes with research studies of all kinds—both for the researcher and the participants. I am forever thankful to those individuals who were skeptical of my research, challenging me to understand the various dilemmas (including ethical ones) that fall hand-in-hand with research studies.

I would also like to acknowledge a few individuals in the School of Communication Studies who have contributed to my success at OU. Gayle McKerrow and Heather Grove for having the ability to fix problems and facilitate solutions without
blinking. Dr. Beck, your upbeat energy and love for your research made me learn early on how important it is to “play” with data and research and to never be afraid to study what interests you most. Dr. Miller and Dr. Titsworth, thank you for making it possible for me to study and teach outside the wall of Athens, Ohio; I am forever grateful for these experiences and opportunities.

I cannot go without thanking all my family and friends for sticking out my graduate career with me. To the Fall 2010 cohort, we are rock stars who together, celebrated the knowledge that Dr. Bates (and the Communication Studies Program) lit in each of us. To my brother, Billy, my soon-to-be sister-in-law, Justine, as well as all my childhood, college, and graduate school friends, each of you have been a consistent support system throughout my entire educational career. Each of you know exactly how to put my life in perspective and make sure that I know how important it is to enjoy the small things in life that matter most. To my parents, William and Lilly Aubuchon, thank you for your ongoing support, motivating me to continue out this dream to pursue my doctoral degree in Communications. Some of the most important things that I’ve learned was not though school systems and textbooks, it was through your life lessons and teachings. It is your love and support coupled with your drive to push me to my highest limits that have contributed to me becoming the woman that I am today.

Last, and certainly not least, to my loving, and newly-wedded husband, Aaron. Aaron, you deserve an honorary Ph.D. for putting up with me and all my stressful moments over the last three graduate degrees. You always knew what to do to make me realize that when the going gets tough, I need to be even tougher; your tough-love mentality got me through the hard times and your sweet surprises made each small
victory even more worthy of celebration. Your willingness and ability to shoulder me
and my data “nightmares” while I finished writing my dissertation and planned our
wedding, continues to amaze me. Our love for life and learning is strong and together we
are unstoppable. I cannot wait to see what our future holds, together.
TABLE OF CONTENTS

Abstract ........................................................................................................................................ iii
Acknowledgments .......................................................................................................................... v
List of Tables .................................................................................................................................. xii
List of Figures .............................................................................................................................. xiii
Chapter 1: Problem Statement ................................................................................................. 1
  Background on South Africa ........................................................................................................ 4
    Race ....................................................................................................................................... 5
    Socio-economic status ............................................................................................................ 10
    Province and residence ......................................................................................................... 13
  Purpose ..................................................................................................................................... 14
  Significance of the Study ......................................................................................................... 17
  Present Research Questions ................................................................................................. 18
  Conceptual Framework ............................................................................................................ 18
  Overview ................................................................................................................................... 19
Chapter Two: Review of Literature and Theoretical Framework ........................................... 20
  Oral Health, Oral Hygiene, and Theory .................................................................................. 20
    Health belief model ............................................................................................................... 22
    HBM and Africa .................................................................................................................... 32
    Toothbrush .......................................................................................................................... 35
    Dental floss .......................................................................................................................... 35
    Dental exams ....................................................................................................................... 36
    Chewing stick ....................................................................................................................... 36
    Toothpick ............................................................................................................................. 38
    Smoking behavior ............................................................................................................... 40
Chapter 3: Methodology ............................................................................................................ 55
  Original Instrument: Oral Health Beliefs Survey .................................................................. 55
    Scale development ............................................................................................................... 57
    South African Research ...................................................................................................... 62
    Preliminary study ............................................................................................................... 62
    Data collection .................................................................................................................... 71
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Challenges</td>
<td>95</td>
</tr>
<tr>
<td>Delimitations</td>
<td>98</td>
</tr>
<tr>
<td>Data screening and cleaning</td>
<td>98</td>
</tr>
<tr>
<td>Data analysis</td>
<td>112</td>
</tr>
<tr>
<td>Intellectual Merit</td>
<td>130</td>
</tr>
<tr>
<td>Chapter 4: Results</td>
<td>132</td>
</tr>
<tr>
<td>Research Question 1</td>
<td>132</td>
</tr>
<tr>
<td>Tooth brushing behavior</td>
<td>132</td>
</tr>
<tr>
<td>Flossing behavior</td>
<td>133</td>
</tr>
<tr>
<td>Routine dental exams</td>
<td>135</td>
</tr>
<tr>
<td>Toothpick behavior</td>
<td>138</td>
</tr>
<tr>
<td>Research Question 2</td>
<td>140</td>
</tr>
<tr>
<td>Research Question 3</td>
<td>142</td>
</tr>
<tr>
<td>Tooth brushing behavior</td>
<td>144</td>
</tr>
<tr>
<td>Flossing behavior</td>
<td>146</td>
</tr>
<tr>
<td>Routine dental exams</td>
<td>148</td>
</tr>
<tr>
<td>Toothpick behavior</td>
<td>150</td>
</tr>
<tr>
<td>Research Question 4</td>
<td>153</td>
</tr>
<tr>
<td>Research Question 5</td>
<td>162</td>
</tr>
<tr>
<td>Research Question 6</td>
<td>164</td>
</tr>
<tr>
<td>Chapter 5: Discussion</td>
<td>172</td>
</tr>
<tr>
<td>Review of Procedures</td>
<td>172</td>
</tr>
<tr>
<td>Summary of Results and Implications</td>
<td>174</td>
</tr>
<tr>
<td>Research question 1</td>
<td>174</td>
</tr>
<tr>
<td>Research question 2</td>
<td>183</td>
</tr>
<tr>
<td>Research question 3</td>
<td>187</td>
</tr>
<tr>
<td>Research question 4</td>
<td>191</td>
</tr>
<tr>
<td>Research question 5</td>
<td>200</td>
</tr>
<tr>
<td>Research question 6</td>
<td>204</td>
</tr>
<tr>
<td>Data Collection in a Foreign Country</td>
<td>210</td>
</tr>
<tr>
<td>Benefits</td>
<td>211</td>
</tr>
</tbody>
</table>
LIST OF TABLES

Table 3.1 Question topics and number of items that assess each topic in the adopted version of OHBS in the South African population ............................................................75
Table 3.2 Basic Demographics of Survey Participants .................................................................121
Table 4.1 Research Question 1: Tooth Brushing Behavior Frequency .........................................133
Table 4.2 Research Question 1: Flossing Behavior Frequency .....................................................134
Table 4.3 Research Question 1: Routine Dental Exam Frequency (original code) .........................136
Table 4.4 Research Question 1: Routine Dental Exam Frequency (recode for other) ....................137
Table 4.5 Research Question 1: Toothpick Behavior Frequency ................................................139
Table 4.6 Grading Information for South African vs. U.S. Grading Scales ..................................141
Table 4.7 Research Question 3: HBM Oral Hygiene Data Correlations among Brushing Behavior and Regression Independent Variables ...........................................145
Table 4.8 Research Question 3: Independent Variables Multiple Regression on Brushing Behavior .................................................................................................................146
Table 4.9 Research Question 3: HBM Oral Hygiene Data Correlations among Flossing Behavior and Regression Independent Variables .................................147
Table 4.10 Research Question 3: Independent Variables Multiple Regression on Flossing Behavior .................................................................................................................147
Table 4.11 Research Question 3: HBM Oral Hygiene Data Correlations among Routine Dental Exam Behavior and Regression Independent Variables ......................149
Table 4.12 Research Question 3: Independent Variables Multiple Regression on Routine Dental Exam Behavior .................................................................................................150
Table 4.13 Research Question 3: HBM Oral Hygiene Data Correlations among Toothpick Behavior and Regression Independent Variables ........................................ 152
Table 4.14 Research Question 3: Independent Variables Multiple Regression on Toothpick Behavior .................................................................................................................152
LIST OF FIGURES

Figure 1.1 Health Belief Model Components and Linkages........................................15

Figure 5.1 Discussion of Research Question 4: Correlations among Recommended and Non-Recommended Knowledge and HBM variables.................................194

Figure 5.2 Discussion of Research Question 4: Correlations among Recommended Knowledge and HBM variables.................................................................198
CHAPTER 1: PROBLEM STATEMENT

Despite the vast improvements and innovations in oral health technology and practices, oral health diseases remain a problem globally. As Professor Poul Erik Petersen, director of the World Health Organization’s (WHO) Oral Health Programme, states, “Given their prevalence worldwide, oral diseases are major public health problems. Their impact on individuals and communities in terms of pain and suffering, functional impairment and reduced quality of life is considerable” (2004, p. 12). Among the adult population, oral health problems (e.g., cavities, gum disease, etc.) are prevalent in both Western countries, like the United States of America, and non-Western countries, such as South Africa. For example, nearly one out of five U.S. adults aged 65 years and older have lost all of their natural teeth due to oral diseases (Centers for Disease Control and Prevention, 2008 [CDC]) that are preventable through recommended oral health behaviors (Ndiokwelu, 2004) and oral health education (Broadbent, Thomson, & Poulton, 2006). Additionally, the CDC (2007) estimated that from 1999-2004, the mean decay missing and filled teeth (DMFT) score for American adults aged 35-49 years was nearly 11; a DMFT score reflects how many teeth are decayed, missing, and/or filled. A DMFT score of 11 means that 11 permanent teeth are infected with or affected by decay, and/or are missing entirely (Dye et al., 2007).

The DMFT score for adults aged 35-49 years in South Africa, a non-Western country, is essentially unknown (Petersen, 2004; van Wyk & van Wyk, 2004). The majority of research in South Africa surrounds the oral health of children and young adolescents; there is a gap in the knowledge base on adults’ oral hygiene in this country (Petersen, 2004; van Wyk & van Wyk). Additionally, there is little literature and
research concerning non-recommended traditional dental practices and dental systems in African countries. Non-recommended behaviors include oral hygiene behaviors that are not suggested as a standard practice by the South African Dental Association (2012). Most literature covers the emerging Western dental systems (behaviors and practices) in many developing countries within Africa (Willis & Bothun, 2011); thus a gap in available data remains unfilled among the South African population regarding the oral health beliefs that surround both their traditional and adopted Western behaviors. Western behaviors are known as brushing the teeth, flossing the teeth, and going to the dentist; these three behaviors have recommendations and guidelines set by oral hygiene organizations (e.g., the South African Dental Association). Throughout this paper, these three behaviors are referred to as recommended behaviors. Behaviors that are not recommended by or have guidelines set by an oral hygiene organization (e.g., the South African Dental Association) are referred to as non-recommended behaviors. Non-recommended behaviors include using a chewing stick and using a toothpick to clean the teeth and gums.

Identifying individuals’ beliefs and perceptions that influence adult oral hygiene behaviors may pave the way towards understanding unique oral health behaviors (see Hochbaum, 1958; I. M. Rosenstock, 1974). From a research standpoint, these beliefs can be the focus of future health campaigns that aim to increase awareness of healthy oral health behaviors and of the risk factors associated with oral diseases. These campaigns could also aid in improving the overall quality of life among the target population.

The WHO (2011) defines oral health as:
Being free of chronic mouth and facial pain, oral and throat cancer, oral sores, birth defects such as cleft lip and palate, periodontal (gum) disease, tooth decay and tooth loss, and other diseases and disorders that affect the mouth and oral cavity. (para. 1)

In addition, oral health has been found to be a reliable measure of one’s general health (Petersen & Yamamoto, 2005; U.S. Department of Health and Human Services, 2000 [USDHHS]). Specific behaviors can be influenced by particular health beliefs (e.g., perceived threat, perceived barriers; Janz, Champion, & Strecher, 2002). From an oral health standpoint, it may be possible that healthy oral hygiene behaviors (e.g., brushing the teeth and routine dental visits) are influenced by specific health beliefs (e.g., perceived threat, perceived efficacy, and barriers).

Furthermore, these behaviors and beliefs can also be shaped by one’s culture (Witte & Morrison, 1995). Ting-Toomey (2005) defines culture as a “learned system of meanings that fosters a particular sense of shared identity and community among its group members,” a “complex frame of reference that consists of patterns of traditions, beliefs, values, norms, symbols, and meanings that are shared to varying degrees by interacting members of a community” (pp.71-72). While Ting-Toomey stresses how culture shapes beliefs, Dutta-Bergman (2005) adds that individual perceptions are influenced by a learned systems of meaning—stressing that structure, as well as culture, shapes perceptions. Each of these factors (e.g., structure, culture) affects behavior and influences behavior change.

Due to multiple levels of change, each component of culture and cultural understanding can be influenced by a variety of contexts, including structural and
individualistic contexts (M. J. Dutta-Bergman, 2005). For example, a health campaign on sexually transmitted infections could focus on the interpersonal level of change since this behavior occurs between two people. Likewise, a school nutrition campaign might focus on the structural changes within the school system or even branch out to the familial level to target changes made at home. Furthermore, a campaign that focuses on increasing the number of stop signs in a neighborhood focuses on local community or governmental change. In the case of oral hygiene, it is appropriate to address individual level variables for individual level change.

**Background on South Africa**

South Africa is a country full of rich cultural, socio-political, and ethnic systems that may aid in shaping health beliefs—specifically oral health beliefs. Cultural beliefs are important because of their influence on an individual; these learned systems of meaning may aid in shaping individual behavior. Thus, uncovering individual cultural beliefs that surround oral hygiene may shed light on the oral hygiene behaviors among South Africans.

South Africa is a developing country that has faced unique challenges, including increases in population growth and unemployment rates, which have consequently lead to the rise of poverty rates within this country. Since the early 1900s, South Africa has endured a history of racial inequalities and segregation (AVERT, 2011). In modern day South Africa, class often divides populations of people, further complicating the topic of discrimination among this population.
**Race.** In the South African context, Posel (2010) defines race as the “social construction of bodily difference, practices that have been inseparable from other faultlines of difference and repertoires of power” (p. 161). Posel’s definition of race is fitting for South Africa because of this country’s immense history of racial inequalities that began before the Apartheid movement and have continued into the present day. The paragraphs that follow will outline and describe race and the racial inequalities that South Africans experienced throughout South African history.

From before 1910 through 1941, the South African government continually conflated race, nationality, and ethnicity (Moultrie & Dorrington, 2012). Much of the history surrounding race surrounds the South African Government censuses. The South African Government used racial classification, as described by Khalfani and Zuberi (2001), as “a tool in its official state policies to control its population” (p. 161). That is, local government determined the racial identity for both individuals and households prior to census data collection. Khalfani and Zuberi (2001) described that during this time in South African history, “the state imposed its own racialised ideas on the enumeration process” (p. 167). The racial classifications during this time included Europeans, Natives, Asiatic, and Coloureds (Khalfani & Zuberi, 2001; Posel, 2010). Asiatic is referred to by Moultrie and Dorrington (2012) as the “natives of Asia and their descendants, mainly Indians and Pakistani, with a few thousand Chinese, and small numbers of various other Asiatic nationalities” (p. 1453). If the individual filling out the census form classified their race as one that did not match the enumerator’s or supervisor’s opinion of that individual’s race, the enumerator was responsible for transferring their data to the correct race form before census tabulation could take place.
The grounds for reassigning one’s race were based on one’s appearance, behavior, and social acceptance within a racial group (Khalfani & Zuberi, 2001; Moultrie & Dorrington, 2012). In all, the state governments gave the illusion of allowing individuals the freedom of self-classification of their race, while in actuality they imposed their own opinions of race, thus affecting the population data (Khalfani & Zuberi, 2001).

To fully understand South African culture, it is important to comprehend the history behind the evolution of each race group. Coloured race evolved from acts of violence before and during the Apartheid movement. This issue is rarely found in text but is well-known throughout South African history. In 1652, during the colonial period, the Dutch settlers were known to have raped black South African women (Jenkins, 2008); in the late 1700s, British settlers were also known to have raped black South African women, contributing to the development of the “mixed-blood, the ‘coloured’” race in South Africa (Gutto, 2001, p. 152). As far as the coloured racial category found on the South African censuses, coloured, or often noted as coloured and mixed races, represented all persons not classified as a white, native, or Asiatic. The vast majority of those individuals represented in this group included the coloured, persons of mixed white blood, and persons of non-white blood (Khalfani & Zuberi, 2001; Moultrie & Dorrington, 2012). Throughout the 1900s, there was a major disconnect concerning rights of the coloured group; being that they were not “black enough” or “white enough” (Adhikari, 2006, p. 472). In the 1930s, the coloured race moved to assimilate towards their affiliations with whiteness (i.e., conformity with Whites’ values and practices), in hopes to move towards being accepted in the dominant, white society. Before 1948, the
coloured race was known to have rights similar to those of the white people (Khalfani & Zuberi). That is, the coloured race experienced the racial hierarchy in South Africa as a three-tiered system. Being coloured was seen as an intermediate status; whites being the superior race, blacks being the inferior race. As far as education, coloured people recognized that they were not fit to be taught within white schools but were “too good to be taught with African children” (Adhikari, p. 478).

By the 1950s, the legislative basis of Apartheid was formed in South Africa (Khalfani & Zuberi, 2001). Under the legislative branch of government, two new policies had an important impact on racial classification during this time: the Population Registration Act and the Group Area Act. These acts allocated 80% of the land to whites. All non-whites, including coloureds were required to carry a document allowing their visit to the restricted white-only areas (Khalfani & Zuberi). Although they were once seen as an intermediate race, coloureds lacked significant economic and political power as a race; “under white minority rule, the coloured community had no meaningful leverage to bring about change in the society, to reform it or to influence the way in which it was governed” (Adhikari, p. 485).

In addition to inequality for the coloured race, other non-white races also experienced unfairness in South African society due to the Population Registration Act and the Group Area Act (Khalfani & Zuberi, 2001). Under these acts, each South African person was assigned an identity number. Benjamin Pogrund, author of the book, *How can man die better…: Sobukwe and Apartheid*, writes about the experiences he and his friend, Robert Mangaliso Sobukwe, had with racial issues that South Africans faced during Apartheid. Pogrund (1990) writes about the Population Registration Act,
specifically the identity numbers that determined one’s fate as a South African. He claims:

Those vital two digits [racial identity number] were intended to, and did, affect life from birth to death, with every detail specified and fixed by law: in which hospital you could born; in which suburb you could live; which house you could buy; which farm you could buy; which nursery school and school you could attend and which university or technical college… (p. 79)

Nearly every aspect of life in South Africa during the 1950s appeared to be regulated and controlled by race. Race served to limit or make available the opportunities and resources available for an individual during the Apartheid.

Racial identity numbers included those for the following racial classifications: White South African, Coloured, Malay, Chinese, Asian, a plethora of indigenous ethnic groups, as well as a category for “Other Asian” and “Other coloured” (Pogrund, p. 79).

The South African colonial administration at this time felt that the social context of being “generally accepted” was the deciding factor between populations groups (Khalfani & Zuberi, 2001, p. 168). The administration (i.e., administration of white settlers) was more concerned with ‘white supremacy’, an effort to “keep ‘White’ identity separate from that of other races” (Khalfani & Zuberi, p. 168). Needless to say, race at this time reflected “a history of governmental policies of racial discrimination in southern Africa” (Khalfani & Zuberi, 2001, p. 168).

Under the Apartheid laws, non-whites had limited access to health care, including oral health care. In 1994, the country broke away from the Apartheid laws, drafting a new constitution that relaxed laws that segregated whites from non-whites (AVERT,
Although the South African Government stopped assigning racial identity numbers to citizens after the end of the Apartheid, even present day South Africa remains fractured by race (Adhikari, 2006; Khalfani & Zuberi, 2001). Currently, a limited amount of economic opportunities (e.g., employment, education, benefits, etc.) within South Africa have caused a shift from inequalities between racial groups to inequalities within racial groups (Van Der Westhuizen, 2012). Limited employment can then lead to financial burdens, making it harder for individuals to purchase items necessary to maintain positive oral health. Furthermore, due to the financial burdens that many South Africans face, children often drop out of school in order to contribute to the family’s income. Limited education can lead to literacy issues. In turn “health literacy level potentially mediates disparities between blacks and whites” and can have an effect on oral health behaviors (Berkman, et al., 2011 ). Moreover, in a country immersed in inequalities and poverty, insurance or medical aid is often seen as a luxury item. Likewise, South Africans are often unconcerned about oral care because of the other greater concerns that they face in their everyday lives, including access to adequate food and water, as well as protecting their home from environmental disasters such as floods and strong winds (AVERT, 2011). As such medical aid in present day South Africa includes full or partial coverage of dental treatments (including cleanings) among all South Africans (i.e., socialized medicine; Department of Health Republic of South Africa, 2013). Furthermore, South Africa has a national oral health plan; this plan aims to strengthen the quality of oral health care in South Africa, as well as access to oral health care by overcoming environmental and social barriers to health care (Myburgh, Hobdell, & Laloo, 2004; Sambo, 2009).
**Socio-economic status.** Social class, also known as socio-economic status (SES), is a complicated topic in the South African context, as class and race are often interwoven in contemporary South Africa (Seekings, 2008a). Despite “deracialisation of public policy and the criminalization of racial discrimination” in post-Apartheid South Africa, segregation remains widespread among groups of individuals (Seekings, 2008b, p. 40). Unlike during the Apartheid period when individuals were discriminated upon based on their race, discrimination in present day South Africa mostly concerns social class (Seekings, 2008a). Social class and race do, though, coincide; one’s class is often determined by the opportunities available to them, including education, employment, and living conditions; these opportunities can be limited due to one’s race (Felix, Dornbrack, & Scheckle, 2008). It should be said that social class in South Africa is stratified by race; thus social class perpetuates economic inequalities (Felix, et al., 2008; Seekings, 2008a, 2008b). The following paragraphs outline what SES is, how it is determined, and describe the different tiers of SES in South Africa.

South African SES can be measured in two different ways. First, SES can be determined by using a principal components analysis (PCA; Vyas & Kumaranayake, 2006)\(^1\) which is a composite of variables including the quality of one’s home (e.g., lighting source, access to safe drinking water, type of roof and wall materials, etc.), parental education, and one’s possessions (e.g., ownership of car, livestock, etc.; Ataguba, Akazili, & McIntyre, 2011). Populations are divided into quintiles that range from lowest to highest SES (Ataguba, et al.). SES can also be measured on a continuum

---

\(^1\) PCA refers to using asset data to create socio-economic status (SES) guides that are used to measure and describe SES differentiation within a population (Vyas & Kumaranayake, 2006).
based on household income per annum; levels include: 1.) Less than R6,001 (i.e., less than $665), 2.) R6,001-R12,000 (i.e., $665-1,330), 3.) R12,001-R24,000 (i.e., $1,130-2,662), 4.) R24,001-R60,000 (i.e., $2,662-6,653), 5.) R60,000 -R120,000 (i.e., $6,654 -$13,306), and 6.) More than R120,000 (i.e., more than $13,307; Ligthelm & Jonkheid, 2009). The first three tiers represent the lower class to working class while the upper three tiers represent the middle, upper middle, and upper class, respectively (Carter & May, 1999). For the most part, the lower half of the SES continuum represents the black and coloured races; the middle-class tier is known as the multi-racial class, as it is comprised or African, Indian, and whites (Seekings, 2008a). Last, the two highest classes are dominated by the white race, yielding white privilege and supremacy in South Africa (Felix, et al., 2008; Seekings, 2008a, 2008b).

Neighborhoods of individuals are stratified by different social classes. Although the Group Area Act ceased to exist after the end of the Apartheid movement, housing choices remain limited due to economic inequalities. For example, the high price of land and houses in suburban areas (e.g., middle-class and higher neighborhoods where the majority of white South African families reside) makes it difficult for lower income families to reside in these areas (Felix, et al., 2008). Additionally, South Africans who can afford to live in higher-end neighborhoods typically fall within either the middle and upper level SES income classes. Individuals within these social classes are known to hold higher levels of education and are able to obtain better jobs with higher pay and benefits, as compared to more rural area, working-class adults who are less educated and fall within the lower SES brackets (Felix, et al.; Seekings, 2008a).
Likewise, better schools and education systems are found in higher SES suburbs; children who attend these schools receive better quality education by well-educated teachers, attend classes in well-maintained building, with amenities such as computer labs (Felix, et al., 2008). Furthermore, parents with middle to upper SES are often able to assist their children with homework at the end of the day and help them learn in conjunction with school since they generally come from educated backgrounds. A child that grows up in such an environment is provided with more resources to be successful later in life; higher quality education can translate into a larger skill set and knowledge base which makes these children more likely to hold higher-paying jobs later in life (Felix, et al.). Thus, living in a middle-class suburb provides opportunities for future growth and success in South Africa (Felix, et al.; Seekings, 2008a).

As mentioned above, a direct relationship exists between social class and education level (Felix, et al., 2008; Seekings, 2008a). Furthermore, racialized and classed notions inform education systems thereby perpetuating inequality. That is, lower classes generally consist of the black and coloured races. Blacks generally hold the lowest SES, are generally unemployed or do high labor jobs for cheap wages, and reside in areas known as townships (Carter & May, 1999; Felix, et al.). Township homes are known as shacks and may not have electricity or plumbing (Felix, et al.).

Next, working-class individuals typically consist of the coloured race; these individuals live in better areas as compared to townships, and usually receive aid and housing from the government. The quality of education in the townships is lower compared to the government-assisted schools in the coloured neighborhoods. Township school systems are more run down and have fewer resources (e.g., computers, printers,
playgrounds, etc.) available for students (Seekings, 2008a). Learners in the township schools receive the lowest quality education from less-educated teachers. Large class sizes with as many as 51 learners to one teacher are common. On the other hand, schools in the working-class communities (e.g., government-assisted schools) provide an environment that is more conducive for learning; these building are better maintained have more resources (e.g., computers and printers); class sizes do not exceed 31 learners per classroom (Felix, et al.). Furthermore, parents in the working class typically hold blue-collar jobs and can often read and write. Parents are able to better assist their children with homework as compared to lower SES parents. A child that grows up in the working class, as compared to lower class, has more opportunities to be successful later in life, but is very limited as compared to the middle to upper classes (Felix, et al.; Seekings, 2008a).

Seekings (2008a) argues that, since the end of Apartheid, “persistent racial inequalities reflect class stratification rather than racial discrimination” in South Africa (p. 2); opportunities for individuals to move into better, higher-paying occupations has expanded over the past few decades, resulting in the growth of the African middle class (Seekings, 2008a, 2008b). Overall, as South Africa digresses from Apartheid ways, discrimination in terms of race lessens and social class becomes increasingly important (Felix, et al., 2008; Seekings, 2008a, 2008b).

**Province and residence.** Nine provinces make up the country of South Africa. Provinces are similar to states in the United States, as each has its own capital and regional government. South Africa’s provinces are the Eastern Cape, Northern Cape, Western Cape, North West, Free State, Gauteng, KwaZulu-Natal, Limpopo, and
Each province is unique in that they each have languages that are specific to that area, their own distinctive agriculture, vegetation, and climate, as well as specific industries that provide area jobs which support growth and economic development within the province (van Niekerk, 2012b). For instance, the second largest province, the Eastern Cape (population 6.5 million people; main province studied among the present research), lies across the south-eastern South African coast. The Eastern Cape is known for its agriculture, including sheep farming, fertile land, and dense indigenous forests which yield enormous fruit production. This province is home to three major universities, including the Nelson Mandela Metropolitan University. The industrial sectors within the Eastern Cape provides infrastructures which create jobs and expand this economy; industries include the automotive sector, forestry and timber, pharmaceuticals, and capital goods (van Niekerk, 2012b).

**Purpose**

This study presents the opportunity to examine the South African population and culture in order to identify specific health beliefs that surround oral health and oral hygiene behaviors. The Health Belief Model (HBM; Hochbaum, 1954; Rosenstock, 1974) serves as the theoretical framework for the present research study. The oral hygiene behaviors that will be assessed among the South African population include brushing the teeth, flossing the teeth, use of a chewing stick, use of a toothpick, and visiting the dentist. The present research may allow us to get one step closer to determining how beliefs influence oral hygiene behavior(s) and one’s readiness to change one’s behavior(s) (Rimer & Glanz, 2005) in the South African context.
Presented in 1950 by Godfrey Hochbaum, Irwin Rosenstock, and Stephen Kegels, and adopted by the United States in 1970 by the United States Public Health Service, the HBM is a “value-expectancy theory” (N. K. Janz, Champion, & Strecher, 2002b, p. 47) used to motivate people to make better decisions about their health (see Figure 1.1). Hochbaum and colleagues hypothesized that individuals would be more compelled to make better health decisions if they thought they were susceptible to an illness/health

---

The HBM is divided into three main categories: Individual perceptions, modifying factors, and likelihood of action. Perceptions relate to the individual’s beliefs about a behavior and the outcomes they could have, including perceived susceptibility and perceived severity. Modifying Factors, including age, sex, ethnicity, socioeconomics, knowledge, personality, perceived threat, and cues to action, affect individual beliefs’ thus, indirectly influencing health behaviors. The combination of perceived susceptibility and severity has their own impact on the modifying factor, perceived threat. Together, the individual perceptions and modifying factors lead to the likelihood of action. If cues to action and perceived threat alone do not influence behavior change, it is vital for the individual to complete a cost benefit analysis of the benefits and the barriers to taking action. In all, the HBM is a value-expectancy theory which predicts that individuals will take action to prevent or control for a negative health outcome if they believe themselves to be susceptible to the condition, believe the condition has serious consequences, see taking action to be beneficial in reducing their susceptibility to or severity of the health condition, and believes that the benefits to taking action outweigh the anticipated barriers to care. Adopted from: HBM [Diagram]. The health belief model. (p. 52), by Janz, N. K., Champion, V. L., & Strecher, V. J. (2002). In K. Glanz, B. K. Rimel & F. M. Lewis
behavior outcome and believed there was a benefit to early detection (Hochbaum, 1954; I. M. Rosenstock, 1974).

The HBM is a theoretical framework that functions on an intrapersonal level in order to determine what factors encourage or discourage an individual to change his/her behavior. Six constructs help determine what “influence[s] people’s decisions about whether to take action to prevent, screen for, and control illness” (Rimer & Glanz, 2005, p. 14); prospective constructs are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action. The sixth construct, self-efficacy, was added to the model at a later time (Hochbaum, 1954; I. M. Rosenstock, 1974).

Perceived susceptibility refers to beliefs about the likelihood of developing a health condition. Perceived severity is the belief about the seriousness of the health condition, as well as its consequences. Coupling perceived susceptibility with perceived severity determines an individual’s perceived threat towards a health condition. The perceived benefits construct of HBM represents the individual’s “beliefs about the effectiveness of taking action to reduce risk or seriousness” (Rimer & Glanz, 2005, p. 14). Perceived barriers are their beliefs in relation to the effectiveness of taking action in order to decrease risk or seriousness of the health condition. Furthermore, cues to action are any factors that serve to activate change within the individual. Last, self-efficacy measures the individual’s confidence in their ability to take action and/or make the behavioral change. In other words, the HBM theorizes that beliefs about whether or not an individual is susceptible to a health condition, and their perceptions towards the benefits of trying to avoid a health problem, influence their readiness to act on behavior change messages (Rimer & Glanz).
As a theoretical framework, the HBM is ideal for analyzing the individual level of change. Using the HBM in this exploratory study allows us to establish a framework for understanding current perceptions about oral health and hygiene in South Africa, as well as to determine what factor(s) influence(s) the ability to practice healthier oral health behaviors. Understanding oral health perceptions will aid in the ability to target and improve the oral health status in South Africa through health communication efforts. Chapter 2 includes more explanation of the HBM.

**Significance of the Study**

Scholars have provided research on individual oral health knowledge and behaviors (J. Al-Ansari, Honkala, & Honkala, 2003; J. M. Al-Ansari, 2007; Kawamura, Ikeda-Nakaoka, & Sasahara, 2000; Kawamura, Takase, Sasahara, & Okada, 2008; Komabayashi, et al., 2005), but not beliefs. The majority of this research is limited to the Middle Eastern, Asian, and European countries, thus research on these topics in South Africa are lacking. The present research will help fill the gap in knowledge on oral health beliefs of a sample of South Africans. The South African population is worthy of study because of the uncertainty associated with risk factors and social and environmental determinants related to oral hygiene behaviors among the South African population (van Wyk & van Wyk, 2004). It is also valuable to study the South African population because of the limited information on the unique oral hygiene behaviors (e.g., chewing stick and toothpick) and the beliefs that surround these indigenous behaviors. Application of the HBM to the South African oral-hygiene-related beliefs may help provide insight into the participants’ unique oral health behaviors (Hollister & Anema, 2004).
The long-term goal of this project is to provide formative research for guiding future health communication campaigns on oral health and hygiene in South Africa. The short-term goals of this research project are to determine which beliefs about oral hygiene surround the South African region’s oral hygiene behaviors, as well as to identify the effects of these beliefs and perceptions on behavior.

**Present Research Questions**

Based on preliminary research, the central research questions for this study are examining the relationships exist among the four HBM variables (i.e., perceived benefits, perceived susceptibility, perceived severity, and perceived barriers) and (a) brushing behavior, (b) use of a chewing stick, (c) flossing behavior, (d) use of a toothpick, and (e) routine dental exams. It is also theorized that relationships exist among modifying factors, including knowledge and gender, and the five oral hygiene behaviors listed above. Once this research examines the beliefs that surround oral hygiene behavior in South Africa, we can identify what factors influence these behaviors. These efforts can inform future communication strategies and messages that might aid behavior change (Rimer & Glanz, 2005).

**Conceptual Framework**

The focus of this research is to uncover oral hygiene-related beliefs of South Africans and to understand if these beliefs influence behavior. Health communication scholars have argued that the HBM is a fitting model for uncovering individuals beliefs and behaviors because of its nature as an intrapersonal model (Hollister & Anema, 2004; Rimer & Glanz, 2005). Specifically, this proposal focuses on applying the HBM to oral-
health-related beliefs in an effort understand better the oral health behaviors of South Africans.

Overview

The following paragraph provides an overview of the chapters to follow within this research study. Chapter Two offers a review of the literature surrounding oral hygiene and HBM. Specifically, I draw on the South African context and explain the theoretical framework that guides this project. Chapter Three describes the quantitative research design plan I employed during the present research study; this chapter will describe in full my plan for data collection and analysis, as well as my commitment as a American-based student conducting research in the foreign country of South Africa. Chapter Four outlines the results and findings from this research study, answering the research questions introduced in Chapter Two. Chapter Five concludes this dissertation by providing readers with the conclusions of the study, the interpretations of the primary researcher, and recommendations for future studies. Last, Appendix A provides readers with a list of defined oral health terms and concepts used throughout this research document.
CHAPTER TWO: REVIEW OF LITERATURE AND THEORETICAL FRAMEWORK

Dental caries and periodontal disease—two major dental diseases (Ndiokwelu, 2004)—can result in pain and discomfort, and may interfere with an individual’s ability to function on a daily basis (Kassak, Dagher, & Doughan, 2001; Percy, 2008). Oral health is a reliable measure of one’s general health (Petersen & Yamamoto, 2005; U.S. Department of Health and Human Services, 2000), a finding which stresses the importance of oral health education and practices (Quinney, 2003). Research on oral health communication reveals the challenge these efforts have at changing and sustaining improved oral health behaviors (Brukiene & Aleksejuniene, 2009). The purpose of the review of literature below is three-fold. First, this review of literature provides an overview of oral health and hygiene studies which employed the HBM theoretical framework. Second, there is a review of the literature on the African, and specifically the South African, population. Last, suggested research questions which were prompted from the literature are integrated into the review.

Oral Health, Oral Hygiene, and Theory

Past research revealed that a relationship exists between oral diseases and other health-related problems. The majority of oral disease incidences result from socio-environmental factors (e.g., cost, availability, resources). Oral disease has, as its proximate cause, bacteria; but the incidence rate in a given population is affected by socio-economic factors, such as cost and resource availability (Astrom & Mbawalla, 2011; Hobdell, Johnson, Laloo, & Myburgh, 2004; Kiyak, 1993; U.S. Department of Health and Human Services, 2000). Cost includes the price associated with visiting a
dentist for routine dental exams, correcting an oral health problem (e.g., filling a cavity, removing a decayed tooth, etc.), and purchasing oral hygiene products (e.g., toothbrush, toothpaste, interdental floss, etc.). The lack of availability and resources is also a contributing factor to oral disease. These limited resources can include limited availability of dentists or dental hygienists in a particular area, limited supply of or access to oral hygiene tools (e.g., toothbrush, dental floss, chewing stick, and toothpick), or barriers associated with transportation (i.e., traveling to a dentist). These findings stress the importance of oral health education and practices around the world (Hobdell, et al.; Petersen, 2004; Quinney, 2003). However, most research on oral health has been conducted using developed nations, or Western populations; thus, it remains to be examined the extent to which such findings are applicable in other non-Western contexts (Petersen, 2008; Thorpe, 2003).

The data on adults’ oral health and hygiene in South Africa is out of date; the most current data comes from findings in 1989. The 1989 data state that 68% of individuals between the ages of 33-44 years had untreated caries (van Wyk & van Wyk, 2004). The percentage of untreated caries for 15 year olds was 49.9 (van Wyk & van Wyk, 2004). While copious amounts of data exist on children between four and 15 years and their oral health status, the current percentage of untreated caries in the adult population is essentially unknown. The lack of current knowledge on adult oral health status is a major barrier to developing prevention efforts such as communication campaigns in South Africa.

Researchers apply theories and theoretical components, or constructs, to their studies as a guiding framework. Theories and constructs serve as means towards learning
about an individual’s knowledge, beliefs, and behaviors (Hollister & Anema, 2004). There is a need for more oral health research with a theoretical framework, such as the HBM, in order to see if the HBM is effective at communicating messages regarding healthy oral health behaviors (Hollister & Anema, 2004; D. J. O'Keefe & Jensen, 2007). Fishbein and Cappella (2006) state that “theories of behavioral prediction and behavior change are useful because they provide a framework to help identify the determinants of any given behavior, an essential step in the development of successful interventions to change that behavior” (p. S1). Moreover, a theoretical framework helps promote behavior change by providing insight on the program planning, implementation, and evaluation processes. Additionally, theories also allow us to understand individual and population-based behavior better (DeBarr, 2004).

In this study, the HBM will serve as the theoretical framework through which to examine what population(s) is(are) at risk of oral diseases, as well as determine what factor(s) influence the ability to practice healthier oral health behaviors. These formative research efforts will allow researchers to achieve a better understanding of the South African population by assessing more up-to-date perceptions about this population’s oral health and hygiene in order to target and improve their oral health status (see Cameron, et al., 2009).

**Health belief model.** Presented in the early 1950s by Godfrey Hochbaum, Irwin Rosenstock, and Stephen Kegels, and adopted by the United States in 1970 by the United States Public Health Service, the HBM is used to motivate people to make better decisions about their health. Hochbaum and colleagues hypothesized that individuals would be more compelled to make better health decisions if they thought they were
susceptible to an illness/health behavior outcome and believed there was a benefit to early detection (Hochbaum, 1954; I. M. Rosenstock, 1974). Today this theory has been applied to a plethora of health topics, including HIV/AIDS (Airhihenbuwa & Obregon, 2000), tanning and sun behaviors (Hill, White, Marks, & Borland, 2002; Wood, 2011), contraception (Larsson, Eurenius, Wresterling, & Tydén, 2004), personal risk and safety (Agha, 2003), influenza vaccination (Blue & Valley, 2002), and osteoporosis prevention through calcium consumption and weight bearing exercise (Schmiege, Aiken, Sander, & Gerend, 2007), in an effort to describe how beliefs predict behavior. Examples of how the HBM has been applied to various oral health topics will be outlined below in this review of literature.

The HBM is a theoretical framework that was developed to understand why individuals do not participate in preventive behaviors (Hochbaum, 1954; I. M. Rosenstock, 1974). This model functions on an intrapersonal level in order to determine what factors encourage or discourage an individual from enacting behavior change. Six constructs help determine what “influence[s] people’s decisions about whether to take action to prevent, screen for, and control illness” (Rimer & Glanz, 2005, p. 14). The original constructs include: perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Hochbaum, 1954; Rosenstock, 1974). The first four constructs constitute the original four variables of the model (Hochbaum; Rosenstock). The last two constructs, cues to action and self-efficacy, were added later to the model to promote lifestyle behaviors entailing long term change (N. K. Janz, Champion, & Strecher, 2002a). In all, the HBM theorizes that beliefs about whether or not an individual is susceptible to a health condition, their perceptions towards the benefits of
and barriers to trying to avoid a health problem, and their beliefs associated with the severity of the health condition all influence their readiness to act on behavior change. The model hypothesizes that promoting health beliefs will have an effect on increasing the desired behavior (Rimer & Glanz, 2005). The following paragraphs will define each of these six constructs, as well as explain why they serve as an antecedent to behavior intention.

First, perceived susceptibility refers to beliefs surrounding the probability of developing a health condition in the future. The HBM predicts that if an individual feels they are vulnerable to developing a health condition, they are more likely to seek preventive measures such as early detection techniques. For example, a woman who feels susceptible to developing breast cancer will have an interest in getting a mammogram (Quick, LaVoie, Scott, Bosch, & Morgan, 2012). A study by Quick and colleagues (2012) looked at students’ perceptions toward organ donation, finding that their perceived susceptibility to the need for a donated organ was based on a wide range of perceptions, including personal experiences, environmental and societal risk factors, and the unpredictability of life. A review of the research on the effects of susceptibility beliefs as predictors of behaviors, reveals conflicting findings (Carpenter, 2010; Cyr, Dunnagan, & Haynes, 2010; Daddario, 2007; N. Janz, K. & Becker, 1984; Ross, Ross, Rahman, & Cataldo, 2010). Perceived susceptibility has been found to be the strongest predictor of behavior among the HBM constructs in some studies (Daddario, 2007; N. Janz, K. & Becker, 1984; Ross, et al., 2010). However, there are three studies that reveal that perceived susceptibility is not the strongest predictor of behavior, but it is a strong predictor of behavior (Cyr, et al., 2010; Daddario, 2007; Ross, et al., 2010). On the other
hand, Carpenter (2010) found perceived susceptibility to be the weakest predictor of behavior (Carpenter, 2010). As noted above, the effect size of perceived susceptibility as a predictor of behavior varies among studies and more research is necessary in order to understand better the power of this HBM construct in predicting oral health behaviors.

The conversation between susceptibility being a strong or weak predictor of behavior extends to whether or not the health behavior at hand relates to a preventative technique or a treatment option (Carpenter, 2010). For instance, perceived susceptibility was found to be a stronger predictor of preventative techniques, such as routine dental exams or routine mammograms, than of treatment options (N. Janz, K. & Becker), such as having a cavity filled. Regarding treatment, Carpenter (2010) explains that the correlation between the effect size for perceived susceptibility and the window of time (e.g., the number of days) between measures, “suggests that the longer the period between measurements, the weaker is the relationship between the time one measure of susceptibility and time two behavior” (p. 666). What Carpenter’s findings suggest is that it is possible that long lengths of time between dental exams results in lower feelings of susceptibility towards oral health problems or diseases. A potential reason for the susceptibility to be less related to behavior in a treatment case is that once a person has developed a health condition, they no longer fluctuate in their perception of susceptibility.

Second, perceived severity refers to the belief(s) about the seriousness of the health condition, as well as of its consequences. Severity is measured by considering both the medical and clinical consequences (pain, disability, death, etc.), as well as the social consequences (financial burden, lost time at work, effects on a family, etc.),
associated with the health condition (Champion & Skinner, 2008). The HBM predicts that if the person has strong beliefs that a health outcome will be negative and severe, they are more likely to adopt the target behavior (Hochbaum, 1954; I. M. Rosenstock, 1974). A meta-analysis by Carpenter (2010) found that studies that assessed prescription drug regimen have larger effect sizes of perceived severity to predict behavior, compared to studies that assessed treatment or prevention without the use of prescription drugs. This finding suggests that individuals who comply with taking a drug, may take into consideration the severity of the consequences of not complying with taking the prescription; these perceptions of severity may be higher than those of individuals who seek treatment or prevention without prescribed drugs. Furthermore, a study by Ross and colleagues (2010) on bicycle helmet use among undergraduates found that helmet wearers reported more perceived susceptibility, benefits, and cue to action, had higher regard for perceived severity of the consequences of not wearing a helmet and fewer barriers than non-helmet wears. These findings suggest that individuals make positive health choices if they see their current situation is at risk or could have serious consequences. In order to increase perceived severity in a target population, Daddario (2007) recommends that researchers emphasize “the risk and severity of the medical conditions and health complications that can occur” (p. 365) from the negative health outcome.

Coupling perceived susceptibility with perceived severity helps determine an individual’s perceived threat of a health condition (Hochbaum, 1954; I. M. Rosenstock, 1974). Threat is a function of both a person’s perceived susceptibility to the disease and how severe they perceive the disease to be to them (Champion & Skinner, 2008).
Combining perceived susceptibility with perceived severity to make perceived threat is uncommon in the literature. Carpenter’s (2010) meta-analysis concludes that it is possible that the effects these two variables have on behavior may be moderated by one another.

Third, the *perceived benefits* construct represents the individual’s “beliefs about the effectiveness of taking action to reduce risk or seriousness” (Rimer & Glanz, 2005, p. 14). If a person feels threatened by a health outcome, perceived benefits likely influence behavior change because benefits reduce the threat (Champion & Skinner, 2008). The HBM suggests that individuals are more likely to perform a health-protective behavior (such as brushing their teeth and visiting the dentist) if they perceive that the disease is a threat to them and that the benefits of the performing the behavior outweigh the costs, or barriers associated with performing the behavior (Hochbaum; Rimer & Glanz, 2005; Rosenstock). Janz and Becker’s (1984) meta-analysis found this construct to be a strong predictor of behavior while Carpenter’s (2010) meta-analysis found it to be a weak predictor of behavior. Recent studies (none of which were included in Carpenter’s meta-analysis), including studies on genetic testing (Cyr, et al., 2010), exercise and weight loss (Daddario, 2007), and bicycle helmet use (Ross, et al., 2010), found perceived benefits to be the strongest indicator of behavior. It is also important that individuals believe that the benefits of changing or adopting a behavior outweigh the perceived barriers, which is outlined in the upcoming paragraph.

Fourth, the *perceived barriers* construct includes individuals’ beliefs in relation to the “tangible and psychological costs of the advised action” (Champion & Skinner, 2008, p. 48). To increase the likelihood of overcoming barriers towards a desired health
outcome, barriers should be identified and then reduced through education to correct misunderstanding, reassurance, incentives, and mentoring or assistance (Champion & Skinner). Carpenter (2010) found perceived barriers to be the strongest predictor of behavior, mirroring the findings from Harrison and colleagues’ (1992) meta-analysis of HBM studies. Additionally, perceived barriers are a stronger predictor if the behavioral outcome was a prevention technique rather than treatment (Carpenter). A study on perceptions about organ donation found perceived barriers (e.g., fear, misconception, social disapproval, etc.) to be three times stronger a predictor than perceived benefits (Quick, et al., 2012). In another study on genetic testing for colorectal cancer, perceived barriers were found to be the second strongest predictor of behavior (Cyr, et al., 2010), which makes sense because the benefits (largest predictor) outweighed the barriers in this study. The reason why the finding in the Cyr and colleagues’ (2010) study makes sense is because the HBM suggests that individuals are more likely to perform a health-protective behavior (such as brushing their teeth and visiting the dentist) if they perceive the disease is a threat to them and that the benefits of the performing the behavior outweigh the costs, or barriers associated with performing the behavior (Hochbaum; Rimer & Glanz, 2005; Rosenstock).

In 1958 the construct of cues to action was added to the HBM; this construct assesses factors that serve to activate change within the individual, such as reminder emails or billboards promoting a healthy behavior (Hochbaum, 1958). It should be said that this construct is often not systematically studied due to cues to action being different for and/or specific to each individual (Carpenter, 2010). In the genetic testing study by Cyr and colleagues (2010), cues to action was the weakest predictor of behavior, while a
study on helmet use found cues to action (e.g., family and friends) to be the strongest predictor of behavior (Ross et al., 2010). These conflicting variations in strength of prediction make it difficult to assess cues to action in exploratory studies (Champion & Skinner, 2008).

Last, self-efficacy measures the individual’s confidence in their ability to take action and/or make the behavioral change (Rimer & Glanz, 2005). Added to the HBM by Becker in 1988, self-efficacy concludes that motivation to change a behavior is backed by one’s confidence in successful behavior change (Rosenstock, Strecher, & Becker, 1988; see Carpenter, 2010; McKenzie, Neiger, & Smeltzer, 2005). The original model did not include self-efficacy because the behaviors for which it was intended to measure were not perceived as complex (e.g., screening test, immunization, exam, etc.; Champion & Skinner, 2008). As a whole, the original HBM predicts that in order for behavior change to be successful, the individual must feel threatened by the current situation (perceived susceptibility + perceived severity) and believe that the advantages (perceived benefits) of performing the new behavior outweigh the costs (perceived barriers) of performing the desired behavior. With self-efficacy added to the model, it suggests that individuals must “feel themselves competent (self-efficacious) to overcome perceived barriers to take action” (Champion & Skinner, p. 50). Overall, self-efficacy is another construct (similar to cues to action) that is rarely seen in HBM studies (see Carpenter; Zimmerman & Vernberg, 1994).

In all, the HBM is a widely-used, theoretical framework that aids in explaining what motivates people to make decisions about health issues (Broadbent, et al., 2006; Coons, McGhan, Bootman, & Larson, 1989; Hochbaum, 1954; I. M. Rosenstock, 1974;
Watson, Gibson, & Guo, 1998). The HBM functions on an intrapersonal level in order to determine what factors encourage or discourage an individual from enacting behavior change. Likewise, these six constructs work together, or can be used individually to help researchers predict and understand behaviors (Hochbaum, 1954; I. M. Rosenstock, 1974).

In addition to the six constructs described above, the HBM also acknowledges that other variables may play a role in influencing individuals’ perceptions. Predictors, such as knowledge, gender, and socioeconomic status may serve as modifying factors to one’s beliefs or perceptions. In turn, these variables, or modifying factors as noted in the HBM, indirectly influence health-related behaviors. Predictors such as knowledge and gender serve as potential modifying factors to one’s beliefs or perceptions (Champion & Skinner, 2008). However, just because someone understands the benefits of changing an unhealthy habit to a healthy habit (i.e., they have knowledge), which may generate a positive belief towards changing the behavior, does not mean that they will practice the behavior change (Smyth, Caamaño, & Fernández-Riveiro, 2007). Furthermore, a study by Bynum and colleagues (2011) assessed gender differences regarding knowledge, beliefs, and behaviors related to the Human Papillomavirus (HPV). Males scored significantly lower than females on the HPV knowledge test. Additionally, males scored lower on perceived severity, benefits, and cues to action for HPV vaccination, and higher scores on the perceived barriers to HPV vaccination scales, compared to their female counterparts. Authors note that communication strategies on HPV generally target females, thus indirectly communicating unimportance to the male population. Gender-specific health communication may be an effective strategy for reaching out and disseminating information to specific both male and female target populations.
Additionally, gender-specific campaigns may be necessary in making males more aware of and increase their knowledge of issues that are of importance to them, such as HPV (Bynum, et al.). Here we see how modifying factors, such as sex and knowledge, can affect beliefs. Modifying factors like sex and knowledge may influence health perceptions, which in combination with these beliefs, lead to behavior. It is vital to test these modifying factors in order to see if they do influence beliefs that predict behavior.

Much conversation exists regarding whether or not a stronger HBM model includes all six constructs or retains only the original four constructs (Carpenter, 2010; Champion & Skinner, 2008; Zimmerman & Vernberg, 1994). Carpenter explains that “cues to action is the most underdeveloped and rarely measured or researched element of the model” (p. 662); this construct is difficult to assess in exploratory studies, as the triggers of behavioral action are often unknown (Champion & Skinner). Another construct often excluded from HBM studies is self-efficacy (Carpenter; Champion & Skinner; Zimmerman & Vernberg). Zimmerman and Vernberg have expressed concern regarding whether or not the HBM is the same model when other variables (i.e., cues to action and self-efficacy) are added. This concern is reflected in the ambiguity regarding the relationship among the six HBM constructs, which are noted by Champion and Skinner as “undefined” (p. 50); while some studies examine the interaction among these variables, in terms of behavior, the majority of research assesses the direct effects of each variable on the target behavior (Champion & Skinner; Carpenter). Likewise, a consistent six construct module is rarely seen in the literature.

The application of theory to practice often involves modification of a theory or model in order to see key results in the end. Scholars suggest that researchers consider
the needs of their target audience and not let theory dictate their professional decision making (McKenzie, et al., 2005; Schiavo, 2007). Understanding the target audience’s needs and capabilities is vital for the success of any research. The present research will include the four original HBM constructs, also including modifying factors, gender and knowledge. Considering that English is one of the 11 national languages (Mosala, 2003) and that it is the “second language of the majority of South Africans” (van Niekerk, 2012a), having only the original constructs represented in the survey provides a lower participant burden (i.e., participants have fewer questions to comprehend and respond to) than having questions that cover all six HBM constructs. Last, due to the limited research that is available on oral hygiene and South Africans, it is unclear as to if self-efficacy is understood in this context. Likewise, the cues to action for this population have not been developed or yet understood, thus there is not a need to test this construct at this point in time.

**HBM and Africa**

Past research provides evidence of the application of HBM or HBM constructs to medically-underserved regions within Africa. The HBM has been applied to many African regions, including barriers towards condom use in sub-Saharan Africa (Hounton, Carabin, & Henderson, 2005), South Africa (Mashegoane, Moalusi, Ngoepe, & Peltzer, 2004), East Africa (Volk & Koopman, 2001), and West Africa (Ndiokwelu, 2004). A variety of other sexual health studies in Africa include perceived susceptibility and the likelihood of voluntary HIV counseling and testing (Vermeer, Boss, Mbwambo, Kaaya, & Schaalma, 2009), as well as sexual risk perceptions (Okal, et al., 2009). There have also been efforts to use the HBM to understand the diverse spiritual beliefs of traditional
medicine among Ethiopians (Hodes, 1997). Scholars have applied the HBM to topics including intimate partner violence (Klomegah, 2008) and perceived control of sweets (Astrøm & Mbawalla, 2011) in East Africa. These are a few of the many studies that address HBM constructs in terms of beliefs Africans hold about health behaviors. To my knowledge, currently there are no published studies that use the HBM as a guiding framework to predict oral hygiene behaviors in South Africa. Thus, it cannot be stressed enough that the research on the beliefs South Africans hold towards their personal oral hygiene is lacking.

The evidence above reveals that a broad spectrum of health topics have incorporated the HBM framework into the African context and specifically the South African context; this indicates the utility of HBM for a study of this kind. The studies presented above recognize that the locus of control for these behaviors is the individual, further validating the HBM as a fitting theoretical framework for such study (Hochbaum, 1954; I. M. Rosenstock, 1974). It is important to make note of the valid argument made by Dutta-Bergman (2005) and Marmot and Wilkinson (1999) about the HBM not being a useful theoretical framework for guiding research due to its ability to minimize the context of the given study. Since the HBM is an intrapersonal model (Rimer & Glanz, 2005), Dutta-Bergman argues that it does not have the ability to capture the “structural, measurement, and mediated contexts of the health behaviors being studied” (p. 108). Although these scholars have a valid point; the present research aimed to study individuals’ oral hygiene behaviors and the beliefs that surround these efforts, rather than structural contexts that initiate or impede these behaviors. Additionally, identifying individual behaviors may point to structural issues that serve as barriers to care or barriers
to healthy oral hygiene behaviors. Thus, the HBM seems fitting as a theoretical framework for this study.

Application of the HBM to oral-health-related beliefs may help provide insight into the oral health behaviors (Hollister & Anema, 2004) of South Africans. From the behavioral aspect, past research stresses the importance of examining individual oral health behaviors such as smoking, brushing, and dental visits (Sheiham & Watt, 2000; Wardle & Steptoe, 1991), as well as the unique behaviors that are prevalent among different cultures, including the use of a chewing stick (Rwenyonyi, Muwazi, & Buwembo, 2011) and toothpick (Willis & Bothun, 2011) to clean the teeth, and the use of smokeless tobacco (Peltzer, 2008). A study by Barker (1994) looked at patient compliance with oral health recommendations, finding that the HBM construct beliefs (i.e., benefits, and benefits and susceptibility combined), were significantly correlated with compliance. Additionally, Barker found that combining together both HBM beliefs of susceptibility and benefits also predicted compliance with oral health recommendations. Modifying factors, such as gender, are also often predictive of oral health behaviors (Astrǿm & Mbawalla, 2011). In a similar vein, socio-behavioral risk factors (e.g., diet, tobacco use, alcohol, genetics, and hygiene) also affect an individual’s DMFT (Petersen, Bourgeois, Ogawa, Estupinan-Day, & Ndieye, 2005). Applying these ideas to the context of developing countries of Africa, those who suffer from tooth decay or pain are often left untreated and over time, the tooth/teeth is/are extracted (Kaimenyi, 2004; Petersen, et al., 2005). The findings above stress how important it is to continue testing the HBM constructs in relation to oral health and hygiene in order to better understand beliefs in relation to behaviors. The following paragraphs will provide an
overview of these oral hygiene behaviors, as well as the modifying factors that influence behavior.

**Toothbrush.** Periodontal disease and oral caries can be prevented through the oral hygiene behavior tooth brushing (Broadbent, et al., 2006; Horton, Zimmermann, & Collings, 1969; Ndiokwelu, 2004). The South African Dental Association (SADA) emphasizes the importance of daily oral care, as it is “vital to good oral health which is important to overall general health” (The South African Dental Association, 2012 [SADA]). Daily oral care includes both brushing and flossing the teeth. SADA suggests thoroughly brushing the teeth at least twice a day, stressing the significance of brushing the teeth before bedtime. Additionally, the SADA recommends brushing for a minimum of two minutes, as this is enough time to “ensure that all teeth are reached and food debris is removed” (SADA). In order to better understand the positive oral hygiene behavior, brushing the teeth among the South African population, a research question was developed and is presented after the toothpick section.

**Dental floss.** Particles from food can become stuck or lodged between teeth and gums resulting in decay causing bacteria to adhere in the oral cavity, resulting in the build-up of plaque (SADA, 2012). Although brushing the teeth is a way to help clean the gums and teeth, the bristles of a toothbrush cannot reach all the bacteria in the mouth during this process. In addition to brushing the teeth, the SADA (2012) recommends the use of floss, or interdental cleaner, once a day, to clean between the teeth and gum line. The SADA recommends the following when flossing: “do not snap floss onto the gums when cleaning between the teeth,” rather, follow “the curves of the teeth when flossing.”
Due to the absent literature on this behavior among South Africans, this behavior is assessed in the forthcoming research question.

**Dental exams.** Dental exams focus on the treatment of oral disease and cleaning of the teeth (ADA, 2012). From the behavioral aspect, they are important for the overall oral health of the individual (SADA, 2012). According to the SADA (2012), “Regular visits with the dental team are also very important as they can assist you in learning techniques to maintain good oral health. The dental team are also able to identify potential problems before they become painful, worrisome and potentially expensive” (para. 5). The ADA recommends that Americans visit the dentist at least once yearly for oral exams and professional cleanings (ADA, 2012); the Centers for Disease Control and Prevention (CDC) recommends two visits in a 12 month period (Centers for Disease Control and Prevention, 2008 [CDC]). The SADA does not define or give specific guidelines for “regular visits with the dental team.”

**Chewing stick.** Other unique behaviors and pre-emptive measures for preventing oral health problems are prevalent among these African populations (Rwenyonyi, et al., 2011; Willis & Bothun, 2011; Wu, Darout, & Skaug, 2001). The act of using a *chewing stick* to clean the teeth (similar to the behavior recommended by the SADA, the use of a toothbrush) is a popular way to maintain acceptable oral hygiene within many African countries. Using a stick to remove dental plaque and food deposits on the teeth and in the gum line is a natural way to clean the teeth; it is also highly available, simple, and costs little money (Wu, et al.). The SADA does not offer information regarding the use of and benefits a chewing stick, but a 2007 issue of the *Irish Times* notes that some “upmarket health stores in the US are selling ‘chew-sticks’ as the natural form of dental care” (Al-
The plants that the chewing sticks are made of contain protective anti-microbial agents that fight against the gum-disease-causing bacteria in the mouth. Some African chewing sticks are known to secrete fluoride which is known to protect against caries (Hooda, Rathee, & Singh, 2010). The WHO encourages the use of chewing sticks when commercial products, such as toothbrushes or dental floss are either not available or in countries that cannot afford to purchase these products (J. M. Al-Ansari, 2007; Hinyard & Kreuter).

A study by Willis and Bothun (2011) assessed Sudanese refugees (n = 34) currently living in the United States who entered the US between 1993 and 2001. This study assessed the population’s frequency of traditional dental practices and current oral hygiene practices, including using a toothbrush and the traditional method of using a chewing stick. Participants were asked to reflect on their traditional practices prior to moving to the US. The findings from this study show that current US oral hygiene practices includes 44% brushing once a day, just over 17% brushing their teeth twice a day, and 26% reported brushing three or more times a day with a toothbrush and toothpaste. Likewise, regarding the participant’s traditional dental practice while living in Sudan—using a chewing stick—participants reported the following: 2% reported using a chewing stick once a day, 47% reported using it two times a day, and 24% reported using it 3 or more times a day to clean the teeth and gums. The data presented above displays that more people reported more frequent past use of a chewing stick than compared to their current use of a toothbrush, yet this sample is not from South Africa; thus, it is not possible to make an assumption as to what the practices will be concerning
the present study; more research is necessary to make this distinction among the South African population. In order to learn more about the unique oral hygiene practice of using a chewing stick to clean the teeth and gums, chewing stick behavior will be assessed in the forthcoming research question.

**Toothpick.** The literature on oral hygiene reveals absent data about flossing behavior among many African populations. That is, studies show that African populations are more likely to comply with daily tooth brushing behavior and less likely to conform to using dental floss daily (Lewis, Selders, Holder-Ballard, Scarbecz, & Turner, 2005). Rather than using dental floss, South Africans often use toothpicks to clean the teeth and gums in between brushings. Toothpicks are derived from the West African medicinal plant known as the erythrophleum africanum (Kadja, et al., 2011).

In many countries, including the United States and Sudan, people use a toothpick to remove debris between the teeth and gums (Lewis, et al., 2005; Willis & Bothun, 2011). Lewis and colleagues (2005) found that between two groups of people, those that use toothpicks and those that use dental floss, both group plaque index score decreased over time. A baseline plaque index score was assessed for each participant; they were also examined three times during the intervention, and each time their plaque index was assessed. This study concluded that over the 12 week intervention, both groups’ plaque index scores decreased significantly from baseline. These results suggest that both dental floss and use of a toothpick are effective in removing plaque from the teeth and gum line; either method results in improving one’s overall gingival health.

Similar to the Lewis and colleagues (2005) study, Willis and Bothun (2011) assessed Sudanese refugees who were currently living in the United States. This study
assessed the population’s frequency of traditional (e.g., toothpick) dental practices and current (e.g., recommended) oral hygiene practices, including using floss and toothpicks to remove debris from the teeth and gums. Findings reveal that 71% and nine percent respectively reported using toothpicks and dental floss to remove meat and other dense foods from between the teeth. Additionally, authors note that few participants understood the term dental floss and that toothpicks are more common among this population because they closely resemble the reeds and grasses that are used in Sudan to remove debris from the teeth.

In a study which aimed at studying a population of individuals living within Africa, Mumghamba, Manji, and Michael (2006) assessed the oral hygiene behaviors of 302 women in Dar es Salaam, Tanzania, located in Eastern Africa. Women were between the ages of 14 and 44 years, all of whom were mothers of infants in the neonatal unit of a local hospital. Results found that nearly 76% of all study participants used wooden toothpicks as a form of interdental cleaning practice. Authors note that the use of floss was very rare, as only 0.3% reported using floss. Findings conclude that a high percentage of this population are mindful of the need for the use of positive oral hygiene, including the use of wooden toothpicks to clean their teeth and gum line (E. G. S. Mumghamba, et al., 2006).

The findings in this study are congruent to those found in the primary author’s previous work among other adult populations (both male and female) in Tanzania (see E. G. S. Mumghamba & Fabian, 2003; E. G. S. Mumghamba, Markkanen, & Honkala, 1996).

Current, up-to-date information on non-recommended oral hygiene behaviors is lacking in the South African context. In order to gather better understandings of South African oral health behaviors brushing the teeth, flossing the teeth, and visiting the
dentist, as well as to gain better understandings of the unique oral hygiene practices using a chewing stick and using a toothpick, the following research question was derived from the literature presented in the previous five section:

**RQ1:** What are the frequencies of the positive oral hygiene behaviors, brushing the teeth, flossing the teeth, routine dental exams, use of a chewing stick, and use of a toothpick, among the South African population?

**Smoking behavior.** Use of tobacco in any form—cigarette, smokeless or oral tobacco, pipe, or cigar—is an unhealthy behavior that has can affect oral health and ultimately cause oral cancer. Tobacco use is also linked to periodontal disease and the loss of teeth. Also, the user may experience tartar build-up, stained teeth, or blackish stains on the tongue (ADA, 2012). Regardless of the type of tobacco, any use can result in negative effects on the mouth and teeth (Navarro, 2006).

Smoking behavior seems to be increasing in African countries undergoing rapid urbanization; South Africa is included in this category. As such, many South Africans experience health problems that are associated with lifestyle changes which promote abuse of tobacco. Smoking increases the prevalence of caries and tooth decay in these areas of Africa (Enwonwu, Phillips, Ibrahim, & Danfillo, 2004). Peer and colleagues (2009) analyzed the results of the South African Demographic and Health Survey (SADHS) to identify if changes occurred in smoking prevalence from 1998 to 2003. The sample included 13,826 and 8,115 participants in the first and second assessment, respectively. All participants were over the age of 15 years. South Africa results show that, among women, the rates of daily smoking among the first assessment of participants remained the same from the point of baseline in 1998 to the second assessment in 2003.
Among men in South Africa, the smoking rate decreased by six to eight percent over this five-year span. Despite the decrease in smoking rates among men, authors of this study note that “smoking rates in South Africa are higher than those of most other African countries” (Peer, et al., p. 798). Regarding the rate of smokeless tobacco use, the rates of male use increased nearly three percent over time and higher rates of use exist among uneducated males with low social economic status who are either black or white and younger than 65 years. Among females, the prevalence of smokeless tobacco users increased two percent over the five year span. Rates were highest among less educated black women with low social economic status living in rural areas. Peer and colleagues noted that the most frequent users of smokeless tobacco are women and they are considered a vulnerable group because many are unaware of the health hazards associated with using smokeless tobacco (Peer, et al.).

The most recent data relating to smoking and smokeless tobacco use in South Africa is dated. A more recent sample is necessary to accurately assess the prevalence of tobacco use as well as to make better sense of it in relation to oral health and hygiene. The literature reveals that smoking behavior is prevalent among individuals living in African countries, specifically South Africa. It is important to note that such issue has negative consequences on oral health but due to the exploratory nature of this study, research questions will not assess smoking behavior among this target population.

*Modifying factor: knowledge.* Theoretical models typically cover the nature of information critical to “behavior change, the beliefs and attitudes that need to be changed, and barriers to persuasion and action” (Snyder, 2007, p. S37). Snyder’s review of a nutrition campaign using the HBM suggests that health communication efforts should
address the barriers that prevent behavior change, as well as the beliefs surrounding the behavior. Per Snyder’s recommendations, these messages should be designed around the beliefs that center on the behavior, such as the HBM’s perceived severity and perceived susceptibility, as well as the target audience’s perceived benefits of “compliance with the recommendation” (p. S37). Last, Snyder states that behavior change is not feasible without knowledge change. He argues that future campaigns should focus on “knowledge, beliefs, and communication behaviors that are advocated in campaign messages, to further our understanding of the behavior change process and improve models of nutrition behavior change” (p. S38). Petersen and colleagues (2008) add to this argument stating that “oral health-related behaviours are associated with… knowledge towards oral health care” (p. 82). Thus the research from Snyder and Petersen and colleagues emphasizes that campaigns and health education strategies focus on the educating the population on healthy oral behaviors, stressing the knowledge of the behavior, specifically the “how to” and the “when to” knowledge that supports behavior change (Snyder, p. S37).

The HBM states that modifying factors, including knowledge of a behavior, may influence health perceptions (Champion & Skinner, 2008). Thus, it is vital to develop a baseline of knowledge among the target population. These data can be used to guide future research efforts, as well as to evaluate future campaigns in order to see if it was effective in changing the knowledge of the target audience (Hether, Huang, Beck, Murphy, & Valente, 2008). Guided by the insight from Snyder regarding knowledge change, the following research question was added to this study in order to gain a baseline of the target population’s knowledge or oral health and hygiene practices:
RQ2: What is the level of knowledge regarding oral health and effective oral hygiene practices among this sample of South Africans?

**Perceived benefits.** The beliefs an individual holds toward performing a particular behavior may be used as a predictor of certain behavioral outcomes (J. Al-Ansari, et al., 2003; J. M. Al-Ansari, 2007; Watson, et al., 1998). Regarding oral health, it has been shown that if an individual holds high concern for their oral health, they are more likely to partake in healthy oral health behaviors (J. Al-Ansari, et al.; J. M. Al-Ansari; Watson, et al.). On the other hand, a correlation has been shown between negative oral health behaviors and low concerns for oral health (J. Al-Ansari, et al.; Watson, et al.). Ultimately, evaluating beliefs of an individual’s oral health may help us to understand their oral health behaviors (Coons, et al., 1989; Hochbaum, 1954; McKenzie, et al., 2005).

Over the past three decades, multiple meta-analyses of studies that use the HBM have been performed (Carpenter, 2010; Harrison, et al., 1992; N. Janz, K. & Becker, 1984; Zimmerman & Vernberg, 1994). These meta-analyses examined HBM’s ability to predict a plethora of health behaviors. In the most recent meta-analysis, Carpenter (2010) found that beliefs about the benefits and barriers of preventive care were the strongest predictors of behavior; these beliefs were also weak, yet positive predictors of behaviors when the outcome in question was treatment. The results of Carpenter’s analysis, and the literature from J. Al-Ansari et al. (2003), J, M. Al-Ansari (2007), and Watson et al. (1998), regarding beliefs about oral health behaviors and barriers to care, contributed to the development of the third research questions which will be displayed after the perceived susceptibility and severity section.
**Perceived severity and susceptibility.** Referring back to Carpenter’s (2010) meta-analysis, perceived severity is often a weak predictor of behavior in terms of prevention and treatment outcomes. Harrison et al. (1992) predicts that this is the case due to the low variability in responses regarding responders’ perceptions of the diseases and/or health concerns assessed as extremely severe, such as breast cancer (Harrison, et al.) and influenza (N. Janz, K. & Becker, 1984). In a similar vein, Carpenter also found that perceived susceptibility was “almost always unrelated to behavior” (p. 667), suggesting that those who already have a disease do not fluctuate in their perceptions of susceptibility. Two hypotheses for why these constructs are weaker predictors of behavior include the length of time between time one and time two measurements, as well as the effects of these two constructs being “mediated by perceived threat,” and thus having indirect effects on behavior (Carpenter, p. 667).

Contrary to Carpenter’s (2010) meta-analysis, studies that are more recent show the strength of perceived threat as a predictor of behavior. First, Caltabiano and Ghafari (2011) found perceived threat to be a significant predictor of physical activity, stating that participants who were physically activity perceived themselves to be a less risk of illness compared to non-physically active participants. In a similar vein, Raude and Setbon (2011) found this combined HBM construct to be a strong predictor of health protective behaviors for risk reduction strategies regarding avian influenza. Scholars found that those who felt a sense of threat regarding the outbreak of avian influenza were more likely to adopt behaviors that aided in reducing their risk of contracting the disease. Here we see how combining the two HBM constructs of perceived susceptibility and perceived severity to make the variable perceived threat can be a powerful predictor of behavior.
Furthermore, D. J. O’Keefe and Jensen (2008) performed a meta-analytic review on the potential for loss-framed versus gain-framed messages to produce message processing. Authors took this review a step further to see how such messages encouraged disease detection behaviors (D. J. O'Keefe & Jensen, 2009). These authors use the ideas of gain and loss-framed messages to show the strength of perceived threat as a predictor of behavior. Authors explain that a gain-framed appeal stresses the desirable significances associated with obedience with the directed viewpoint; a loss-framed message highlights the undesirable consequences associated with nonconformity with the directed viewpoint (D. O'Keefe, J. & Jensen, 2008). This meta-analysis suggests the strength of a fear appeal, particularly loss-framed messages, by discussing how such messages prompt a threatening event all while suggesting action aimed at reducing or avoiding the fearful cost(s) associated with the viewpoint behavior. D. J. O’Keefe and Jensen (2008) explain how loss-framed appeals generally produce higher engagement with a message as compared to gain-framed appeals; they explain this by using the observed effects of appeals that produce fear. The authors discuss that fear-arousing appeals have two main components:

The fear-arousal component [of the fear appeal] emphasizes the disadvantages of noncompliance (“if you don’t floss regularly, you can suffer horrible gum disease”) and the recommended-action component emphasizes the advantages of compliance (“if you floss regularly, you can avoid gum disease”). (D. O'Keefe, J. & Jensen, 2008, p. 52)

In this example above, authors explain that there is greater engagement with a loss-framed, fear-inducing message because it arouses greater message processing. It is
important to point out that although these messages aim to produce fear due to the threat of not complying with the viewpoint behavior, it is not the same idea of perceived threat in the HBM. The threat imposed in the loss-frame messages does not take into account the perceived susceptibility and perceived severity of the health related behavior.

In addition to the loss-framed fear-appeal messages producing greater message processing due higher engagement with the message from the audience, such messages can also be considered more engaging. That is, loss-framed fear-appeal messages are thought by O'Keefe and Jensen (2008) to be more engaging because they can produce “heightened impact of and sensitivity to negative information” (D. O'Keefe, J. & Jensen, 2008, p. 53). This is because negative messages, rather than positive messages, can often create stronger, more rapid reactions. The results of the meta-analysis revealed that these ideas did not hold up to be statistically significant, as gain-framed messages produced a slightly larger significance in message engagement when compared to loss-framed messages (D. O'Keefe, J. & Jensen, 2008). In their 2009 meta-analysis on studies that used gain and loss-framed messages for increasing disease detection behaviors (e.g., detection of skin, breast, other cancers, dental problems, etc.), only loss-framed messages for breast cancer detection was found to be slightly more persuasive than gain-framed appeals (D. J. O'Keefe & Jensen, 2009). The authors state that these findings are rather disappointing. These scholars explain that loss-framed messages do not significantly improve persuasiveness; it should be said again that the production of fear due to the threat of not complying with the viewpoint behavior in loss-framed appeals is different than perceived threat in the HBM. The threat imposed in the loss-frame messages does not take into account the perceived susceptibility and perceived severity of the health-
related behavior. The present study aimed to identify if perceived threat (i.e., perceived severity + perceived susceptibility) can be a strong predictor of oral health behaviors in South African context.

Africa as a whole “faces an acute lack of recent, reliable, and comparable data, as well as processes for converting data into information for [program] planning” (Thorpe, 2003, p. 62). For this reason, it is vital to collect current data from the countries within Africa (e.g., South Africa) in order to assess properly the country’s oral health status, as well as plan programs that center on their priority oral health needs (Thorpe). According to Thorpe, the most severe oral health problems within low socio-economic communities within Africa include, cancrum oris (NOMA), acute necrotizing gingivitis (ANUG), oral cancer, oral manifestations of HIV/AIDS, facial trauma, and dental caries (p. 62). Across Africa, oral diseases are prevalent due to rapid urbanization resulting in the increased use of alcohol, tobacco, and sugar (Myburgh, et al., 2004; Thorpe). A call for oral health improvements within Africa is the current focus of many health initiatives, in part due to the inflation of serious, and often fatal, oral conditions (Myburgh, et al.).

Gingivitis is a widespread problem across Africa. More specifically, ANUG, which is rarely seen in Western countries, is prevalent in South Africa (Enwonwu, et al., 2004). The prevalence of ANUG in sub-Saharan Africa ranges from two percent in rural communities, to almost 28% in urban patients (Enwonwu, et al.). A study in Enugu, Nigeria (located in the West African region), looked at oral health beliefs of students (n = 700) aged 14-21 years. Nearly 97% of the students felt they were not susceptible to periodontal diseases at any point in their life; less than 40% were aware of the side effects of periodontal disease—which explains why they did not perceive the diseases as severe.
These results suggest that more awareness of oral health concerns, such as periodontal diseases, is needed to help increase knowledge surrounding risks associated with developing oral health diseases (Ndiokwelu, 2004). Additionally, the HBM posits that positive behaviors are likely to be adopted if individuals feel endangered by their current behavior pattern and can see that change will result in a valued outcome regardless of the expenditure (McKenzie, et al., 2005; Rimer & Glanz, 2005). If one does not feel a sense of threat from their current behavior, they then are less likely to engage in behavior change.

Although South Africa is a part of sub-Saharan Africa, it is not known how well the results from Enwonwu and colleagues’ (2004) study generalize to South Africa; the same is true for the Ndiokwelu (2004) study conducted in West Africa. To date, there are no known research studies that model this study in South Africa alone. Thus, we cannot properly assess South African adult beliefs and knowledge towards periodontal diseases (van Wyk & van Wyk, 2004). In light of the research from Enwonwu et al., as well as the literature from the perceived benefits section of this literature review, the following two research question were prompted:

RQ3: Using the HBM, what is the best predictor (perceived benefits, perceived susceptibility, perceived severity, and knowledge of the specific oral hygiene behavior) of positive oral health behaviors (brushing behavior, flossing behavior, routine dental exams, using a chewing stick, using a toothpick)?

RQ4a: Do people who use recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who use a non-recommended behavior?
RQ4b: Do people who meet the guidelines set by the SADA for recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who do not meet the recommendations?

Perceived barriers. As noted above, perceived barriers to preventive care are consistently shown in studies to be a strong predictor of behavior (see Carpenter, 2010). Barriers lessen the likelihood that one will engage in the preventive behavior (M. J. Dutta-Bergman, 2005). Likewise, it is vital to examine what barriers control the ability to practice healthier oral hygiene behaviors (Petersen, et al., 2005). Unfortunately, an alarming statistic released by WHO (2005) estimates that the dentist to population ratios in African countries are approximately 1:150,000, compared to 1:2,000 in other industrialized countries (see Petersen et al.). The relative lack of dentists and dental personnel in the African countries may reduce residents’ ability to practice healthier oral hygiene behaviors (Petersen et al.). In contrast, South Africa is currently one of 16 African countries that has a national oral health plan—a plan that may help strengthen the quality of, and access to, oral health care within South Africa. This national oral health plan is a government effort to overcome environmental and social barriers to health care. Unfortunately, progress towards future implementation of the national plan has been stagnant (Myburgh, et al., 2004). The WHO Country Cooperation Strategy for 2008-2013 stated that policy and implementation strategies for the South African national oral health plan are “currently being finalized” (Sambo, 2009, p. 8). To date, there is no updated information on the progress of this plan. The lack of resources available for South Africans to seek adequate oral health care poses huge barriers to preventative care as well as treatment of oral health problems.
South Africa is a country full of rural areas, where dental care may not be readily available (Myburgh, et al., 2004). A study by Kikwilu and colleagues (2008) explained the prevalence of oral pain and barriers to oral care facilities in their study of 1,759 Tanzanian (located in Eastern Africa) adults living in rural and urban areas. Results concluded that 59% reported experiencing oral pain within the last year, but only 26.5% sought out treatment. Scholars found that, of those who did not seek treatment, nearly 43% did not seek treatment for financial reasons. They either did not have enough money for treatment or they did not have money to pay for transportation to a clinic because there was not one in their hometown. The authors of this study recommend oral health clinics in rural areas to improve the health of rural citizens in Africa (Kikwilu, et al., 2008). Although this study was conducted in East Africa, its conclusions may be applicable to many rural areas within South Africa. Similar to the context of the study in East Africa, South Africa is heavily comprised of rural areas with limited access to medical clinics (Myburgh, et al.).

Based on the research findings above, regarding barriers to oral hygiene behaviors in South Africa, as well as the research from Hochbaum (1954, 1958) and Rosenstock (1974), the following research question emerged from the literature:

RQ5: What are the primary barriers to positive oral hygiene behaviors, brushing the teeth, flossing the teeth, routine dental exams, using a toothpick, and using a chewing stick?

**Modifying factors.** The HBM is used to explain what motivates people to make decisions about health issues (Hochbaum, 1954; Rosenstock, 1974). Modifying factors, such as knowledge, gender, and socioeconomic status may also serve as predictors to
one’s oral health beliefs or perceptions. In all, these variables indirectly influence health-related behaviors (Champion & Skinner, 2008). Although having knowledge of the benefits of changing an unhealthy habit to a healthy habit may generate a positive belief towards changing the behavior, it does not mean that a person will enact a behavior change (Smyth, et al., 2007). It is vital to test these modifying factors in order to see if they influence beliefs that predict behavior.

*Gender.* The HBM states that modifying factors, including gender, may influence health perceptions (Champion & Skinner, 2008). Data on gender influences can be used to guide future research efforts, as well as to evaluate future campaigns in order to see if it was effective in changing the behavior of the target audience or a section of a that audience (Hether, et al., 2008).

Females and males in many countries have been studied to determine whether gender is predictive of toothbrush behavior (Chen, R., & Barmes, 1997). Reports from many studies have shown that females are more likely to brush their teeth and to brush more often than males (J. M. Al-Ansari, 2007; Chen, et al., 1997; Kassak, et al., 2001). These studies did not take place in African countries, but rather paint a picture of the kind of research that is needed in South Africa in order to determine if brushing behavior can be predicted by one’s gender.

Kassak and colleagues (2001) examined adolescent Lebanese college students’ (N=954) oral hygiene and factors associated with the frequency they brushed their teeth. This study found that more females brush their teeth two or more times a day; females (78%) and males (54%) (Kassak et al.). Another study by J. M. Al-Ansari (2007) looked at oral health behavior among health science college students (N=700) in Kuwait.
Similarly to the study by Kassak and colleagues, more female students reported twice a day brushing behavior (females 62%; males 35%; J. M. Al-Ansari). Last, a study by J. Al-Ansari and team (2003) looked at the oral health related behaviors in Kuwait. Findings concluded that 34% of the population brushed their teeth two or more times a day; 45% reported only once daily brushing behavior and 20% responded to brushing less than once a day. These findings show that few students reported brushing their teeth the international dental recommended two or more times a day (J. Al-Ansari, et al., 2003). Another trend in this literature is that more women than men brush more frequently each day. The lack of tooth brushing behavior found in these studies (J. Al-Ansari, et al., 2003; J. M. Al-Ansari, 2007; Chen, et al., 1997; Kassak, et al., 2001) emphasizes the need to expand these findings to the South African context, and to assess the gender differences in toothbrush behavior that may exist in this population.

Race. Additionally, race is a modifying factor that may influence health perceptions. Recalling the vast history of race in South Africa (see Chapter One), race is added as a modifying factor in the following two-part research question:

RQ6a: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of recommended oral health beliefs (Brushing benefits and flossing benefits)?

RQ6b: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of non-recommended oral health beliefs (Toothpick benefits and chewing stick benefits)?

The recommended oral hygiene behavior, routine dental exams, will not be assessed in this question in an effort to keep the number of predictors even between these two questions.
**Predictors of behavior.** It is evident that oral health problems are on the rise in many African countries (Petersen, 2008; The Bangkok Charter for Health Promotion in a Globalized World, 2005). In order to improve these oral health statuses, it is vital to investigate the health beliefs that influence oral hygiene behaviors. Taking a cultural approach to understanding public health problems allows the research to point towards critical factors that influence several health and oral health problems (Petersen, 2004, 2008; The Bangkok Charter for Health Promotion in a Globalized World, 2005). These factors may include increasing inequalities within and between countries (The Bangkok Charter for Health Promotion in a Globalized World, 2005), new patterns of communication and consumption, such as oral traditions through storytelling (Y. Pillay, 2003), as well as urbanization and “rapid and unfavorable social, economic, and demographic changes that affect working conditions, learning environments, family patterns, and the culture and social fabric of communities” (The Bangkok Charter for Health Promotion in a Globalized World).

The findings from this research study are important for the foundation of future oral health campaigns in South Africa. The relative lack of oral hygiene personnel as well as the socio-behavioral risk factors, especially in African countries, increases the need for individuals to take personal ownership of their oral health needs (Kaimenyi, 2004, p. 378; Petersen, et al., 2005). Before health educators and health communicators can begin to target any cultural groups or individuals of a certain population, we must first discover the beliefs that help shape their behavior (Hochbaum, 1954; Rosenstock, 1974). Such beliefs are typically learned and passed down within cultural groups (Ting-Toomey, 2005). Campaigns that target individual oral health behaviors (e.g., brushing
and flossing the teeth) may increase knowledge, awareness, and frequency of these behaviors. Campaigns that center on the specific health beliefs and opinions of the target population have a higher significance of behavioral adoption among that population (Butani, Weintraub, & Barker, 2008; Chao & So, 2011). The next chapter will outline the methodology, including data collection and analysis, as well as my ethical guidelines as an outside researcher in South Africa.
CHAPTER 3: METHODOLOGY

The review of literature in the previous chapter outlined six research questions for this study. These research questions were used to guide this study, which sought to assess a South African sample using a valid instrument to measure individuals’ oral hygiene behaviors and components of the HBM that predict oral health behaviors (using a chewing stick, toothpick, toothbrush, dental floss, etc.). Results from this study will contribute to the literature related to the HBM, health communication campaigns, and the oral health of South Africans. Research on this target population may help contribute to data that informs future oral health campaigns about the oral health beliefs surrounding South Africans. Additionally, results will add to the knowledge base on adult oral health in South Africa. More specifically, results will contribute to research regarding the target population and the beliefs that surround their oral hygiene practices. The results from the present study have the potential to contribute to future oral health campaigns in South Africa, as these data may be useful in the development of education and prevention strategies designed to further help individuals take action and improve their oral health and hygiene behaviors. To begin it is important to explain and describe the instrument that was adopted for this study and adapted for use among the sample of South Africans.

Original Instrument: Oral Health Beliefs Survey

The Oral Health Beliefs Survey (OHBS)\(^3\) was originally developed based on HBM constructs to measure college students’ knowledge, beliefs, and behaviors related to oral health and hygiene. No other instrument is available to measure the oral health

---

\(^3\) To request a copy of the original OHBS instrument, please contact the primary researcher at sa119610@ohio.edu.
beliefs of any age population (Aubuchon, 2010). Preliminary research (i.e., qualitative interviews) aided in validating the instrument for study in this target population. Data collected using the OHBS provides scholars with formative research that can inform future interventions by understanding what beliefs influence oral health behaviors. The oral hygiene behaviors measured using OHBS are: brushing the teeth, flossing the teeth, routine dental exams, using a chewing stick, and using a toothpick.

Beliefs were chosen as the scope of OHBS for both the original research study (the initial study in which the survey was developed to use on college students) and the present study (i.e., presented research using the South African subpopulation) and aligned with research on HBM (Hochbaum, 1954). The original OHBS contained 73 items (includes demographic items); 25 items measured HBM constructs directly, which included five HBM scales: perceived benefits of brushing scale (5 items), perceived benefits of flossing scale (5 items), perceived benefits of dental visits (5 items), perceived severity of dental problems (5 items), and perceived susceptibility toward dental problems (5 items). OHBS also originally contained a knowledge index (13 items), barriers questions (7 items), and a demographic section of questions (7 items) located at the end of OHBS. Additionally, OHBS contained one motive behind behavior item and 20 single-item measures of a variety of oral hygiene behaviors and oral health related topics, including brushing and flossing the teeth, routine dental visits, oral piercings, sexually transmitted infections, use of whitening products, and food and drink consumption. The demographics section on the original OHBS was included to obtain a better understanding of the characteristics of the target population.
**Scale development.** Within OHBS, each HBM construct is measured using five questions; items comprising each factor of the HBM (e.g., perceived susceptibility, perceived severity, perceived barriers, etc.) are assessed using a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Depending on the number of questions assessed within each construct, each scale has a highest potential score of 25 points. A Cronbach’s alpha was used to determine if factors were reliable. Reliability scores were assessed using the standard set by Richmond and colleagues (2003) which states that a Cronbach alpha that exceeds 0.6 reveals a satisfactory marker for a reliable instrument. Findings for each construct from the original HBM are outlined in the paragraphs that follow.

**Perceived benefits.** Perceived benefit questions were developed in order to answer the questions about when the population partakes in healthy oral hygiene behaviors and what benefits they associate with these behaviors. Five items measure perceived benefits for each behavior recommended by the ADA for healthy oral health: Brushing, flossing, and visiting the dentist (for a total of 15 perceived benefits items). Perceived benefits were measured using the recommendations of Klassen (2012) and Waddington (2000). Each perceived benefits scale has a highest potential score of 25 points. Respondents were given statements to elicit understandings of the benefits that would arise from engaging in proper oral health behaviors. Scale items include statements such as, “a benefit of brushing the teeth is preventing cavities” and “a benefit to flossing the teeth is a confident smile.” Five items measured the responder’s feelings or beliefs towards the benefits of each of the three oral health behaviors in relationship to: Preventing cavities, preventing gum disease, clean teeth, fresh breath, and a confident
smile. Initial testing of the internal consistency of the perceived benefits of brushing, flossing, and routine dental visits scales were found to be high (Cronbach’s $\alpha = 0.94$; Cronbach’s $\alpha = 0.90$; Cronbach’s $\alpha = 0.92$, respectively). These Cronbach alphas represent the perceived benefit scales for the original study. The present research study further tested the reliability of these scales using the South African data set.

**Perceived severity.** Perceived severity questions were developed in order to understand better the populations’ perceptions towards the consequences of negative oral health. Five items measure perceived severity of a dental problem (cavity, gum disease, etc.), yielding a potential score of 25 points. Respondents were given statements to obtain understandings of their perceptions towards how serious they view oral health problems. Scale items included statements such as, “if I had a dental problem (cavity, gum disease, etc.), I would take it very seriously” and “it would be very painful if I had a dental problem (cavity, gum disease, etc.).” Five items measured the responder’s feelings or beliefs towards the severity of dental problems in relationship to: its seriousness, pain, the negative effects, cost, and depression. Initial assessment of the perceived severity scale concluded that the internal consistency was satisfactory (Cronbach’s $\alpha = 0.68$). Additionally, the present research further tested the reliability of perceived severity using the projected South African data set.

**Perceived susceptibility.** To expand understandings on the beliefs the college-age population holds towards how vulnerable they are to developing a dental disease, five perceived severity questions measured one’s perceived susceptibility towards of a dental problem (cavity, gum disease, etc.); items yielding a potential score of 25 points for this scale. Respondents were given statements to obtain a better understanding of their
perceptions towards how susceptible they view themselves to be towards oral health problems. Scale items included statements “it is extremely likely that I will experience a dental problem (cavity, gum disease, etc.) during my life” and “being in college makes it more likely that I will experience a dental problem (cavity, gum disease, etc.).” Five items originally measured the responder’s feelings or beliefs towards their susceptibility to dental problems in relationship to: their likeliness, education, lifestyle, gender, and the average person. Assessment of the internal consistency for the original five item scale was relatively high (Cronbach’s α = 0.84). In respect to the present research study, the perceived susceptibility scale was further tested for reliability using the South African data set.

**Perceived barriers.** Seven categorical questions assessed the obstacles that the college-age population perceived towards enacting routine oral hygiene behaviors (twice a day brushing, once a day flossing, and routine dental visits). Seven barrier items were measured using multiple choice scales (Klassen, 2012; Waddington, 2000). Barrier questions include items such as “A barrier to brushing your teeth twice a day is” and “A barrier to flossing your teeth daily is.”

Responders are asked to answer the question by choosing the main reason from the multiple choice list. Choices were derived from literature on barriers identified by the target population (Kikwilu, et al., 2008; Myburgh, et al., 2004), including cost, pain, convenience, forgetfulness, time, as well as a response that allowed participants to note if they do not actually partake in that particular behavior. In the original OHBS survey, participants were able to choose all barriers that served as obstacles to fulfilling the behavior. Last, two questions assess whether or not the respondent has any form of
medical aid that pays for some or all of their dental care. This question is asked in the survey portion of OHBS, as well as in the demographics section (the barriers item that is included in the demographics section is counted as a survey item on OHBS, not as a demographic question). The purpose behind asking this question twice is for validity verification. Reliability was not assessed for this construct since these seven questions were not developed using a Likert scale. In regards to the present research study, the perceived barriers scale was not further tested for reliability due to the exploratory nature of the study which is described later in this chapter.

**Knowledge.** A nominal index of 13 knowledge questions was created in order to measure the oral health facts and behavioral practices among the college-age population (McKenzie, et al., 2005). This index was developed on an additive scale and participants’ knowledge was scored with correct answers receiving one point and incorrect responses not receiving a point. The range of knowledge scores ranged from 0 (low knowledge of oral hygiene) to 13 (high knowledge of oral hygiene). The original OHBS yielded a mean score of 11.46 (SD = 1.92) among the original college-age population.

**Brushing behavior.** Two questions were developed to measure the brushing behavior among the college-age population. Scales were developed using the American Dental Association’s recommendations for brushing the teeth twice daily (ADA, 2012). The first brushing question, “I brush my teeth…” was measured using a categorical scale (Waddington, 2000) with six specific categories that measure the frequency of tooth brushing behavior: Less often or never, twice per month, once a week, two to three times per week, once a day, and two or more times a day. The second brushing behavior
question asked if the participant brushed their teeth at least twice a day; this question is measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington).

**Flossing behavior.** Two questions were developed to measure the flossing behavior among the target population. Scales were developed using the same recommendations stated in the brushing behavior description above. Questions were measured using the same scales and specific categories as the brushing questions (see Klassen, 2012; Waddington).

**Routine dental exams.** Four questions were developed to measure how often one visits the dentist. Again, scales model the recommendations from the ADA for routine or yearly visits to the dentist (ADA, 2012) The first dental exam question, “How often do you visit the dentist?” was measured using a categorical scale (Waddington, 2000) with seven specific categories that measure the frequency of visiting the dentist: every 3 months, every 6 months (2 times a year), once a year (every 12 months), once every 2 years, every 2-5 years, never, and other. The second dental exam question asked the participants’ “Main reason for your last dental exam” with six categories of responses, including a check-up, experiencing pain or discomfort in the mouth, treatment was needed (e.g., cavity filled, work done), cosmetic reasons, I do not go to the dentist, and other. The last two questions asked if the participant has seen the dentist in the last year; this question is measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington).

**Demographics and other items.** A total of 13 items assessed unique behaviors of the college-age population, including: Use of mouthwash, diet, risky oral hygiene behaviors (i.e., oral piercings, oral tattoos), and use of tobacco. Additionally, seven
questions assessed basic demographic data (e.g., level in school, age, gender, academic major, race, and ethnicity). The decision to include these questions came from the informative interview conducted as preliminary research for the present study.

**South African Research**

The analytic process for the present study took place in four steps: Preliminary research, data collection, data screening and cleaning, and data analysis. The preliminary research phase was completed in two parts. First, qualitative interviews with individuals from southern African countries were conducted by the primary researcher prior to conducting research in South Africa. Second, a pilot study with participants in South Africa was led by the primary researcher. These preliminary efforts were completed for validity purposes: to strengthen the data collection process and in turn strengthen the analysis phase. The analysis process varied slightly based on the research question being investigated. In the sections which follow, the steps taken for each research question are addressed and outlined.

**Preliminary study.** As mentioned above, the completion of the preliminary research phase was twofold. First, the primary researcher conducted qualitative interviews with individuals who identified as being from southern African countries. After the qualitative interviews were completed, the primary research conducted a pilot study with South Africans living in South Africa. The following two sections will outline and describe these two preliminary efforts in more detail.

**Qualitative interviews.** Since the literature on oral hygiene in Africa is lacking, qualitative interviews with individuals from southern Africa were completed. Permission for research was obtained from the Institutional Review Board (IRB) from the primary
researcher’s university before beginning the study. Qualitative interviewing is a method used to gather information about a subject that cannot be obtained via observation or by other means (e.g., published research; Lindlof & Taylor, 2002). Lindlof and Taylor (2002) suggest using qualitative interviews as a “digging tool” (p. 185) for the researcher to uncover the true realities of cultural activities (e.g., oral hygiene behaviors and beliefs). Additionally, in terms of validating an instrument for the use of study in a foreign country, qualitative interviews allow researchers the ability to “elicit the language forms used by the social actors in natural settings” (Lindlof & Taylor, p. 174), thus providing a way to refine and adjust questions to be understood better by the target population. In all, the long-term goal for this study is to move one step closer to being able to more accurately assess the South African population’s oral health beliefs, behaviors, barriers, and knowledge by using a valid and reliable instrument. The short-term objectives for this study were to further verify and validate this instrument and to achieve efficiency of the instrument via qualitative interviewing. The short and long-term goals can be reached by using the interview questions to answer the following research questions for this preliminary study:

RQ1: Does the pre-existing instrument cover topics that are relevant to individuals’ (living in an African country, particularly a Southern African country) oral health beliefs, barriers, knowledge, and behaviors?

RQ2: What beliefs, barriers, knowledge, and/or behaviors, if any, are not mentioned on this instrument that should be included in this assessment?
RQ3: Are there any questions that should be removed from the instrument because they are not relevant to the target population (African or Southern African populations)?

The design of this preliminary study was a convenient sample and was conducted in effort to strengthen the forthcoming study by including advice and suggestions from individuals from African countries. Participants were recruited for study via word of mouth or snowball sample. To begin, the researcher attempted to locate individuals from South Africa to participate in this pilot study. The primary researcher exhausted all resources available to locate participants from South Africa (e.g., email list serves, word of mouth, Study Abroad and cultural studies departments, etc.) to participate in this study. South African participants were not willing or able to participate. During the process of attempting to locate individuals from South Africa, one individual from an African country was willing and able to participate in an interview on oral health behaviors, beliefs, barriers, and knowledge. In turn, this individual recommended or recruited two others who were interested in participating in the study. All participants were provided with the IRB approved consent form with waived signature. Qualitative interviews with three individuals from Kenya, Malawi, and Swaziland were held by the primary researcher. Both Swaziland and Malawi are considered southern African countries, while Kenya is located in the eastern region of Africa.

Since the purpose of the pilot study was to fix any mistake(s) within the instrument and to ensure it was relevant to a South African population, it was important to work through each question with the participant. In other words, the participants were not asked to complete the survey, rather they were asked to read the instrument and
comment on the various sections. Participants were asked to take a few minutes to read over the instrument and once they were finished reviewing, the primary researcher asked a series of interview questions about the instrument. Interview questions asked about the overall length of the survey and their opinion as to if there were questions in each section (e.g., knowledge, barriers, beliefs, behaviors, etc.) that were not suitable or relevant to oral health and hygiene practices in their country. Participants were asked if they thought it would be necessary to add questions about topics that may have been missed on the instrument—topics they found relevant to oral health and hygiene in an African country. Additional questions included asking about the complexity of the survey—were any questions or directions in the survey difficult to understand, did they think that others, like themselves, would understand this survey? Last, the primary research raised the question of whether or not any question(s) asked on the instrument should be removed. These findings are described in more detail in the paragraph that follows.

After the preliminary study, the information obtained from the three informative interviews were compiled and further assessed. The following conclusions were made in an effort to strengthen the OHBS for use in South Africa. First, across the board of interviews, both cancrum oris and acute necrotizing gingivitis, acute forms of gingivitis in African countries (Thorpe, 2003), were thought to not be perceived as common terms among people living in African countries. The term “gum disease” was suggested as a common phrase to express these two diseases. Therefore, gum disease was the term used throughout the OHBS. Second, one item was added to the already developed perceived susceptibility of oral diseases scale; this item resonates with the specific culture of South Africa, and simply asks if one’s culture makes them more susceptible to oral diseases.
This suggestion came about during validation interviews at the beginning stages of this study’s formative research. Third, per the informative interviews with Southern African participants, questions regarding oral piercings were preserved in the current version of OHBS while the single-items measures of oral hygiene behaviors that were either not relevant or appropriate for to the South African population (i.e., oral sex practices, STI transmission, and oral decorative encasements) were removed from the adapted version of OHBS. Fourth, participants concluded that the barriers to oral care (e.g., cost, pain, convenience, and forgetfulness) encompassed all known barriers in this context. Therefore, no changes were made to the barriers questions on OHBS. Last, all three interviewees expressed concern about the length of OHBS, stating that there may be too many questions assessed within one survey. With this concern expressed by all three interviewees, additional questions for the HBM constructs cues to action and self-efficacy were not included in the version of OHBS developed for the South African population. Efforts to include these questions may be useful in future studies that assess the oral health beliefs of South Africans.

In all, the results of the qualitative interviews were used to make modifications to the instrument. Furthermore, the interview questions helped to answer the research questions covered above. First, the pre-existing instrument did cover topics that were relevant to individuals living in African countries. It was suggested that modifications be made to words such as ANUG and NOMA; substituting in “gum disease,” a better known term, among the target population. For the second research question, it was brought to my attention in each interview that the survey was very long and to not add any more
questions. Additionally, suggestions for questions to remove and further strengthen the instrument were noted above.

One limitation of the preliminary study was not being able to find people that were willing and able to participate in a short, informative interview on oral hygiene. Future efforts may be more successful if the researcher offers an enticing incentive that attracts people to participate. Although the interviews were not held with individuals directly from South Africa, they did provide information that was helpful for filling in gaps from the literature about oral hygiene practices in Southern Africa. In the future, it would be more ideal if preliminary efforts to refine the instrument, such as informative interviews, are conducted with individuals who are from the country for which one is studying (e.g., South Africa). Despite these challenges, these preliminary research efforts allowed the researcher to get one step closer to validating an instrument that is the first of its kind to use the HBM to assess the oral health and hygiene related beliefs of South Africans. The section that follows outlines and describes the second stage of this research study, the data collection for the formative research study conducted in South Africa.

Adaption of OHBS for a South African population. In an effort to understand a subsection of a South African population’s oral health needs and concerns, this research attempted to address the gap in the research base. This research used an existing instrument, the OHBS, adapted for use in a South African population, to examine South Africans’ oral health beliefs and behaviors. Understanding these oral health beliefs may predict oral health behaviors, and, thus, allow us to better design future oral health campaigns in South Africa. If we understand which beliefs, if any, can predict behavior,
we can develop oral health campaigns that may serve to improve those beliefs, which may, in turn, change or influence the target behavior. The preliminary study, qualitative interviews, aided in adapting the OHBS to the South African subpopulation. Additionally, the review of literature revealed key issues that play a large role in the cultural beliefs that shape behaviors of South Africans. Both the qualitative interviews and the review of literature were helpful in revising a version of the OHBS that was fitting for the South African population. The version of OHBS for the South African population is comprised of 82 items and eight demographic questions. Although flossing behavior does not appear to be a prevalent behavior among the South African population, questions regarding flossing (e.g., perceived benefits of flossing, barriers to flossing, etc.) are preserved to see if Western (i.e., recommended) practices have been adopted due to globalization in South Africa (Thorpe, 2003). In addition to the three perceived benefits scales related to brushing, flossing, and visiting the dentist, scales about a chewing stick and a toothpick were added to the instrument. This will ensure that beliefs about common oral health behaviors among the South African culture, using the chewing stick and toothpick, are common practices among South Africans (Rwenyonyi, et al., 2011).

The adapted OHBS for the South African population contains 82 oral health related questions and eight demographic questions that are located at the end of the instrument (a total of 90 questions in OHBS). The item measures and scale variables are: knowledge index (18 items), perceived benefits of brushing (5 items), perceived benefits of flossing (5 items), perceived benefits of dental visits (5 items), perceived benefits of using a chewing stick (5 items), perceived benefits of using a toothpick (5 items), perceived severity (5 items), perceived susceptibility (6 items), perceived barriers (6
items), and individual behavior questions (22 items). It should be noted that the behavior questions: brushing the teeth, flossing the teeth, and routine dental exams, were originally developed using the ADA’s recommendations (ADA, 2012). The South African population was assessed by using the recommendations set by the SADA (SADA, 2012). Table 3.1 (found under the Instrument section) outlines the types of questions asked in OHBS and how many questions assess the corresponding construct.

Pilot study: qualitative interviews in South Africa. In order to continue to refine the instrument, the primary researcher applied for IRB at the primary researcher’s university; IRB was obtained for conducting informal interviews in South Africa. The purpose of this preliminary study was exploratory; that is, in the instance that once the primary investigator was in immersed in the culture if issues with the survey emerged, qualitative interviews could be used to better refine and validate questions and/or scales within OHBS. Likewise, within the first days of being in South Africa, issues did emerge with the instrument and it was necessary to make changes to the OHBS before continuing on in the data collection. To begin, my first two participants (n = 2) made vocal comments about the scales not applying to them, thus I took this situation as an opportunity to have light, informal conversations with these participants about ways in which I could strengthen the scales used to assess questions on OHBS. The challenges that emerged among these participants concerned the scale for the knowledge and negative oral behaviors (e.g., oral piercings, tobacco use, etc.) questions (i.e., questions 1-25). Participants expressed concern that the dichotomous answer selection for these questions did not fit their intended response to some of the questions in these two sections. For instance, with the questions about chewing sticks, for those participants
who did not use a chewing stick, they felt that these questions were not applicable to their lifestyle, thus responding either yes or no did not fit for them. The third answer selection, “not applicable (NA)” was added to the first 25 questions on OHBS. Scales used to assess the knowledge scale and negative oral hygiene behavior questions were amended and new copies of OHBS were printed for further data collection.

After making changes to the OHBS after the first two participants aided in enriching the value of this instrument, additional challenges emerged with the next three (n = 3) participants. In the second batch of data collection, three participants expressed concerns with the scale used to assess the barriers to behavior questions (i.e., questions 74, 76, 78, 80, & 82). Recall from the “adoption of OHBS to South African Population” section to see how the perceived barriers questions were developed. Choices for the perceived barriers to behaviors questions were derived from literature on barriers identified by the target or related populations (Kikwilu, et al., 2008; Myburgh, et al., 2004), including cost, pain, convenience, forgetfulness. During these beginning stages of data collection in South Africa, participants either wrote in on their survey that they did not do the specified behavior or asked me about how they should answer the question because they did not enact the particular behavior. Take for instance the barriers to behavior questions. For using a chewing stick, if they did not use a chewing stick to clean their teeth and gums, the options provided (e.g., cost, convenience, pain, and forgetfulness) were not applicable to them. Consequently, the fifth option of “I do not (go to the dentist, brush my teeth, floss my teeth, use a chewing stick, use a toothpick)” was added as a response to these five barrier questions. After these changes were made, final barrier questions asked responders to answer these questions by choosing the main
barrier to the particular behavior (going to the dentist, brushing the teeth, flossing the teeth, using a chewing stick, using a toothpick) from the multiple choice list. In all, changes from the first qualitative interview session (n = 2) and the second qualitative interview session (n = 3) in South Africa aided in strengthening the OHBS for further use in the field. Furthermore, after changes were made to OHBS, per the suggestions and feedback from the five qualitative interviews, data collection began to run more smoothly; if additional issues were to arise, they would have been addressed. Since no other problems or challenges emerged in the subsequent sessions of data collection, moving forward in this study, the OHBS was considered as a valid tool to assess the oral health beliefs and behaviors of South Africans.

**Data collection.** The data collection section contains four key parts. First, the target sample size is explained in terms of how the number of participants was determined by the primary researcher. Second, the criteria for eligible participants is explained in detail. Third, how the instrument used in South Africa was developed and adopted for use is uncovered. Fourth, the scale development section explains each scale used in OHBS.

**Sample size.** This formative research study employed a convenience sampling method. The estimated sample size for the South African population was calculated using G*Power 3.1.3 (Faul, Erdfelder, Buchner, & Lang, 2009). Sample size estimations were made for linear multiple regression testing, assuming that R² is different from zero, which is the least-powerful analysis anticipated. Additionally, the expected effect sizes

---

4 To request a copy of the OHBS instrument adapted for the South African study, please contact the primary researcher at sa119610@ohio.edu.
for these studies are estimated at the moderate effect size of .15. Coupling this effect size with a generally accepted guide of power of .80 and an alpha level of .05, the sample sizes were calculated for the multiple regressions with six predictors (perceived severity, susceptibility, benefits, barriers, knowledge, and race). This calculation indicates that 92 participants were needed for the South African population. Based on response rates from prior research studies (Nulty, 2008), a conservative approach to the data assumes an 80% response rate; the minimum sample size for the population was re-estimated at 115, thus to have a clean target sample size (and assure an adequate sample size), the researcher made every effort to recruit at least 130 participants for this study.

**Participants.** The primary researcher obtained approval from her home university’s Institutional Review Board (IRB). Once at the research location in South Africa, if additional IRB or permission was needed from the field placement site(s), and/or changes needed to be made to the initial IRB, proper procedure was followed before starting any research. Additional IRB was not needed for each field placement site in South Africa. The primary researcher did obtain permission to conduct research from each manager or supervisor at each field placement site.

This study sought to recruit a convenience sample of South Africans over the age of 18 years (\(n = 130\)) from a variety of South African organizations and groups, including non-profit, to participate in the oral health beliefs study. Participants were recruited through the field placement of the primary researcher while completing the coursework for her primary area of study in South Africa. Field placement sites included House of Resurrection (an orphanage serving children either infected with or affected by HIV), Missionville Care Center (a community center which serves as a church, hospital, school,
and soup kitchen for the local community), and Grassroots Soccer (an organization that uses the sport, soccer, to teach school children about HIV). Additional recruitment of participants occurred within the local community, including nearby prayer groups and yoga classes, as well as the Boardwalk Shopping Center. After approval from the IRB from the home university, as well as oral permission from the placement sites listed above, was granted, the primary researcher recruited participants for the study. Data collection methods first included developing a relationship with the organization, then asking their permission to survey workers and local members. After developing a rapport with the organization or group of individuals, the primary researcher asked if they would be willing to complete a survey that asks about their oral health beliefs and behaviors, in an effort to uncover beliefs that surround such behaviors. If individuals agreed to participate in the study, the primary researcher then distributed pencil and paper surveys and asked participants to fill out the questionnaire. When literacy concerns arose, the primary researcher offered to read the survey to the participant(s). Many times during the study, the primary researcher read the survey aloud to a group of five to 10 participants.

**Instrument development.** The procedural steps for item writing and instrument development were two-fold. First, the procedure was adopted from past researchers (Espie, et al., 2001; Leung, et al., 2005; Maciel, Jennings, Jones, & Natour, 2009; Mueller, 1986; Perko, 1999; Wiersma & Jurs, 1990). Second, the data obtained from the primary researcher’s informative interviews with individuals from African countries was used to better refine the items in the instrument. More specifically, the primary investigator identified the scope and parameters of the OHBS, which included measuring the core constructs of HBM in relation to oral hygiene behaviors of South Africans.
Constructs included perceived susceptibility and perceived severity of oral diseases, as well as perceived benefits of brushing, flossing, routine dental visits, use of a chewing stick, and using a toothpick. Second, the researcher developed five to six questions for each HBM construct; this step aided in establishing the face reliability of OHBS. Finally, behavior was determined as a focus of the scope of the study due to the many unique oral health behaviors that affect today’s South African people. Findings from the two preliminary studies were used to refine OHBS. Table 3.1 displays the question topics found on the final version of OHBS for use in South Africa.
Table 3.1

*Question Topics and Number of Items that Assess Each Topic in the Adopted South African Version of OHBS*

<table>
<thead>
<tr>
<th>Question Topic</th>
<th>Number of Items in OHBS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>18</td>
</tr>
<tr>
<td>Behaviors</td>
<td>22</td>
</tr>
<tr>
<td>Smoking</td>
<td>2</td>
</tr>
<tr>
<td>Brushing</td>
<td>2</td>
</tr>
<tr>
<td>Flossing</td>
<td>2</td>
</tr>
<tr>
<td>Chewing Stick</td>
<td>2</td>
</tr>
<tr>
<td>Toothpick</td>
<td>2</td>
</tr>
<tr>
<td>Dental Visits</td>
<td>3</td>
</tr>
<tr>
<td>Other Behaviors</td>
<td>9</td>
</tr>
<tr>
<td>Perceived Benefits</td>
<td>25</td>
</tr>
<tr>
<td>Brushing the Teeth</td>
<td>5</td>
</tr>
<tr>
<td>Flossing the Teeth</td>
<td>5</td>
</tr>
<tr>
<td>Using a Chewing Stick</td>
<td>5</td>
</tr>
<tr>
<td>Using a Toothpick</td>
<td>5</td>
</tr>
<tr>
<td>Routine Dental Exams</td>
<td>5</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>5</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>6</td>
</tr>
<tr>
<td>Perceived Barriers</td>
<td>6</td>
</tr>
<tr>
<td>Demographics</td>
<td>8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>90</strong></td>
</tr>
</tbody>
</table>
The next sections will explain the development of each scale comprised within OHBS and outline the questions that assess each construct.

**Scale development.** Within the adapted version of OHBS, each HBM construct is measured as a scale which contains either five or six questions which correspond with that construct. Scales described below include the HBM constructs of perceived benefits, perceived susceptibility, and perceived severity. The HBM construct perceived barriers, as well as the four oral hygiene behaviors, are assessed in multiple items within OHBS. Additionally, knowledge is measured as an index. The last section described in this section includes the demographic questions which complete OHBS. Each of these items are discussed in the subsections which follow.

**Perceived benefits.** Perceived benefit questions were adapted in order to answer the questions about the benefits participants associate with healthy oral hygiene behaviors. Five items measured perceived benefits for each behavior: Brushing, flossing, visiting the dentist, using a chewing stick, and using a toothpick (for a total of 25 perceived benefits items). Perceived benefits were measured using the recommendations of Klassen (2012) and Waddington (2000). Respondents were given statements to elicit understandings of the benefits that would arise from engaging in proper oral health behaviors (e.g., brushing the teeth, flossing the teeth, visiting the dentist, using a chewing stick, and using a toothpick). Scale items for brushing benefits included five questions or statements. Statements for brushing benefits were: “a benefit of brushing the teeth is preventing cavities,” “a benefit of brushing the teeth is preventing gum disease,” “a benefit of brushing the teeth is clean teeth,” “a benefit of brushing the teeth is fresh breath,” and “a benefit of brushing the teeth is a confident smile”. Five items measured
the responder’s feelings or beliefs towards the benefits of each of the five oral health behaviors in relationship to preventing cavities, preventing gum disease, having clean teeth, having fresh breath, and having a confident smile. Testing of the internal consistency of the scales for perceived benefits of brushing, flossing, routine dental visits, use of a chewing stick, and use of a toothpick are discussed in the data analysis section.

*Perceived severity.* Perceived severity questions were adapted to the target population in order to understand better the South African population’s perceptions towards the consequences of negative oral health. Five items measured perceived severity of a dental problem (cavity, gum disease, etc.), yielding a potential score of 25 points. Respondents were given five statements to obtain understandings of their perceptions towards how serious they view oral health problems. Scale items were composed of the following statements: “if I had a dental problem (cavity, gum disease, etc.), I would take it very seriously,” “it would be very painful if I had a dental problem (cavity, gum disease, etc.),” “my overall health and wellbeing would be negatively affected if I had a dental problem (cavity, gum disease, etc.),” “it would be very costly if I had a dental problem (cavity, gum disease, etc.),” and “I would be depressed if I had a dental problem (cavity, gum disease, etc.).” Overall, the five items measured the responder’s feelings or beliefs towards the severity of dental problems in relationship to: its seriousness, pain, the negative effects, cost, and depression. Initial assessment of the perceived severity scale is discussed in the data analysis section.

*Perceived susceptibility.* To expand understandings on the beliefs the South African population holds towards how vulnerable they are to developing a dental disease, OHBS contained six perceived susceptibility questions which measured respondents’
perceived susceptibility of a dental problem (cavity, gum disease, etc.); items yielded a potential score of 30 points for this scale. Respondents were given statements to obtain a better understanding of their perceptions towards how susceptible they viewed themselves to be to experiencing oral health problems. Scale items included these statements: “it is extremely likely that I will experience a dental problem (cavity, gum disease, etc.) during my life,” “my education level makes it more likely that I will experience a dental problem (cavity, gum disease, etc.),” “I am more likely than the average person to have a dental problem (cavity, gum disease, etc.),” “my lifestyle makes it more likely that I will experience a dental problem (cavity, gum disease, etc.),” “my gender (male/female) makes it more likely that I will experience a dental problem (cavity, gum disease, etc.),” and “my culture makes it more likely that I will experience a dental problem (cavity, gum disease, etc.).” Overall, these six items measured the responder’s feelings or beliefs towards their susceptibility of dental problems in relationship to their chance of experiencing a dental problem, the likelihood that they are more susceptible compared to the average person, and if their culture, education, lifestyle, or gender makes them more susceptible to experiencing a dental problem. The internal consistency for the six item susceptibility scale will be discussed in the data analysis section.

*Perceived barriers.* A barriers index was used in OHBS to explore the obstacles that the South African population perceived towards enacting routine oral hygiene behaviors (twice a day brushing, once a day flossing, routine dental visits, using a chewing stick, using a toothpick, and obtaining medical aid). Six items, using multiple choice categories (Klassen, 2012; Waddington, 2000), measured barriers to carrying out ideal, healthy oral health behaviors. Barrier questions included the following five stems:
“a barrier to going to the dentist at least once a year is ________,” “a barrier to brushing your teeth at least twice a day is_________,” “a barrier to flossing your teeth at least once a day is________,” “a barrier to cleaning your teeth with a chewing stick is ________,” and “a barrier to cleaning your teeth with a toothpick is________.” The blank lines in the question stems above represent the fact that these questions are completed by the participant selecting one of the answer choices provided for each question; these answer choices are discussed below.

Responders were asked to answer the question by choosing the main barrier to enacting the behavior from a multiple choice list of options. Choices were derived from literature on barriers identified by the target population (Kikwilu, et al., 2008; Myburgh, et al., 2004), including cost, pain, convenience, forgetfulness, as well as a response that allowed participants to note if they do not actually partake in that particular behavior. This response was added during the final stages of this scale development (see: Qualitative interviews in South Africa) during the small pilot study in South Africa. Adding the fifth option of “I do not (go to the dentist, brush my teeth, floss my teeth, use a chewing stick, use a toothpick)” to the five barrier questions provided participants with the option to note if they do not do a particular behavior, rather than being forced to respond to questions about behaviors that they do not enact, and vice versa. Participants were asked to choose the choice that served as the largest barrier to fulfilling the behavior specified in the question. Participants were asked to identify one barrier per behavior question. The decision to limit the number of barrier choices the participant could identify was decided because it was important to assess the largest perceived barrier towards each of the five oral hygiene behaviors.
Last, two questions assess whether or not the respondent has any form of medical aid that pays for some or all of their dental care. This question was asked in the survey portion of OHBS, as well as the demographics section (the barriers item that is included in the demographics section is counted as a demographic item on OHBS). The purpose behind asking this question twice is for validity verification.

*Knowledge.* A nominal index of 18 knowledge questions was created to measure the knowledge of oral health facts about behavioral practices among the South African population (McKenzie, et al., 2005). This index was developed on an additive scale and participants’ knowledge will be scored with correct answers receiving one point and incorrect responses not receiving a point. The range of knowledge scores could potentially range from 0 (low knowledge of oral hygiene) to 18 (high knowledge of oral hygiene).

*Brushing behavior.* Two questions were developed to measure brushing behavior among the South African population. Scales were developed using the American Dental Association’s and the South African Dental Association’s recommendations for brushing the teeth twice daily (ADA, 2012; SADA, 2012). The first brushing question, “I brush my teeth…” used a categorical scale (Waddington, 2000). Six specific categories measured the frequency of tooth brushing behavior: Less often or never, twice per month, once a week, 2-3 times per week, once a day, and two or more times a day. The second brushing behavior question asked if the participant brushed their teeth at least twice a day; this question was measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington).
Flossing behavior. Two questions were developed to measure the flossing behavior among the target population. Scales were developed using the same recommendations stated in the brushing behavior description above. Questions are measured using the same scales and specific categories as the brushing questions.

Routine dental exams. Two questions were developed to measure how often the sample of South Africans’ surveyed for this study, visits the dentist. Again, scales model the recommendations from both the ADA and the SADA for routine or yearly visits to the dentist (ADA, 2012; SADA, 2012). The first dental visits question, “How often do you visit the dentist?,” was measured using a categorical scale (Waddington, 2000). Seven specific categories measured the frequency of visiting the dentist: every 3 months, every 6 months (2 times a year), once a year (every 12 months), once every 2 years, every 2-5 years, never, and other. The second dental exam question asked if the participant has seen the dentist in the last year; this question was measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington).

Chewing stick behavior. Two questions were developed to measure how often the South Africans population uses the indigenous behavior, chewing stick, to clean the teeth and gums. Limited research on this behavior as well as the absent dialogue from the SADA made it difficult to develop scales to measure these questions. Therefore, the scales from the previous behavior questions (i.e., brushing and flossing behaviors) were used to measure chewing stick behavior. This also allows for consistency in measurement among four of the five behaviors.

Toothpick behavior. Regarding the behavior of using a toothpick, two questions were developed to measure how often the sample population of South Africans partook in
this behavior to clean their teeth and gums. Limited research on toothpick behavior, as well as the absent dialogue from the SADA, made it difficult to develop scales to measure this subject matter. The scales from the previous behavior questions (brushing and flossing behaviors) were used to measure the questions that assess toothpick behavior. Again, this allowed for consistent measurement among these four oral hygiene behaviors (i.e., brushing, flossing, chewing stick, and toothpick).

**Demographics and other items.** A total of 20 items either assess basic demographic data (eight questions: Age, gender, medical aid, education level, residence, race, country of origin, and South African province) or unique behaviors of the South African population (oral piercings, tobacco use, sugar consumption, sweetened beverage consumption, etc.). The decision to include these questions came from the informative interview conducted as preliminary research for the present study; these items did not contribute to the overall formation of OHBS for the South African population.

The demographics section of OHBS was adapted to fit the target population in South Africa. In order to adapt these questions to this population, the categories for each inquiry were adopted from the 2011 South African Census Statistical Release (2012). Below are descriptions for each demographic question and how each was adapted for the use of OHBS in South Africa. The questions regarding the age and gender of the participant were preserved from the original version of OHBS.

The 2011 South African census report is the country’s most recent population census. The United Nations Secretary, Jeremiah P. Banda (2003), defined population census as “the total process of collecting, compiling, evaluating, analysing [analyzing] and publishing or otherwise disseminating demographic, economic and social data.
pertaining, at a specified time, to all persons in a country or in a well-delimited part of a country.” Suharto (2001) expresses the usefulness of census data, stating that this data allows analysts to produce estimates for population subgroups (e.g., races, sex, age groups, etc.), and it also supplies the sampling frame for sample surveys. Census data provides a framework for which other surveys can use or adapt measures that relate to or reflect similar sample populations. The 2011 South African census served as a platform for adopting measures used in OHBS for this research study.

Age. As a standard question on OHBS, participants were asked to indicate their age in years. The purpose for obtaining the participants current age was to follow the IRB protocol stating that all participants must be 18 years or older. Ages were recorded in SPSS, a statistical software package, and recoded into the age-specific categories marked by the South African census (Statistics South Africa, 2012). Age categories are distributed by every four to five years starting with birth. Groups are as follows: ages 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 70-74, 75-79- 80-84, 85-119. The last age group is made up of everyone over the age of 85 years.

Sex. Using the scale from the South African census (Statistics South Africa, 2012), participants were asked to indicate whether their sex was male or female. The purpose for obtaining this information was in order to get a better understanding of the sample population.

Medical aid. Dental insurance, known as medical aid in South Africa, is a policy arrangement that is designed to pay or cover all or a portion of the costs associated with one’s dental care (ADA, 2013b). The original question in OHBS was stated as follows:
Do you have dental insurance, with the response choices of “yes,” “no,” and “I do not know.” Insurance in South Africa is known as medical aid. Medical aid scheme is a term that is used to describe a plan that provides full or partial coverage of medical related expenses for a group of individuals; these policies typically include medical, eye, and dental coverage (Profmed Medical Scheme, 2012). In the demographic section of OHBS, a slight change was made in the question regarding dental insurance; dental insurance was changed to “medical aid” in order to have a valid measure of those who have medical aid in South Africa.

Before 2008, many medical aid schemes did not offer partial or full coverage of dental procedures; lack of coverage made it financially difficult for South Africans to care for their oral health. On February 1, 2008, Act Number 19 of 1979 was amended. The updated Act now reads:

Every registered dental technician contractor owning a dental laboratory that is registered in terms of section 30 may from the date of signature of this notice will be entitled to directly claim fees from the patient or medical aid scheme for professional services rendered. (2008, p. 75)

Modifications to Act Number 19 of 1979 now states that dental services may be covered under some medical aid schemes. Not all medical aid schemes cover full or partial dental services but, under this act, some medical aids may cover patient fees. Thus, some South Africans that have medical aid may not have to pay money at time of dental services (South African Department of Health, 2008).

Having a question regarding medical aid was vital for OHBS in order to understand how many of those sampled had medial aid. This information can be used to
understand how many of those who did have medical aid seek oral health care treatment and preventive care from a dental professional.

*Level of education.* Education level has been shown to indirectly influence behavior and beliefs (Champion & Skinner, n.d.), thus it is important to address this question in a demographics section of a questionnaire. The original question regarding education on OHBS asked about the responder’s current class level; class represented their year in school since the initial target population was college students. Students were provided with the following answer choices for this demographic question, including freshman, sophomore, junior, and senior. Since the target population in South Africa did not only include college students, this question was formed a bit differently by asking for the responder’s highest level of education. The seven categories for this question were: Some primary school, completed primary school, some secondary school, completed secondary school, some higher education, higher education graduate, and other with the option to write in a response.

The levels of education in South Africa are represented by a three tier system: Primary school, secondary school, and tertiary education. Primary school includes the first seven years of school (grades 1 through 7). Secondary school is comprised of the next five years of school (grades 8 through 12; Southern and Eastern Africa Consortium for monitoring Educational Quality, 2012; Unicef, 2012). Tertiary education, also known as higher education and training, includes universities that offer bachelor and masters’ degrees, universities of technology that offer diplomas, degrees, and certificates in technology, as well as comprehensive universities that offer bachelor, master, and technology certifications (International Education Association of South Africa, 2012).
In the United States, race is often a factor associated with one’s level of education. For example, the 2009 U.S. Census reports that whites and Asians have a higher educational attainment when compared to blacks and Hispanics (Ryan & Siebens, 2012). Education and race can be used to understand health related issues, such as oral cancer (Johnson, McDonald, & Corsten, 2012) and general oral hygiene (Borrell & Baquero, 2011).

In the South African context, during the Apartheid movement, education systems were racially differentiated and also set apart in terms of funding (Fiske & Ladd, 2005). “At the peak of Apartheid, schools serving white students had more than ten times the funding per pupil than the schools serving African students” (Fiske & Ladd, 2005, p. 5). White schools had teachers of higher quality and facilities were more superior to those of the black schools. Overall, “education of most blacks—and Africans in particular—was extremely impoverished” (Fiske & Ladd, p. 6). Furthermore, regarding higher education, the Council on Higher Education (CHE; 2009) explains that under the Apartheid laws, “institutions [higher education] were developed to offer segregated education to black students, but the number of black students completing higher education remained small.” Since the end of the Apartheid laws in 1994, students of all races can enroll in any higher education institution (CHE). Here we see that race in South Africa is associated with the quality of and opportunities for education in South Africa during the Apartheid movement. The inequalities between races may have contributed to one’s level of education obtained during Apartheid. Understanding one’s current level of education may be beneficial in understanding one’s oral hygiene behaviors and beliefs.
Using the levels of education noted by the South African Census 2011 Statistical Release (2012), the categorical question for education included the following categories of “some primary education,” “completed primary education,” “some secondary education,” “completed secondary education,” “some higher education,” “higher education graduate,” and “other” (Statistics South Africa, 2012). For the response options “higher education graduate” and “other”, these responses were marked with a comment saying “please specify” in parentheses. Since there are three types of higher education programs found under the tertiary education systems in South Africa, the option was included to specify allows the participant to provide more information about their particular education program.

Allowing participants the ability to specify under the “other” category also allowed participants to write in options such as “no school” if they never attended school or write in their level of Adult Basic Education and Training level (ABET) if they are an adult who decided to return back to school (Western Cape Government, 2012). According to the Adult Basic Education and Training (ABET; n.d.) Website, ABET is explained as follows:

Adult basic education and training is the general conceptual foundation towards lifelong learning and development, comprising of knowledge, skills and attitudes required for social, economic and political participation and transformation applicable to a range of contexts. ABET is flexible, developmental and targeted at the specific needs of particular audiences and, ideally, provides access to nationally recognised [recognized] certificates. (n.d.)
ABET (n.d.) estimates that there are currently 3.3 million illiterate adults living in South Africa. ABET courses aid in increasing the literacy levels. There are four levels to the ABET education system. These levels translate to the first nine grades in primary and secondary education system. Once an adult passes ABET level four, they can enter into the 10th grade of secondary school (ABET, n.d.).

A majority of the field research was conducted in township schools in Port Elizabeth, South Africa. In these communities, many women choose to attend ABET courses while their child/children are in school. Conveniently, these classes are held at the same schools that their child/children attend. As a result, participants often wrote ABET on the “other” line provided for this question. ABET was recoded as a category for the demographic question asking about one’s highest level of education in OHBS.

Province and residence. The country of South African is divided by nine provinces; provinces are similar to states in the United States, as each province has its own capital and state government. The nine provinces that make up South Africa on the Eastern Cape, Northern Cape, Western Cape, North West, Free State, Gauteng, KwaZulu-Natal, Limpopo, and Mpumalanga (Statistics South Africa, 2012). These nine provinces made up the category selection for the question on the demographic section; participants were asked to select their province of residence. The additional response of “Other” with a space provided for the participant to specify a response was added in case a participant felt the need to specify a more specific area or city in which they live.

In the United States, areas, cities, and towns are characterized as urban or rural; being urban or rural depends on the land mass and population density of the measured area. In South African context, the difference between urban and rural areas is “blurred”
due to urbanization and growth in many African areas (U. Pillay, 2004). Likewise, during the pilot informative interview study, participants voiced opinions against using urban and rural categories as identifiers of one’s type of residence. Rather, it was suggested to include urban and non-urban as the two categories for this demographic question asking about the participants’ residence. An additional question on the demographic section of OHBS served as a way to determine how many participants identified as living in urban and non-urban residences in South Africa.

*Country of origin: South Africa.* The following question was added to the demographics section as a delimitation criteria for participants: “Are you from South Africa,” with the following responses: “Yes,” “No,” and a space for the participant to specify their country of origin if they are not from South Africa. Essentially this helped serve as an identifier for distinguishing among completed surveys that fit the criteria for this study, being from South Africa.

*Race.* In Chapter 1 we reviewed the history of race in South Africa. Posel (2010) defines what race is understood to mean in the South African context, stating that it is the “social construction of bodily difference, practices that have been inseparable from other fault-lines of difference and repertoires of power” (p. 161). Posel’s definition of race is fitting for the South African context because of this country’s large history of racial inequalities that date back to before the Apartheid movement, but also still exist in present day. Thus, when determining categories with which to measure race for the present study, it was important to examine the history of racial classifications in South Africa in order to both understand race in South Africa and to develop or adopt a scale
that was equally fitting for the present study population, as well as understood by the target population.

Much conversation surrounds the issue of asking about race on the South African Census. This controversy is a result of a vast history of discrimination and inequalities among the different racial groups in South Africa before, during, and after the Apartheid movement. The South African Census (2012), as well as the history surrounding race and the different racial groups in South Africa, were both inputs into developing the race question found on the OHBS demographic section.

The South African government persistently conflated race, nationality, and ethnicity from 1910 through 1941 (Moultrie & Dorrington, 2012), during which time racial classifications (e.g., Europeans, natives, Asiatics, and coloureds) served as means for the government to control the population (Khalfani & Zuberi, 2001; Posel, 2010). Europeans accounted for the white, dominant population, and the native group (i.e., Bantu races) united all indigenous races or tribal groups in Africa (Moultrie & Dorrington; Posel); Asiatics referred to individuals who were natives of Asia (Moultrie & Dorrington). In terms of the coloured race, this race evolved from acts of violence during the Apartheid movement. In the course of the colonial period, Dutch (Jenkins, 2008) and British settlers (Gutto, 2001) were also known to have raped black South African women, contributing to the development of the “mixed-blood, the ‘coloured’” race in South Africa (Gutto, 2001, p. 152). British settlers raped black South African women, leading to the development of what Gutto (2001) referred to as “mixed-blood” or the “‘coloured’” race in South Africa (p. 152). These acts of violence are rarely found in texts but are well known throughout South Africa. Furthermore, from 1911-1991, the
South African Census changed what was known as the ‘coloured’ race to ‘mixed and other coloured,’” which included those who identified as coloured, mixed, Indian, and Arab (Posel). A slight change was made to the mixed and other coloured racial category in 1948, when the Indian race was removed from this category and combined with ‘Asian’ (Khalfani & Zuberi; Posel).

Now that we have an understanding of the different race categories used by the South African government, we can move into the discussion on race reassignment (Khalfani & Zuberi, 2001; Moultrie & Dorrington, 2012). The government used race as a tool to control the population by requiring separate censuses for both individual and a collection of racial groups (Khalfani & Zuberi). That is, the 1918, 1926, 1931 and 1941 censuses were white-only censuses (i.e., only asked of the European settler and white populations). The 1921 and 1936 censuses collected data on all other racial groups (i.e., non-white races) in South Africa. The census data collector, or enumerator, used separate forms for each racial group (Khalfani & Zuberi; Moultrie & Dorrington). The process for assigning individuals to a specific census or racial group is outlined below.

The South African government, specifically each state government, determined the racial identity for both individuals and households prior to census data collection. Khalfani and Zuberi (2001) describe as this process as “the state of imposing its own racialised ideas on the enumeration process” (p. 167). The ways in which the government conflated ethnicity, race, and nationality were represented in their method of reassigning one’s race based on their appearance, behavior, and social acceptance within a particular racial group (Khalfani & Zuberi; Moultrie & Dorrington, 2012). The process for race reassignment was clever in the state’s mind. The state governments gave the
illusion of allowing individuals the freedom of classifying their own race on the corresponding census form (Khalfani & Zuberi). If the state government did not agree with the individual’s racial classification, the enumerator would transfer their data to a new race form, one in which the enumerator believed fit which race they belong to (Moultrie & Dorrington).

The South African Government took a new approach to racial classification with the formation of the legislative branch of government by the 1950s (Khalfani & Zuberi, 2001). The legislative branch was responsible for enforcing two new policies which changed racial classification during this time; the Population Registration Act and the Group Area Act (Khalfani & Zuberi). Under these acts, each South African was assigned an identity number which fixed each person, by law, and regulated where they lived, went to school, attended church, used hospitals, and could travel (e.g., towns, provinces, countries, etc.; Pogrund, 1990).

During the Apartheid (1950-1994), race reflected a history of racial discrimination imposed by the South African Government and governmental policies (Khalfani & Zuberi, 2001). During the time of the Population Registration Act, racial identity numbers included those for the following racial classifications: White South African, Coloured, Malay, Chinese, Asian, a plethora of indigenous ethnic groups, as well as a category for “Other Asian” and “Other coloured” (Pogrund, 1990, p. 79). Remember back to the time (1910-1941) when race was determined by appearance, behavior, and social acceptance within a particular race (Khalfani & Zuberi; Moultrie & Dorrington, 2012). From the end of the 1950s thru to the end of the Apartheid, the South African colonial administration felt that the social context of being “generally accepted”
was the deciding factor between populations groups (Khalfani & Zuberi, p. 168). The administration of white settlers was overly concerned with ‘white supremacy,’ an effort to keep the ‘White’ identity pure from other races (Khalfani & Zuberi).

After the Apartheid movement in 1994, the South African government stopped assigning racial identity numbers to citizens (Khalfani & Zuberi, 2001). Furthermore, since 1994 the classifications for race on the South African census changed three times (Moultrie & Dorrington, 2012). In 1996, the race classifications included African/Black, Coloured, Indian/Asian, and White. In 2001, the census changed to Black African, Coloured, Indian or Asian, White, and Other with the option for the responder to specify their race. The 2007 census classifications included Black, Coloured, Indian or Asian, and White (Moultrie & Dorrington). As you can see, a plethora of options for race have evolved and changed in South Africa from 1911 to present day.

To recap the vast amount of information on about race noted above, the following paragraph reviews the history of racial classifications in South Africa. Before 1910 until the advent of the Apartheid movement in 1948, racial classifications included Europeans, natives, and coloureds. After 1948 through the end of Apartheid, four racial classifications included whites, coloureds (natives, Bantu, or blacks), and Asians (Khalfani & Zuberi, 2001; Posel, 2010). In 1996, after the end of the Apartheid movement, racial classifications included African/Black, Indian/Asian, Coloured, and White. In 2001, the census classifications changed again to include Black African, Coloured, Indian or Asian, White, and Other (Please specify). Changing again in 2007, this census’ classifications encompassed black, coloured, Indian or Asian, and White. The most recent data, coming from the 2011 census include the population racial groups
of Black African, Coloured, Indian or Asian, White, and Other. After the Apartheid movement, the government changed the African racial classification to include “blacks.”

A problem arises with using the term “black” as a racial group; this issue stems back to before the Apartheid movement (Khalfani & Zuberi; Moultrie & Dorrington, 2012; Posel). Posel explained what it meant for the different racial classifications during this time, as well as explains the trouble associated with “black” as a racial classification: “The discourse of the anti-Apartheid struggle reproduced the notion of these four distinct races as a fact of everyday life in the country; but the term ‘black’ was used politically to encompass all those who were not ‘white’” (p. 161). Today, using “black” as a population group to consist of those individuals who identify as ‘Black Africans’ can be confusing considering the history tied to the term “black”.

Due to the inconsistencies in classification choices for race among the South African censuses, OHBS was structured slightly differently than the 2011 South African Census. The race groups, Coloured, White, and Other were preserved from the most recent version of the South African Census. The option under “other” to please specify their race was added to OHBS; this option allows the participant to freely describe their race as it may not fit into the five categorical options provided for this question. As noted above, the term “black” as in Black African, has a history of different meanings associated with including many racial groups other than white (Posel, 2010, p. 161). OHBS did not include “black” or “black African” as a race category; rather “African” is used to include all indigenous black population groups native to South Africa. Additionally, including African instead of Black/African was also in an effort to avoid binary classifications and to preserve the African nature of the study. Regarding the
Indian and Asian racial groups, Statistical South Africa (2012) (i.e., the 2011 South African Census) often describes these two races as separate identities and also as a binary race. In other words, throughout the document, Asian and Indian are found separated out into two different categories and also combined to describe the Asian/Indian race. Due to the inconsistency between the double-barreled category of Asian/Indian and the separation between these two categories (i.e., Asian and Indian), the demographic section of OHBS separates these two race groups into two categories. Separating these two different races allows us to obtain a clearer understanding of both the Indian and Asian populations, individually, in South Africa. In all, these decisions helped end with the following race categories for OHBS: African, Coloured, Indian, Asian, White, and Other—with the option for the participant to specify their race. The following section provides an overview of the potential challenges that come with this type of research study.

**Potential Challenges**

Research studies often come with potential limitations, or challenges (Bardy, Drew, & Kennedy, 2012). There are predicted limits that may exist among the present research study. These limitations are noted within this section as a potential situation that may occur; all efforts were made by the primary researcher to prevent all possible challenges from occurring during data collection and analysis. For instance, self-reports are often looked at as an imperfect predictor of behavior (Dumitrescu, 2007; Levin & Shenkman, 2004). As a researcher, one cannot know for sure if their sample population is accurately reporting their knowledge, beliefs, and behaviors related to their oral health and hygiene, resulting in a possible risk for bias among results. A more accurate
assessment of the target population would be one that includes clinical indices and self-report (Dumitrescu; Levin & Shenkman). Due to the relative absence of literature on this topic, not much is known about the South African population and their oral hygiene beliefs and behaviors. Undertaking an exploratory study using self-report seems appropriate in order to uncover more information on this target population.

Additionally, there is a potential for bias among the survey design of this formative-exploratory study. Particularly, selection bias may occur due to subjects having the choice to respond or not respond to the survey during the study. This type of bias could affect the participation rate, which may, in turn, limited the target participant population of 130 subjects.

Comprehension of the instrument present for data collection serves as another potential limitation to this study. We know that comprehension is based on literacy levels. If potential participants do not speak or read English, then they cannot fully comprehend the items assessed throughout the instrument. During the Apartheid movement in South Africa, the language policy allowed only Afrikaans and English to be the language of instruction (Conner, 2004). At the end of the Apartheid in 1994, legislation expanded, allowing the indigenous languages of South Africa to be more freely used among native speakers (Conner).

The 1996 Constitution of the Republic of South Africa, “guarantees everyone the right to use the language and participate in the cultural life of their choice, but no one may do so in a manner that is inconsistent with any provision of the Bill of Rights” (van Niekerk, 2012a). Today, South Africa is referred to as the “rainbow nation” because there are 11 official languages spoken in South Africa (Mosala, 2003; Ngubane, 2002).
Furthermore, the National Language Policy Framework (NLPF) states that the local government can assess each community and “determine the language use and preferences of their communities within an enabling provincial language policy framework” (Mosala, 2003, p. 7). As a researcher, I cannot predict the level of comprehension of this survey among potential participants. We know that although “English is the mother tongue of only 8.2% of the population, it is the language most widely understood, and the second language of the majority of South Africans” (Niekerk). The plethora of languages spoken in South Africa poses a threat to the validity; the instrument present for data collection was developed using the English language (Windsor, Clark, Boyd, & Goodman, 2004). Thus, it is difficult to determine if the sample population will read and/or comprehend the English language.

Potential challenges may also exist within this study design. The present study includes a pilot study of informative interviews (n = 3) with individuals from African countries. Findings may not accurately validate the developed survey, Oral Health Beliefs and Behaviors of People Living in South Africa, due to the pilot study assessing a small sample of individuals from a selection of African countries. More information about the pilot study of informative interviews can be found in the forthcoming methods section.

Another limitation for this study relates to the body of research available on knowledge, beliefs, and behaviors of oral health and hygiene in South Africa. The majority of similar studies have been from countries other than South Africa, which forms a potential limitation for the present research study because the results may not be generalizable to South Africa. Most of these studies have been conducted on children.
and elderly populations (i.e., adults over the age of 65 years); only a small amount of research has been done on the adult population, aged 18-64 years (van Wyk & van Wyk, 2004). Due to these challenges, the present study will contribute to the beginning efforts to uncovering this population’s prominent oral health needs and concerns.

A final challenge for the present research relates to the nature of the present study and potential results. Although this study aims to add to the South African-based body of research regarding the adult population’s oral health related knowledge, beliefs, and behaviors, it may not be comparable to all adults in South Africa. The present study population consists of South African adults living in or visiting the Eastern Cape region of South Africa. As such, there may be cultural difference between the various groups of individuals (e.g., different race groups, age groups, etc.) within this sample that cannot be controlled within this study. Likewise, the results of the present study may lack generalizability to other adult population sectors of South Africa. In all, the challenges suggested above are suggested merely as potential threats to the overall validity of the present study.

**Delimitations.** Delimitations set boundaries and limits for the present research study. Demographic accessibility is vital for the success of this research, and because of this, participants were limited to only adults living in or visiting the Eastern Cape region of South Africa. Participants were also all over the age of 18 years. Adults who fulfill these requirements were recruited for the present study, and the study was further delimitated to only those subjects who agreed to participate.

**Data screening and cleaning.** After data was collected via pencil and paper questionnaires, data was coded and entered into SPSS Version 18. The following section
outlines the coding schemes for data entry of each variable on the OHBS. The final section under data screening and cleaning includes the preliminary analyses efforts prior to the final data analysis section.

**Variables removed from analyses.** Early on in data collection, it became clear to the primary researcher that there may be a threat to the validity of the questions assessing chewing stick beliefs and behavior. During data collection situations occurred where participants inquired about a chewing stick, asking what a chewing stick was or referencing it as chewing gum. Due to the uncertainty as to how participants answered questions relating to chewing stick behavior and beliefs (explained in more detail in Chapter 5), chewing stick beliefs and behaviors were not included in the research questions that originally aimed to assess chewing stick beliefs and behaviors (presented above in Chapter 2 and the beginning section of Chapter 3). Again, since the face validity of the chewing stick questions are not confirmed, no chewing stick questions will be included in the data analyses that follows in Chapters 4 and 5. Research questions outlined in Chapter 3 which planned to assess areas of the chewing stick (e.g., behavior, knowledge, or beliefs) will no longer include these variables in their analyses.

**Coding.** All variables (e.g., brushing behavior, knowledge question 1) were assigned a data entry code, prior to data entry. Each variable’s answer choices were also assigned a code prior to data entry. The following sections underline how each variable was coded for data entry.

**Knowledge.** The 18 question nominal index for knowledge was created in order to measure the oral health facts and behavioral practices among the South African population (McKenzie, et al., 2005). The answer choices were originally coded with yes
(coded with 1), no (coded with 0), and not applicable (coded with 2). Knowledge questions 15 and 16 were reverse coded with yes (coded with 0), no (coded with 1), and not applicable (coded with 2) because these questions were worded differently than the other 16 questions. After all data was entered, knowledge questions coded with two were recoded to zero. The decision to recode all not applicable answer choices in the knowledge section was because the primary researcher felt if someone answered the question with the not applicable choice rather than answering with the correct answer, then they ultimately did not have the knowledge to answer the question; consequently the answer was wrong. The end result of this coding scheme yielded a dichotomous answer selection.

HBM variables. The OHBS contained 36 questions which used a five-point Likert-type scale to assess three HBM constructs: brushing benefits (five benefits), flossing benefits (five questions), dental exam benefits (five questions), chewing stick benefits (five questions; no longer included in future analyses), toothpick benefits (five questions), perceived severity (five questions), and perceived susceptibility (6 questions). All responses were coded such that: 5 equaled strongly agree, 4 equaled agree, 3 equaled neutral, 2 equaled disagree, and 1 equaled strongly disagree. During data coding it was observed that participants occasionally chose two answer responses for any one question. An example of this includes a respondent answering both strongly agree and agree for a HBM question. When a participant did answer two choices for one question, the decision was made to record the average score for the two answer choices rather than dismissing these answers as missing data.
Oral hygiene behaviors. The first set of brushing, flossing, use of a chewing stick, and use of a toothpick questions were assessed using a categorical scale (Waddington, 2000) with six specific categories which measured the frequency of the respective behavior. The coding for these questions were as follows: 1 equaled less often or never, 2 equaled twice per month, 3 equaled once a week, 4 equaled 2-3 times per week, 5 equaled once a day, and 6 equaled two or more times a day.

The first dental visits question, “How often do you visit the dentist?” was measured using an eight item specific categorical scale (Waddington, 2000) to measure the frequency of visiting the dentist; codes were assigned such that: 1 equaled never, 2 equaled every 2-5 years, 3 equaled once every 2 years, 4 equaled once a year (every 12 months), 5 equaled every 6 months (2 times a year), 6 equaled every 3 months, and 77 equaled other. Other was later coded to equal 1, which was the same code as “never”. Since the category, other, did not offer a space for the participant to respond with an answer choice, it was nearly impossible to determine how often, or even if ever, the participant visited the dentist. There were a few cases where the participant choose “other” and did proceed to write down the frequency for which they visited the dentist. In these few cases, they were recoded to the category which best fit their written response. Additionally during the beginning stages of data coding, it was apparent that participants often chose two answer responses for a question. For instance, responding with both once a day and two or more times a day for the brushing my teeth question. When this did occur, the decision was made to record the average score of the two answer choices rather than dismissing these answers as missing data. The second set of oral hygiene behaviors were measured using a dichotomous scale of “yes” or “no”
Questions asked if the participant had seen the dentist in the last year, if on most days, they brushed their teeth at least twice a day, etc. Responses of “yes” were coded with 1 and “no” with zero.

**Barriers to behaviors.** For the five barrier to behavior questions, the answer selections were as follow: Cost, Pain, Convenience, Forgetfulness, and I do not do the behavior. The coding scheme for these questions were as follows: 1 equaled cost, 2 equaled pain, 3 equaled convenience, 4 equaled forgetfulness, and 5 equaled I do not (insert behavior). The responses for the medical aid barrier question in the OHBS questionnaire was coded as such: follows: 1 equaled yes, 0 equaled no, and 2 equaled not applicable. Once data was entered, the answer selection of not applicable, which was originally coded to equal 2, was recoded to equal 0. The decision to recode this answer category was made by the primary investigator because if someone answered the question with the not applicable choice, over answering either yes or no, then it is possible that they do not know if they have medical aid. If they do not know if they have medical aid, it is probable that they may not utilize the benefits associated with the plan. In all, the end result of this coding scheme for medical aid yielded a dichotomous answer selection.

**Demographics.** Eight items assessed the basic demographic data of age, gender, medical aid, education level, residence, race, country of origin, and South African province. First, age was coded with the numeric age marked on the survey instrument. Second, gender was coded for male with a one and female with a two. Third, medical aid was coded with a one for yes, a zero for no, and a two for I do not know. It was decided before data analysis that “I do not know” would be recoded with a zero because, if the participant did not know if they had medical aid, then they most likely were not utilizing
the benefits associated with the plan. Fourth, level of education asked respondent to mark their highest level of education using a seven categories that were coded as follows: 1 equaled some primary school, 2 equaled completed primary school, 3 equaled some secondary school, 4 equaled completed secondary school, 5 equaled some higher education, 6 equaled higher education graduate, and 7 equaled other. The category of “other” was provided with the option for the participant to write in a specific response for other. The written in responses for other were recoded as necessary, depending on the information provided on the line that accompanied the “other” option. As a result of these responses, the choice or category of Adult Basic Education Course (ABET) was added as category eight which was coded to equal 8. Additionally, the answer choice, “not applicable”, was also added as the ninth category and was coded to equal 0.

The fifth question in the demographics section served as a way to assess if the participant lived in either an urban or non-urban residence in South Africa. Answer choices were coded such as: 1 equaled urban and 2 equaled non-urban. Sixth, a demographic question requested that the participant identified the province for which they live. Coding for this question were as follows: 1 equaled Western Cape, 2 equaled Eastern Cape, 3 equaled Northern Cape, 4 equaled Free State, 5 equaled KwaZulu-Natal, 6 equaled North West, 7 equaled Gauteng, 8 equaled Mpumalanga, and 9 equaled Limpopo. Next, participants were asked if they were a citizen of South Africa; responses were coded as yes equaling 1 and no equaling 0. If the participant specified a country of citizenship that was not South Africa, these countries were assigned new codes. One participant stated that their country of citizenship was with Lesotho; Lesotho is a free state under the South African government, thus their citizenship is South African and this
participant was coded to equal 1. Last, race was coded with the following data codes: 1 equaled African, 2 equaled Coloured, 3 equaled Indian, 4 equaled Asian, 5 equaled White, and 6 equaled Other. The answer choice of “Other” was accompanied with a line for the participant to write out or self-identify their race. Responses provided under the other option were listed out and reassigned codes. The response of “black” or “black African” written in for other, were recoded as 1 equaled African, as suggested by Posel (2010). Throughout the remainder of this document, the category “African” will be referred to as “African/Black” due to this variable now containing both African and Black identifications; this combination of race groups aligns with the “Black African” category that is currently used in the most recent South African Census (i.e., the 2011 census). All other responses remained coded as 6 equals Other.

**Preliminary analyses.** Following data coding, all surveys were entered into SPSS. (N = 308). Subjects that were under the age of 18 years (n = 48) were removed from the data set. Additionally, all participants that were not from South Africa (n = 3) were also eliminated from the data set. In all, the final sample size for this current study was 257.

After the data was coded and entered into SPSS, preliminary analyses were run on all data points. This process was an effort to check normality and assess reliability of HBM scales (discussed in the data analysis section). Additionally, all categorical and continuous variables were screened and cleaned and checked for errors, and errors found in the data file were corrected. When errors or extreme outliers appeared, the primary researcher used the sample identification (ID) variable as a way to identify with which survey the outlier or error corresponded. Then, the original survey was pulled and used
to correct any error(s). Additionally, when outliers occurred, the primary researcher rescanned all data for the participant ID with the outlier to ensure that all other data points were entered correctly. The following section outlines the procedure and methodology for missing data within the data set.

**Missing data.** Due to limitations to the present research study (limitations/challenges will be discussed in more detail in Chapter 5), there was a high frequency of missing data throughout the data set. A bivariate correlation with all data variables set to exclude cases listwise allowed the researcher to see how many cases have full data on all of the variables listed in the SPSS data file. If a case is missing any one piece of information, in a listwise deletion, it will be completely excluded from the analysis. A listwise deletion revealed that less than half of the cases had complete data sets (45.14%; n = 116) and the remaining (54.86%; n = 141) cases contained one or more pieces of missing information. Common analyses of data with missing cases includes only cases with complete data (i.e., not missing any data points). The problem that arises in these instances is biased results from removing the voice of participants that did not complete the research in full. Additionally, the effects of missing data can lend to exclusion of a substantial proportion of the original sample (generally one third), which sequentially, “causes a substantial loss of precision and power” (Sterne, et al., 2009, p. 157). Multiple imputation helps to reduce bias, as well as increasing precision and power, by including those with missing data points in analyses; when more data points are observed in the data set—through imputed data sets—can lead to smaller bias and improved precision (Lee & Carlin, 2012; Sterne, et al.).
Sterne and colleagues (2009) suggest that “the risk of bias due to missing data depends on the reasons why data are missing” (p. 157). Missing data can be a result of one of the following missingness mechanisms: 1.) Missing completely at random (MCAR), 2.) Missing at random (MAR), or 3.) Nonignorable or missing not at random (MNAR). Where MCAR assumes that data do not depend on values observed or missing, MAR assumes the probability that missing data depends on observed values, not missing values (Schafer, 1999). When respondents randomly miss items on a questionnaire, this is an example of when MCAR occurs; it is best if MNAR cases are identified during the data collection stages in order to make changes to eliminate them from continually occurring during the data collection phase, as well as to make sense of them in the data analyses stages. If younger respondents have more missing data than older respondents, this is an example of MAR. Last, the probability that missing data depends on an unobserved value of a response that is missing is known as MNAR (King, Honaker, Joseph, & Scheve, 1998). A textbook example of MNAR includes a nonresponse to a sensitive topic such as a question inquiring about one’s income (Heymans & Twisk, 2012b).

In the preliminary analysis phase of the presented study, a missing values analysis was completed using the listwise deletion method in order to assess the number of completed data points in the data set. Listwise deletion assumes that all missing values are MCAR when in actuality, they may be MAR or MNAR. Applications such as multiple imputation assume that the missing data is MAR or MCAR. In King and colleagues’ (1998) conference paper titled, “Listwise deletion is evil: What to do about missing data in political science,” we learn that listwise deletion removes, on average,
one third of cases in a given study. In the present study, over half of the cases contained missing data; thus, over one half of the cases would be removed if listwise deletion was used for data analysis. With such high percentage of missing cases, it was decided by the researcher and research committee that completing multiple imputation for all missing values would be the preferred method. Using multiple imputation for missing data points allows all participants to be included in the data analysis; thus, reducing the risk of biased results because instead of removing the voice of non-complete participants, multiple imputation was employed to retain them in the study. Furthermore, the effects of multiple imputation can lend to inclusion of a substantial proportion (commonly one third) of the original sample, which would have been excluded due to missing data points. Inclusion of such data points increases the precision and power of results by retaining a complete data set (Sterne, et al.).

Prior to analysis, variables were examined through various SPSS analyses for accuracy of data entry, missing values, and fit between their distributions and the assumptions of multivariate analysis. Percentages of data points missing in a random pattern were calculated using a missing values analysis in SPSS. Five variables displayed complete data sets (knowledge questions 1, 15, & 18, toothpick frequency #1, and demographic question, South African citizenship). The highest percentage of cases missing in a random fashion were observed among the following variables: Each of the Brushing Barriers (Cost, Pain, Convenience, and Forget; 7.4%), Toothpick frequency #2 (7.4%), Tobacco behavior #2 (13.2%), and the demographic question, South African Residence (15.2%). Little’s MCAR test was used to determine whether the data are missing completely at random. Results of Little’s MCAR test revealed a p-value (.287; a
statistically nonsignificant result is desired in Little’s MCAR test) which indicates that the probability that the pattern of missing values diverge from randomness is greater than 0.5, thus MCAR can be inferred among the data (Tabachnick & Fidell, 2007).

Furthermore, for data that is MCAR, there are two techniques that are possible for imputation of missing values: Single and Multiple imputation.

Of the two techniques for imputation of missing data, Tabachnick and Fidell (2007) explain that multiple imputation is the most respectable method for working with missing data. Multiple imputation is the most reasonable method for missing data because this technique considers the uncertainty of missing values that are present in all variables. Furthermore, multiply imputed data can be used with any form of General Linear Modeling (GLM) such as regression, analysis of variance (i.e., ANOVA), and multiple analysis of variance (i.e., MANOVA; Tabachnick & Fidell). Additionally, with MCAR and MAR, single imputation is recommend with lower percentages of missingness among cases in variables (e.g., if cases are less than 5% among multiple variables). With high percentages of missingness among cases in variables (e.g., if cases exceed 5% among multiple variables), multiple imputation is more adequate because the missing values are most likely not MCAR or MAR (Heymans & Twisk, 2012a). The data set for this research study had a high percentage of missing cases, among multiple variables, thus multiple imputation was employed. As with all methods of data screening and cleaning data, problems can also arise with multiple imputation, including, time needed to impute data and the difficultly with implementing (Tabachnick & Fidell).

Prior to conducting the multiple imputation in SPSS, constraints were specified for the minimum and maximum allowable imputed values for each scale variable.
Setting constraints helped prevent the possibility of acquiring negative values for the imputed values (values that fall outside of the normal range). The max iterations (N = 1,000) and upped draws allowed (N = 1,000) were increased. Number of imputations were set to five, meaning that the data was copied into five new data sets and imputation values were made for those that were missing in each of the five data sets. After all constraints were noted in the SPSS syntax, multiple imputation took place and values were imputed.

After imputation took place, all five data sets were analyzed for missing data, using the missing values analysis in SPSS. All variables displayed complete data sets; that is, all variables within each of the five data sets contained complete data without signs of missing data points. The data that was imputed for the once missing data points was either of whole number or decimal value. Additionally, for each imputed data set, a separate mean was computed for each variable within each data set. As such, some variables (e.g., sex) may not round to a whole number (e.g., n = 90.6 males). Due to the mean of each variable being computed/imputed for five imputed data sets (i.e., missing values imputation), the sample size for variables (e.g., males) does not always automatically round to a whole number (e.g., n = 91). The pooled data set reveals an average of all five imputed data sets, revealing a fractional value for variables.

It was mentioned above that five imputations, or data sets, were copied in SPSS and imputed values were given for all missing values a total of five times (i.e., five imputed data sets). What this means is that for each statistical analysis in SPSS, results occurred for each of the five data sets. Options for multiple imputed data were set in SPSS to show/display in the analysis output the results for both observed and imputed
data. Although SPSS generated output results for both observed and imputed data, SPSS does not formulate an output for the pooled results (average of the statistic analyzed for all five data sets). In order to make sense of the statistical results for the five imputed data sets, an average was taken by first completing a summative score then averaging the result by diving the summative score by five (for five imputed data sets). The method of combining analysis results among the five imputed data sets was adopted using Rubin’s (Little & Rubin, 1989) rules for combining imputation estimates (i.e., means for significance levels, percentages, frequencies, etc.). The pooled results for the five imputed data sets was calculated in Microsoft Excel. SPSS output was copied and pasted into excel and equations were made for each calculation, in order to ensure that the same equation was applied to each pooled calculation. In most calculations, the statistic for the five data sets being assessed (e.g., Chronbach’s alpha, mean, SD, etc.) were not even numbers. Since the pooled estimate involved averaging these five statistics (which included decimals points), in most cases, the average, or pooled estimate was not a whole number; rather, it contained decimal points. In the next section, normality of the complete data set (data with missing values imputed) is discussed.

**Normality.** In this discussion, statistics regarding skewness and kurtosis are used to determine whether or not data follow a normal distribution. The scale for skewness lies between $-1 \leq \text{skewness} \leq 1$, and for kurtosis $-1 \leq \text{kurtosis} \leq 2$. If the data does not fall within normal range for both skewness and kurtosis, then we assume that the item or scale of items do not follow a normal distribution and normality cannot be assumed for the data analyzed in that particular analysis. Due to the sample size of the present research study ($n = 257$), the Kolmogorov-Smirnov (i.e., tests of normality), may reveal a
p-value that is less than the alpha level, yielding a significant difference from normal distribution. To be consistent in assessing normality among variables and scales, skewness and kurtosis will be used. Furthermore, standard deviation tells how much variation there is in the data. Throughout the forthcoming data analysis section and Chapter 4: Results, standard deviation will be discussed about noteworthy variables. It is important to express that a small standard deviation reveals that the data is very close together; large deviation reveals that the data is more spread out (Tabachnick & Fidell, 2007).

Within the results section of this report (Chapter 4: Results) normality of data is discussed when it is deemed appropriate by the researcher. All variables used in this data set were checked for normal distribution. Upon checking, some continuous variables did not follow a normally distributed curve, as some were positively skewed and others were negatively skewed. When variables were found to be non-normally distributed, the decision was made to transform the variables. Transformation allows a non-normal distribution to be transformed into a more normal distribution. Transformation involves taking a variable and multiplying or dividing it by a logarithm that will perhaps transform non-normal data into a normal distribution (Tabachnick & Fidell, 2007). For continuous variables that were transformed, a standardized variable was generated using SPSS. Transformed variables experience a shift in means in order for the data to lay on a normal or more normal curve. Often the mean is shifted drastically, making data analysis difficult. Consequently, standardized variables were formed for all variables that were transformed. Additionally, all other continuous variables (those that were normally
distributed) were also formed into the standardized form in order for all variables to be on the same standard.

**Data analysis.** Basic descriptive statistics and frequencies of participant information were assessed (i.e., demographics, including mean age, gender, race, etc.) in order to compare this sample with the overall South African population; this will help with future generalizability of the data. For each question and HBM constructs assessed in OHBS, the primary researcher conducted basic descriptive statistics and frequency analyses, as well as normality checks; these statistics are outlined in the sections that follow. For the sections that follow, the results of dichotomous questions (e.g., behavior) that were not used in this study’s research questions will be discussed.

**Scale development.** Within the adapted version of OHBS, each HBM construct was measured using either five (for perceived benefits of brushing, perceived benefits of flossing, perceived benefits of dental exams, perceived benefits of toothpick, and perceived severity) or six questions (perceived susceptibility); items comprising each factor of the HBM (e.g., perceived susceptibility, perceived severity, etc.) were assessed using a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5). Depending on the number of questions assessed within each construct, each scale had a highest potential score of between 25 and 30 points. For each construct, a scale was developed in SPSS by composing a summative score. That is, the scores for each of the five or six questions are added together then the average is taken for that particular scale. For example, if an individual responded to the five series of brushing benefits questions with the following responses: 1.) Strongly agree, 2.) Agree, 3.) Neutral, 4.) Disagree, and 5.) Strongly disagree, then the summative score for this scale would be 15 out of a
possible 25. Averaging the summative score is the next step in the scale development; the overall mean is calculated to see if participants yield high or low self-perceived beliefs towards either a particular oral hygiene behavior (e.g., perceived benefits of brushing behavior) or towards oral diseases (e.g., cavities and gum diseases). To determine the average mean for our example, SPSS first takes the summative score of the particular HBM construct assessed (15) and then divides by the number of items in the scale; for the example above, since there are five items in the scale, the average or mean score equals 3.0 out of a possible 5.0 for perceived brushing benefits.

After each HBM scale was developed, a reliability analysis was completed in SPSS. The reliability analysis produced a Cronbach’s alpha score which was used to determine if the factors within the scale are correlated in order to see how well the scale items hang together (i.e., internal consistency). Reliability scores were assessed using the standard set by Richmond and colleagues (2003) which states that a Cronbach alpha that exceeds 0.6 reveals a satisfactory marker for a reliable instrument. If any item has a low correlation (under 0.6; Richmond, et al., 2003), the Cronbach alpha analysis was used to determine if the removal of any item(s) from the measure would either increase or decrease the scale’s overall Cronbach alpha. If the Cronbach alpha analyses indicated that removal of any item(s) from the given measure would not increase the reliability estimate for the measure, the item or items were not removed from the scale. In other words, the item or items with low reliability were only removed from the scale if removal increased the overall reliability estimate for the measure. Even though assessing the internal consistency of each scale is beneficial, it was appropriate to run a confirmatory factor analysis (CFA) to determine if each item measured within the HBM construct is
consistent with or fits that construct. A CFA confirms or denies that a relationship exists between the scale items and the corresponding HBM construct. The following sections will explain the reliability analysis for each HBM scale.

*Perceived benefits.* To review the HBM scales develop for this research study’s analyses, recommendations from Klassen (2012) and Waddington (2000) were adopted in an effort to measure the perceived benefits items in OHBS. Respondents were given statements to elicit understandings of the benefits that would arise from engaging in proper oral health behaviors. Testing of the internal consistency for the perceived benefits of brushing, flossing, routine dental visits, and use of a toothpick scales were found to be high (Cronbach’s $\alpha = 0.87$; $\alpha = 0.89$; $\alpha = 0.90$, and $\alpha = .91$, respectively). Since the internal consistencies for the five HBM perceived benefits scales are sufficient, according to Richmond and colleagues’ (2003) recommendations, all items were retained within each HBM scale.

*Perceived severity.* Five items measured the responder’s feelings or beliefs towards the severity of dental problems. Initial assessment of the perceived severity scale concludes that the internal consistency was satisfactory (Cronbach’s $\alpha = 0.69$). Additionally, reliability analysis revealed that the Cronbach alpha for the perceived severity scale would not increase if any questions were removed from this HBM scale. Using the standard set by Richmond and colleagues and the results of the reliability analysis in SPSS, all five questions were retained for this HBM scale.

*Perceived susceptibility.* Six items measured the responder’s feelings or beliefs towards the susceptibility of dental problems. Furthermore, internal consistency for the six item scale was above satisfactory (Cronbach’s $\alpha = 0.77$). The Cronbach alpha for the
perceived susceptibility scale would not increase if any questions were removed from this HBM scale, as revealed in the Cronbach alpha analysis.

Knowledge. A nominal index of 18 knowledge questions was created in order to measure the oral health facts and behavioral practices among the South African population (McKenzie, et al., 2005). This index was developed on an additive scale and participants’ knowledge were scored with correct answers receiving one point and incorrect responses not receiving a point. The range of knowledge scores could potentially range from 0 (low knowledge of oral hygiene) to 18 (high knowledge of oral hygiene). The average knowledge score will be discussed in Chapter 4: Results, as this statistical finding answers Research Question two: What is the level of knowledge regarding oral health and effective oral hygiene practices among this sample population of South Africans?

In order to assess the reliability of the knowledge index, a split-half reliability analysis was employed in SPSS. Split-half reliability measures equivalence among an index of items. In general, a split-half reliability administers two equal sets of items measuring the same index of items in a given instrument. In SPSS, the index of 18 knowledge questions was divided in half in order to test the reliability between the two half sets of questions in the knowledge index. Two coefficients were produced between the two forms, or the half-test reliability: the Spearman-Brown coefficient and the Guttman split-half coefficient.

First, Spearman-Brown split-half reliability analysis produces a Spearman-Brown prophecy coefficient which is used to estimate the reliability of the full index (e.g., 18 knowledge items) based on the measures of a split-half reliability (Garson, 2009). Since
there is an equal number of items in the knowledge index (i.e., 18 knowledge items), this model provides estimates with equal lengths; both halves include equal numbers of items (i.e., 9 items in each half). When assessing the Spearman-Brown prophecy coefficient, the standard measure assumes the following: .80 to .89 yields adequate reliability, .90 or higher yields good reliability, and a limit as low as .60 is considered acceptable for exploratory research (Garson).

Second, the Guttman split-half reliability coefficient is used to assess the reliability of an index of items. The Guttman analysis is similar to the Spearman-Brown coefficient but does not require equal variances between the two split forms of the index. In the Guttman analysis, SPSS generates six lower bounds, or lambdas, as reliability estimates. As a standard, lambda 4 (i.e., L4) is used to assess split-half reliability (Garson, 2009).

An average of the five imputed data sets was calculated for the Spearman-brown coefficient; the knowledge index reliability yielded to be .46. Although this is an exploratory study, according to Garson (2009), a Spearman-Brown prophecy coefficient of .46 is considered to be too low of a reliability measure. Similar to the procedure used to assess the Spearman-brown coefficient (described above), an average of the five imputed data sets was calculated for the Guttman-split half coefficient; the knowledge index reliability yielded to be .43. Again, the present research is an exploratory study, and a Guttman-split half coefficient of .43 is considered too low of a reliability measure (Garson).

**Brushing behavior.** The OHBS contained two questions which measured the brushing behavior among the South African study population. Scales used to measure
brushing frequencies were developed using the South African Dental Associations’ recommendation for brushing the teeth twice daily (SADA, 2012). Results of the first brushing question yielded a frequency of 5.62 (SD = .78), explaining that on average, participants brushed between once a day and two or more times a day. The second brushing behavior question asked if the participant brushed their teeth at least twice a day; this question is measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington). Results of the second brushing behavior question using the dichotomous scale show that 81.4% of participants reported that on most days, they brush their teeth at least twice a day. Less than one-fourth of the sample population reported not meeting the recommendations for brushing the teeth set by the SADA of twice daily brushing.

Flossing behavior. Two questions were developed to measure the frequency of flossing behavior among the target population. Similar to brushing behavior, scales were developed using the recommendation set by the SADA (2012); responses are measured using the same scales and specific categories as the brushing questions. For the first flossing question (six point categorical measure; Klassen, 2012; Waddington, 2000), the mean flossing score was 2.69 (SD = 1.83), revealing that on average, participants flossed their teeth between twice per month and once a week. For the second flossing question (dichotomous measure), 27.2% of participants reported that on most days, they floss their teeth daily. This tells us that a little less than three-fourths of the sample population does not meet the recommendations set by the SADA for flossing behavior.

Routine dental exams. Two questions in OHBS measured how often the South Africans who participated in this study visit the dentist. The scales for these questions
were formulated using the recommendation from the SADA for routine or yearly visits to the dentist (ADA, 2012; SADA, 2012). The first dental visits question, “How often do you visit the dentist?” was measured using a categorical scale (Waddington, 2000). Results from this study reveal that the mean score for dental visits was 3.34 (SD = 1.73), meaning that participants (n = 240.6; nearly 241 due to decimals used in multiple imputation of missing values) reported visiting the dentist between every two years and once a year. The second dental exam question asked if the participant has seen the dentist in the last year; this question was measured using a dichotomous scale of “yes” or “no” (Klassen, 2012; Waddington). Findings for the second dental visit question reveal that 46.3% of participants had seen the dentist in the last year.

Toothpick behavior. Regarding the behavior of using a toothpick to clean food and debris from the tooth and gum region, two questions measured the frequency for which the sample population of South Africans partake in this behavior. Limited research on this behavior as well as the absent dialogue from the SADA made it difficult to develop scales to measure these questions. In an effort to maintain consistency between the measures of healthy oral health behaviors on the OHBS, the scales from the previous behavior questions (i.e., brushing and flossing behaviors) were used to measure the frequency of toothpick behavior. Again, this allowed for consistent measurement among these four oral hygiene behaviors (i.e., brushing, flossing, and toothpick). The findings for the first question assessing toothpick behavior measured on a six point categorical scale, the mean total for use of a toothpick was 2.72 (SD = 1.66). A mean score of 2.72 reveals that on average, participants use a toothpick between twice per month and once a week. For the dichotomous scale used to measure the second toothpick
behavior question, results show that 34.78% of participants reported that on most days they clean their teeth with a toothpick.

*Demographics.* A total of eight items assessed the basic demographic data (eight questions: Age, gender, medical aid, education level, residence, race, country of origin, and South African province) or unique behaviors of the South African population (e.g., oral piercings, tobacco use, sugar consumption, sweetened beverage consumption, etc.). The decision to include these questions came from the informative interview conducted as preliminary research for the present study; these items did not contribute to the overall formation of OHBS for the South African population. The participant results are outlined below for the demographic data. Furthermore, the results of all demographic information is synthesized in Table 3.1 which follows the demographic section.

*Age.* As a standard question on OHBS, participants were asked to indicate their age in years. The average age of the participants in the present study was 28.77 years ($SD = 14.35$); the age of participants ranged from 18 to 75 years.

*Gender.* Using the scale from the South African census (Statistics South Africa, 2012), participants were asked to indicate whether their gender was male or female. Among the participants in the present study, 35.25% were males.

*Medical aid.* Dental insurance, also known as medical aid in South Africa, is a policy arrangement that is designed to pay or cover all or a portion of the costs associated with one’s dental care (ADA, 2013b; Department of Health Republic of South Africa, 2013; Petersen, et al., 2005; South African Department of Health, 2008). Among the target population, 57.51% reported that they did not have Medical Aid.
Level of education. Of the sample population, 1.56% reported some primary school, .39% claimed they completed primary school, 50.82% replied having some secondary school, 11.67% stated that they completed secondary school, 15.18% had some higher education, 18.75% expressed being a higher education graduate, 1.25% reported being in the Adult Basic Education course, and .39% responded with education not being applicable to them.

Residence and province. The fifth question on the demographic section of OHBS asked about the participant’s residence. Participants self-identified as living in urban (92.22%) and non-urban (7.78%) residences in South Africa. South Africa is divided by nine provinces which are similar to states in the United States. The nine South African provinces for which participants could be from, include the Eastern Cape (96.65%), Northern Cape (0.0%), Western Cape (1.63%), North West (0.0%), Free State (0.0%), Gauteng (.39%), KwaZulu-Natal (.78%), Limpopo (.54%), and Mpumalanga (0.0%).

Citizen of South Africa. Concerning citizenship in South Africa, 100% of participants identified as being from the country, South Africa. Being a citizen of South Africa was a delimitation, identified in Chapter 3: Methodology.

Race. The distribution of race among those South Africans who participated in the present study was (48.09%) African, (33.15%) Coloured, (1.63%) Indian, (.39%) Asian, (16.34%) White, and (.39%) Other. Below, Table 3.2 displays the basic demographics of the sample population.
Table 3.2

**Basic Demographics of Survey Participants**

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>(SD)</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Age in Years</strong></td>
<td>28.77</td>
<td>(14.35)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>90.6</td>
<td>5</td>
<td>35.25%</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African</td>
<td>123.6</td>
<td></td>
<td>48.09%</td>
<td></td>
</tr>
<tr>
<td>Coloured</td>
<td>85.2</td>
<td></td>
<td>33.15%</td>
<td></td>
</tr>
<tr>
<td>Indian</td>
<td>4.2</td>
<td></td>
<td>1.63%</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>1</td>
<td></td>
<td>0.39%</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>42</td>
<td></td>
<td>16.34%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td></td>
<td>0.39%</td>
<td></td>
</tr>
<tr>
<td><strong>South African Province</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern Cape</td>
<td>248.2</td>
<td></td>
<td>96.65%</td>
<td></td>
</tr>
<tr>
<td>Western Cape</td>
<td>4.2</td>
<td></td>
<td>1.63%</td>
<td></td>
</tr>
<tr>
<td>KwaZulu-Natal</td>
<td>2</td>
<td></td>
<td>0.78%</td>
<td></td>
</tr>
<tr>
<td>Gauteng</td>
<td>1</td>
<td></td>
<td>0.39%</td>
<td></td>
</tr>
<tr>
<td>Limpopo</td>
<td>1.4</td>
<td></td>
<td>0.54%</td>
<td></td>
</tr>
</tbody>
</table>

Since the pooled estimate of the five imputed data sets involves averaging five statistics for each variable, in most cases, the average, or pooled estimate for each variable, does not equal a whole number value; rather the value contains decimal points.

5 Since the pooled estimate of the five imputed data sets involves averaging five statistics for each variable, in most cases, the average, or pooled estimate for each variable, does not equal a whole number value; rather the value contains decimal points.
Table 3.2 (Continued)

<table>
<thead>
<tr>
<th>Highest Level of Education</th>
<th>Mean (SD)</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some Primary</td>
<td>4</td>
<td>1.56%</td>
<td></td>
</tr>
<tr>
<td>Completed Primary</td>
<td>1</td>
<td>0.39%</td>
<td></td>
</tr>
<tr>
<td>Some Secondary</td>
<td>130.6</td>
<td>50.82%</td>
<td></td>
</tr>
<tr>
<td>Completed Secondary</td>
<td>30</td>
<td>11.67%</td>
<td></td>
</tr>
<tr>
<td>Some Higher Education</td>
<td>39</td>
<td>15.18%</td>
<td></td>
</tr>
<tr>
<td>Higher Education Graduate</td>
<td>48.3</td>
<td>18.75</td>
<td></td>
</tr>
<tr>
<td>Adult Basic Education Training (ABET)</td>
<td>3.2</td>
<td>1.25%</td>
<td></td>
</tr>
<tr>
<td>N/A</td>
<td>1</td>
<td>0.39%</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dental Insurance</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>109.2</td>
<td>42.49%</td>
<td></td>
</tr>
</tbody>
</table>

**Research question analyses.** This section will outline the present data analyses for the six research questions presented in Chapter 2: Review of Literature.

**Research question 1.** The first research question asked: *What are the frequencies of the positive oral hygiene behaviors, a.) Brushing the teeth, b.) Flossing the teeth, c.) Routine dental exams, and d.) Use of a toothpick, among the South African population.*

The analyses for this question included basic frequencies and descriptive statistics for the brushing the teeth, flossing the teeth, using a toothpick, and routine dental exams.

Analyses of this kind will allow us to know what behaviors are the most enacted and how
often participants complete the behavior. These findings will bring us one step closer to understanding the oral health behaviors of South Africans.

Research question 2. Research question two asks: What is the level of knowledge regarding oral health and effective oral hygiene practices among this sample population of South Africans? This question assesses the level of knowledge regarding oral health and effective oral hygiene practices among this sample population of South Africans. A mean knowledge score was calculated to obtain a better understanding of the current knowledge of oral hygiene among the sub-population of South Africans assessed during the research project.

Research question 3. Research question three asks the following: Using the HBM, what is the best predictor (perceived benefits, perceived susceptibility, perceived severity, and knowledge of the specific oral hygiene behavior) of positive oral health behaviors (brushing behavior, flossing behavior, routine dental exams, using a toothpick)? Both Structural Equation Modeling (SEM) and regression analyses allow for multiple independent variables to be used. For the purposes of determining which HBM construct is the best predictor (e.g., perceived benefits, susceptibility, or severity) of positive oral health behaviors (e.g., brushing behavior, flossing behavior, routine dental exams, and using a toothpick), initially, the researcher intended to employ SEM. The SEM procedure takes a confirmatory, or hypothesis-testing, stance on the data analysis (Byrne, 2010) and determines if there is a pattern among the variables. Furthermore, employing a SEM on multiple variables allows the possibility to see if a series of regression equations exist among the variables all while modeling these relationships in a visual way (i.e., picture). Furthermore, for SEM, these independent variables must be
continuous observed indictors (at least three) which measure a latent variable. For regression analyses, the multiple independent variables can either be continuous and/or discrete measures (Byrne, 2010; Tabachnick & Fidell, 2007). Consequently, SEM requires specific variables for successful analysis that were not contained in the current study. The independent variables used in this present study, and in research question three, are ordinal-level continuous-scales variables (e.g., brushing frequency, flossing frequency, etc.) rather than ratio-level scales; regression analysis was done to fulfill the requirements for such research question three.

To answer the third research question, four pairwise multiple regression analyses between the independent HBM variables (perceived severity, perceived susceptibility, perceived benefits of each oral hygiene behavior, and knowledge of the specific oral hygiene behavior) and the dependent variable, or predictor variable (the oral hygiene behaviors being assessed), were employed. First, the mean sum scores for brushing benefits, flossing benefits, dental visit benefits, toothpick benefits, oral health susceptibility, and oral health severity, were compared separately among the oral hygiene behaviors. The oral hygiene behaviors variables, mentioned in research question one, were used to explain the HBM perceptions of oral hygiene behaviors in order to see which HBM construct serves as the best predictor for each behavior. Pairwise multiple regressions were also used to determine the shared variability among the combined independent variables, as well as the size and direction of the relationship between the dependent and independent variables.

Research question 4. Research question four is broken down into two research questions. The first asked: Do people who use recommended oral hygiene behaviors
differ in terms of oral hygiene beliefs compared to those who use a non-recommended behavior? A multivariate analysis of variance (MANOVA) was employed to answer this research question. A MANOVA is similar to an ANOVA, in that both analyses assess whether there are mean differences among groups on a dependent variable occur due to chance. The difference between these two analyses is that an ANOVA assesses these means on a single dependent variable while a MANOVA assesses the mean differences among groups on multiple dependent variables. For the purpose of research presented in this research question, a MANOVA is fitting for uncovering the effect of different independent variables, such as groups of individuals who perform a combination of recommended oral hygiene behaviors (brushing, flossing, and going to the dentist) and a non-recommended oral hygiene behavior (toothpick), on different dependent variables, such as perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, perceived benefits of using a toothpick, perceived susceptibility, perceived severity, and recommended and non-recommended oral hygiene knowledge. A MANOVA will answer whether perceptions vary as a function of the type and number of oral hygiene behaviors one performs. A MANOVA will uncover the mean differences and statistical significance of oral health beliefs among different groups (e.g., performing one to two recommended behaviors and toothpick behavior, performing three recommended behaviors and no toothpick, etc.). In order to complete this analysis, the sample population was divided into groups. The recode and data split is described below.

Three recommended behaviors (i.e., behaviors endorsed by the SADA) and one non-recommended behavior (i.e., behaviors not endorsed by the SADA) were used to answer this question: Brushing, flossing, going to the dentist. The SADA (2012)
recommends the following: Brushing at least twice daily, flossing at least once daily, and routine dental exams. There are no recommendations for the use of a toothpick, but this behavior can serve as a convenient alternative behavior for flossing the teeth. This analysis does not measure if the individual meets the recommendations set by the SADA; this analysis measures if the individual performs the given behavior (recommended or non-recommended), frequently. The ordinal behavior questions were used to measure the recommendations. For brushing, toothpick, and flossing behaviors, the following answer choices were recoded to zero, “performs the behavior”: Once a week, 2-3 times per week, once a day, and two or more times a day; less often or never and twice per month were recoded to zero equals “does not performs the behavior.” Routine dental exams was recoded so that, every 2-5 years, once every 2 years, once a year (every 12 months), every 6 months (2 times a year) and 1 equals “performs the behavior,” and never or other was recoded to zero equals “does not performs the behavior.” In all, the recode for these variables aided in developing a dichotomous variable that represented the sample who met and did not meet the recommendations set by the SADA for each positive oral hygiene behavior.

Using the recoded recommended behavior variables, a summative index was developed by adding together brushing, flossing, and routine dental exams. Since the recommended behaviors were recoded with zero and one, the recommended behaviors index ranged from zero to three. The index was recoded again so that all twos were recoded to one; this way one equaled between performing between one and two behaviors. The new range for the recommended behaviors included performing zero behaviors, 1-2 behaviors, and all three behaviors. Next, new variables were made,
splitting the data sample into the following six groups: Performed three recommended behaviors and no toothpick behavior, performed three recommended behaviors and toothpick behavior, performed one to two recommended behaviors and no toothpick behavior, performed one to two recommended behaviors and toothpick behavior, performed zero recommended behaviors and no toothpick behavior, and performed zero recommended behaviors and toothpick behavior.

The second part research question four asked, *do people who meet the guidelines set by the SADA for recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who do not meet the recommendations?* To answer this research question, the same analysis that was used in the first part of research question four will be used in the second half. A MANOVA was employed. For the purpose of research presented in this dissertation, a MANOVA is fitting for uncovering the effect of different independent variables, such as groups of individuals who meet one to two, all three, or zero recommended oral hygiene behaviors (brushing, flossing, and going to the dentist), on different dependent variables, such as perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, perceived susceptibility, perceived severity, and oral hygiene knowledge. A MANOVA will answer whether perceptions vary as a function of the number of recommendations one meets and will uncover the mean differences and statistical significance of oral health beliefs among different groups (e.g., meeting one to two recommendations, meeting all three recommendations, and meeting zero recommendations).

*Research question 5.* The fifth research question asked: *What are the primary barriers to positive oral hygiene behaviors, a.) Brushing the teeth, b.) Flossing the teeth,*
c.) Routine dental exams, and d.) Using a toothpick? Similar to research question one, this question required analyses including basic frequencies and descriptive statistics for the following barriers to behaviors: Brushing the teeth, flossing the teeth, using a toothpick, and routine dental exams. In order to get a true understand of the barriers to behaviors questions, the categorical barrier questions were transformed into new dichotomous variables. The decision was made to do this because, on multiple occasions, participants marked more than one barrier to enacting the noted behavior. Instead of marking these answers as incomplete or missing, the primary researcher decided it would be better to expand these four barrier questions out into five separate barrier questions for each behavior (i.e., each oral hygiene behavior had five dichotomous barrier questions). To better explain this method, first the original question is stated followed by the new transformed questions. Original question: A barrier to flossing your teeth at least once a day is: Cost (Coded with 1), Pain (Coded with 2), Convenience (Coded with 3), Forgetfulness (Coded with 4), and I do not floss (Coded with 5). The new transformed set of questions included four dichotomous questions. These questions were coded with a one if the participant selected the particular item as a barrier and zero if they did not. If the participant stated that they did not do the behavior, the new questions (i.e., Cost, Pain, Convenience, and Forgetfulness) were each coded with a zero for that particular behavior. The new questions read as follows: A barrier to flossing your teeth at least once a day is Cost: Yes or No. A barrier to flossing your teeth at least once a day is Pain: Yes or No. A barrier to flossing your teeth at least once a day is Convenience: Yes or No. A barrier to flossing your teeth at least once a day is Forgetfulness: Yes or No. The same approach applied to formulating new barrier questions for brushing, routine dental
visits, and use of a toothpick. Next, a summative barrier index was developed for each behavior by adding the scores of each behaviors’ four barrier items together: cost, pain, convenience, and forgetfulness. The new index allows us to see how many participants described a barrier (Cost, Pain, Convenience, and Forgetfulness) to the behavior (brushing the teeth, flossing the teeth, going to the dentist, and using a toothpick). From there, frequencies and basic descriptive statistics were ran to see what percentage of the sample population found cost, pain, convenience and forgetfulness to be a barrier to each oral hygiene behavior. Analyses of this kind will allow us to know what barriers to each behavior are the most reported among the sample population. These findings will bring us one step closer to understanding the oral health barriers to positive oral hygiene behaviors among South Africans.

Research question 6. The last research question, number six is a two-part research question. Research question 6a states the following: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of recommended oral health beliefs (Brushing benefits and flossing benefits)? To assess this research question, a multivariate analysis of variance, or MANOVA, was employed in order to identify statistical significant mean differences among racial groups after adjusting for the multiple dependent variables: Brushing benefits and flossing benefits. This analysis can determine if the effects of the independent variables will predict changes across the dependent variables. In a MANOVA, it is vital to have more cases than dependent variables in every group (Tabachnick & Fidell, 2007). In the instance of this research study, the distribution of race among those South Africans whom participated in the present study, categories for OHBS: African/Black (48.09%; n = 123.6), Coloured (33.15%; n = 85.2),

129
Indian (1.63%; n = 4.2), Asian (.39%; n = 1), White (16.34%; n = 42), and Other (.39%; n = 1). There are two dependent variables in this research study and two race groups which have only one case in them (i.e., Asian and Other). Consequently, it was decided to include only Whites, African/Black, and Coloureds in this analysis. This decision to only include these races was made according to the extensive research provided in Chapter 1 on race, as well as the information provided in the instrument section of data collection of this current chapter (see Moultrie & Dorrington, 2012; Posel, 2010).

The second part of research question six, 6b, states the following: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of non-recommended oral health beliefs (Toothpick benefits)? Just like the assessment in the first part of research question six, a MANOVA was used to identify any statistically significant mean differences among racial groups after adjusting for the multiple dependent variables: Toothpick benefits and flossing benefits. The distribution of race among those South Africans who participated in the present study are consistent with the categories used in the first part of this research question. Thus, research question 6b includes Whites, African/Black, and Coloureds in its analysis (see Moultrie & Dorrington, 2012; Posel, 2010).

**Intellectual Merit**

Oral disease are of high prevalence, severity, and public demand due to their impact on individuals and society, especially in South Africa (Hobdell, et al., 2004; Petersen, 2004). This study was innovative because it was the first of its kind to explore the beliefs of South Africans, using OHBS to understand their oral health behaviors and beliefs—efforts that move closer to predicting behaviors. Findings from this study serve
as formative research that can inform future campaigns by understanding what beliefs influence South African oral hygiene behaviors.

Additionally, continued surveillance of the levels and patterns of behaviors and beliefs that affect an individual’s oral hygiene is of fundamental importance for planning and evaluating future health promotion, education, and communication efforts regarding oral health (Petersen & Yamamoto, 2005). Formative data of this kind served to monitor and evaluate trends and patterns of behaviors and diseases. Furthermore, Petersen (2004) states that “the most effective, sustainable interventions combine social policy and individual action through which healthy living conditions and lifestyles are promoted” (p. 13). Likewise, the present study can provide the SADA and the government with current data and information that can aid in the formation of future South African government policies and programs to prevent oral diseases, and measure the progress, impact and efficacy of preventive efforts among South Africans (see Petersen & Yamamoto, 2005).
CHAPTER 4: RESULTS

The purpose of this chapter is to provide readers with the results of the present study. These results are organized around the six research questions introduced in Chapter 1 and described in more detail in Chapter 3.

Due to the frequency of uncertainty among participants from this study regarding the term referred to as chewing stick, formative research efforts are needed to uncover more information about this oral hygiene behavior. Since the face validity of the chewing stick questions are not confirmed, no chewing stick questions will be included in the data analyses that follow. Research questions that originally sought to assess areas of the chewing stick (e.g., behavior, knowledge, or beliefs) will no longer include these variables in their analyses.

Research Question 1

The first research question for this study asked the following: What are the frequencies of the positive oral hygiene behaviors, a.) Brushing the teeth, b.) Flossing the teeth, c.) Routine dental exams, and d.) Use of a toothpick, among the South African sample? To answer this question, a categorical scale was used (Waddington, 2000). Normality for these behavior questions was not assessed because they were ordinal variables having unequal rankings between each answer choice. The results to this research question are discussed below and separated out by oral hygiene behavior.

Tooth brushing behavior. The mean total for brushing the teeth was 5.62 out of a possible 6 points with a standard deviation of 0.78. A mean score of 5.62 reveals that, on average, participants (n = 257) brushed between once a day and two or more times a day. The results of the participants’ responses for brushing the teeth conclude that nearly
one fourth (n = 64) brushed their teeth once a day and a little over 70% reported brushing two or more times a day (n = 183.4). These results tell us that, of the participants in this South African study, nearly 71.4% of them meet the daily guidelines (ADA, 2012; The South African Dental Association [SADA], 2012) for brushing their teeth, while over 28% fall short of these recommendations. A table (Table 4.1) for frequency of tooth brushing behavior is displayed below:

<table>
<thead>
<tr>
<th>Research Question 1: Tooth Brushing Behavior Frequency</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more times a day</td>
<td>183.4</td>
<td>71.4%</td>
</tr>
<tr>
<td>Once a day</td>
<td>64</td>
<td>24.9%</td>
</tr>
<tr>
<td>2-3 times per week</td>
<td>2</td>
<td>0.8%</td>
</tr>
<tr>
<td>Once a week</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Twice per month</td>
<td>7.6</td>
<td>3.0%</td>
</tr>
<tr>
<td>Less often or never</td>
<td>0</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

Flossing behavior. The mean total for flossing the teeth was 2.69 out of a possible 6 points with a standard deviation of 1.83. A mean score of 2.69 reveals that on average, participants flossed their teeth between twice per month and once a week. It is important to say that this finding reveals a rather large range of time between the measure twice per month and once a week. What this does tell us is that the average frequency of behavior among this sample population is lower than the recommendations set by the
SADA (2012), of flossing at least once a day. The frequencies of flossing the teeth reported by the participants revealed that nearly 45% (n = 114.8) reported flossing less often or never and just over 12% (n = 31.6) reported flossing their teeth once a day.

These results reveal that of the South Africans who participated in this study, 77.4% do not meet the SADA recommendations for once daily flossing. Additionally, 22.5% of those studied do meet these recommendations. These findings show that over three fourths of the sample population do not floss their teeth daily, showing an obvious need for oral health communication research and campaign efforts that aim at increasing flossing behavior among South African adults. A table (Table 4.2) for frequency of flossing behavior is displayed below:

<table>
<thead>
<tr>
<th>Flossing Behavior</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more times a day</td>
<td>26.2</td>
<td>10.2%</td>
</tr>
<tr>
<td>Once a day</td>
<td>31.6</td>
<td>12.3%</td>
</tr>
<tr>
<td>2-3 times per week</td>
<td>32</td>
<td>12.5%</td>
</tr>
<tr>
<td>Between 2-3 times per week and Once a week</td>
<td>2</td>
<td>0.8%</td>
</tr>
<tr>
<td>Once a week</td>
<td>25.4</td>
<td>9.7%</td>
</tr>
<tr>
<td>Twice per month</td>
<td>25</td>
<td>9.7%</td>
</tr>
<tr>
<td>Less often or never</td>
<td>114.8</td>
<td>44.7%</td>
</tr>
</tbody>
</table>

Table 4.2

Research Question 1: Flossing Behavior Frequency
**Routine dental exams.** The following question on routine dental exams was measured using a categorical scale (Waddington, 2000) with eight specific categories that measure the frequency of visiting the dentist. The mean total for routine dental exams the teeth was 2.58 out of a possible eight points with a standard deviation of 1.90. A mean score of 2.58 reveals that on average, participants (n = 257) visited the dentist between once a year and once every two years.

This scale was recoded in an effort to account for the responses for “other.” This recoding did not shift the mean score for frequency of dental exams. Never was recoded from “0” to “1”; each additional category shifted in their code by one (e.g., every 2-5 years coded with 2). The mean score for the scale that adjusted for the response, other, is 3.34 ($SD = 1.73$). The adjusted scale gives us a better understanding of the frequency at which those who participated in the study report visiting the dentist. With a mean score of 3.34, participants (n = 240.6) report visiting the dentist between every two years and once a year.

The data presented above tells us that more than half of the population do meet the recommendations set by the SADA (2012) for yearly dental exams (57% meet recommendations; 42.9% do not meet recommendations). The results of the adjusted scale for routine dental exams revealed that almost equal proportions of participants responded to never visit the dentist and visiting once a year (every 12 months). That is, 26.1% (n = 62.8) never visit the dentist and 28.8% (n = 69.4) reported that they visit the dentist at least once a year (every 12 months). Below, find two tables which outline the frequencies of routine dental exam behavior; the first table (Table 4.3) outlines the frequency of routine dental exam behavior with the original code while the second table
(Table 4.4) outlines the frequency of routine dental exam behavior with the recode that accounts for the “other” response:

Table 4.3

Research Question 1: **Routine Dental Exam** Frequency (original code)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 3 months</td>
<td>26.6</td>
<td>10.4%</td>
</tr>
<tr>
<td>Every 6 months</td>
<td>41.2</td>
<td>16.0%</td>
</tr>
<tr>
<td>Once a year—every 12 months</td>
<td>69.4</td>
<td>27.0%</td>
</tr>
<tr>
<td>Once every 2 years</td>
<td>16.2</td>
<td>6.3%</td>
</tr>
<tr>
<td>Between every 2-5 years and once every 2 years</td>
<td>1.2</td>
<td>0.5%</td>
</tr>
<tr>
<td>Every 2-5 years</td>
<td>23.3</td>
<td>9.0%</td>
</tr>
<tr>
<td>Never</td>
<td>62.8</td>
<td>24.4%</td>
</tr>
<tr>
<td>Other</td>
<td>16.4</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

*Note. N = 257*
Table 4.4

*Research Question 1: Routine Dental Exam Frequency (recode for other)*

<table>
<thead>
<tr>
<th>Frequency</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every 3 months</td>
<td>26.6</td>
<td>11.1%</td>
</tr>
<tr>
<td>Every 6 months</td>
<td>41.2</td>
<td>17.1%</td>
</tr>
<tr>
<td>Once a year—every 12 months</td>
<td>69.4</td>
<td>28.8%</td>
</tr>
<tr>
<td>Once every 2 years</td>
<td>16.2</td>
<td>6.7%</td>
</tr>
<tr>
<td>Between every 2-5 years and once every 2 years</td>
<td>1.2</td>
<td>0.5%</td>
</tr>
<tr>
<td>Every 2-5 years</td>
<td>23.3</td>
<td>9.0%</td>
</tr>
<tr>
<td>Never</td>
<td>62.8</td>
<td>24.4%</td>
</tr>
<tr>
<td>Other</td>
<td>16.4</td>
<td>6.4%</td>
</tr>
</tbody>
</table>

*Note.* N = 240.6

Of those South Africans sampled for this study, a little over 26% responded that they never visited the dentist. A major recommendation for healthy oral care includes routine (1-2 times a year) visits to the dentist. Further investigations of the number of people with access to medical aid is described below in an effort to see if lack of medical aid is correlated with those who do or do not routinely visit the dentist.

In order to see if medical aid was associated with visiting the dentist, a Pearson correlation was performed between the two variables Routine Dental Exams and the demographic question about having medical aid. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a medium, positive correlation between these two variables, $r = .32$, $n = 241$, p
< .001, with higher frequencies of visiting the dentist associated with having medical aid that covers part or all of dental expenses.

**Toothpick behavior.** The mean total for use of a toothpick was 2.72 out of a possible 6 points with a standard deviation of 1.66. A mean score of 2.72 reveals that on average, participants (n = 257) use a toothpick between twice per month and once a week. These findings reveal a large range of time between the measure of using a toothpick twice per month and once a week, but they also tell us that participants do at times use a toothpick to clean food particles from their teeth and gums. The breakdown of responses for use of a toothpick included 35.3% (n= 90.8) reporting the use of toothpicks less often or never and 18.3% (n = 47) stated using a toothpick once a week.

The results above make known that of the South Africans who participated in this study 35.3% do not carry out this oral hygiene behavior and 17.5% reported daily use of a toothpick. There are no recommendations set by the SADA regarding the frequency to use a toothpick to clean the teeth and gums, but the SADA does suggest the use of a toothpick to remove food debris that may gather in the tooth and gum line. More research in the area of the use of a toothpick as an oral hygiene mechanism to clean the teeth and gums of South Africans is needed in order to understand fully the capacity of this behavior in the South African context. A table (Table 4.5) for frequency of toothpick behavior is displayed below:
Table 4.5

Research Question 1: **Toothpick Behavior Frequency**

<table>
<thead>
<tr>
<th>Frequency Description</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two or more times a day</td>
<td>21.8</td>
<td>8.5%</td>
</tr>
<tr>
<td>Once a day</td>
<td>23.2</td>
<td>9.0%</td>
</tr>
<tr>
<td>2-3 times per week</td>
<td>35.4</td>
<td>13.8%</td>
</tr>
<tr>
<td>Between 2-3 times per week and Once a week</td>
<td>1</td>
<td>0.4%</td>
</tr>
<tr>
<td>Once a week</td>
<td>47</td>
<td>18.3%</td>
</tr>
<tr>
<td>Twice per month</td>
<td>37.8</td>
<td>14.7%</td>
</tr>
<tr>
<td>Less often or never</td>
<td>90.8</td>
<td>35.3%</td>
</tr>
</tbody>
</table>

To summarize the findings above for the first research question, the largest frequencies for each behavior are listed below. For brushing behavior the most frequent response was two or more times a day (n = 183.4; 71.4%) and for flossing behavior, the most frequent response was less often or never (n = 114.8; 44.7%). Next, for routine dental exams, the most frequent response was once a year—every 12 months (n = 69.4; 28.8%). Last, for toothpick behaviors, the largest frequency was less often or never (n = 90.8; 35.3%).

Three of the four oral hygiene behaviors (i.e., brushing, flossing, routine dental exams, and toothpick) tested in research question one can be matched against the recommendations set by the SADA (2012). For brushing behaviors, nearly three fourths of the sample population (71.4%) met the recommendations set by the SADA for brushing behavior. Findings from this study revealed that less than one fourth of the
sample population (22.5%) met flossing recommendations set by the SADA (2012); over three fourths of the sample population (77.4%) did not report meeting these recommendations set for flossing behavior.

Last, the SADA (2012) recommends that South Africans regularly visit the dentist. The term “regularly” is ambiguous in that it does not measure a specific time frame; the absence of a measurement for regular dental exams was understood as once a year for this study. With the measurement of once a year dental exams as the recommendation set by the SADA, of those studied, 57% reported meeting this recommendation (n = 137.2 out of 240.6 participants). This means that there are a large percentage of individuals from this study who do not meet these recommendations (42.9%), thus there is a need for oral hygiene campaigns to target dental exam behavior.

Research Question 2

The second research question asked the following: What is the level of knowledge regarding oral health and effective oral hygiene practices among this sample of South Africans? To answer this question, an index, SAKnowledgeScale, was developed from the 15 questions on OHBS about oral health and oral hygiene behaviors. Knowledge items one through 15 were calculated together to form the summative SAKnowledge index; this index reveals the summative oral health and oral hygiene knowledge score for each participant.

A normality check for the SAKnowledgeScale reveals skewness (-0.403) and kurtosis (0.040); results of the normality check reveal that data falls not quite within normal limits for skewness and kurtosis; the SAKnowledgeScale was slightly skewed and
The mean total SAKnowledge score among participants (n = 257) was 10.2 points out of a possible 15 points with a standard deviation of 2.24.

The current grading system used throughout the educational systems in South Africa is known as Outcomes based Education (OBE; Knowles, Bridgman, & May, 2012). This system of learning, measures outcomes, allowing students to demonstrate that they understand and have mastered the material at hand. The OBE system was put into place in an effort to eradicate the legacies of Apartheid that were associated with racism, discrimination, and inequalities in education and to help learners develop the critical thinking skills that are necessary to succeed at the tertiary level (Botha, 2002; Knowles, et al., 2012; Mdikane, 2004). The following table (Table 4.6) displays the South African grading scale:

<table>
<thead>
<tr>
<th>Percentage</th>
<th>South African Level; Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>Level 7: Outstanding Achievement; A</td>
</tr>
<tr>
<td>80-89</td>
<td>Level 7: Outstanding Achievement; A</td>
</tr>
<tr>
<td>70-79</td>
<td>Level 6: Meritorious Achievement; B</td>
</tr>
<tr>
<td>60-69</td>
<td>Level 5: Substantial Achievement; B</td>
</tr>
<tr>
<td>50-59</td>
<td>Level 4: Moderate Achievement; C</td>
</tr>
<tr>
<td>40-49</td>
<td>Level 3: Adequate Achievement; D</td>
</tr>
<tr>
<td>30-39</td>
<td>Level 2: Elementary Achievement; F</td>
</tr>
<tr>
<td>0-29</td>
<td>Level 1: Not Achieved—Fail; F</td>
</tr>
</tbody>
</table>
The table above (Table 4.6) displays the percentage of points allotted for each level within the South African grading system.

Results of Research Question 2 revealed that participants answered, on average, 68% of the questions correctly. Using the South African level of grading, 68% would constitute a B grade, or Level 5: Substantial Achievement; 68% reflects considerable knowledge of the subject matter, oral hygiene. Furthermore, a score of 68% on the oral hygiene test also displays non-expertise of oral hygiene knowledge, stressing a 32% gap in this knowledge of oral hygiene behaviors. Oral health education in the areas of brushing, flossing, and routine dental exams may strive to decrease this gap in knowledge by educating about healthy oral hygiene behaviors.

**Research Question 3**

The third research question asked the following: *Using the HBM, what is the best predictor (perceived benefits, perceived susceptibility, perceived severity, and knowledge of the specific oral hygiene behavior) of positive oral health behaviors (brushing behavior, flossing behavior, routine dental exams, and using a toothpick)?* Four separate regression analyses were used to answer this question, one for each of the following oral hygiene behaviors: Brushing, flossing, routine dental exams, and using a toothpick. Each behavior was compared among the three HBM predictors to see which best predicted each behavior. The HBM beliefs are measured using a Likert scale where one equals “strongly agree” and five equals “strongly disagree” Likert scale. The positive oral health behaviors are measured using a scale that runs from 1—infrequent behavior to 6—frequent behavior. The knowledge questions were measured using a summative index where one equals the correct answer and zero equals an incorrect answer. Three
knowledge scales (brushing, flossing, and dental exams) were each developed measured using a summative score of two knowledge questions that measured each specific positive oral hygiene behavior; one knowledge scale (toothpick) was measured using three knowledge questions.

It was mentioned before that predictors gender, age, race, and socioeconomic status, may serve as modifying factors to one’s beliefs or perceptions. In turn, these variables, or modifying factors as noted in the HBM, indirectly influence health-related behaviors (Champion & Skinner, 2008). However, understanding the benefits of changing an unhealthy habit to a healthy habit, which may generate a positive belief towards changing the behavior, does not mean that they will necessarily practice the behavior change (Smyth, et al., 2007). In order to ensure that the true relationship between the independent and dependent variables emerge more clearly, it would be useful to control for such modifying factors (e.g., race, age, etc.). Unfortunately controlling for such modifiers yielded a small number of participants in each group. Since this was a study conducted in South Africa, the South African census (South African Census, 2012) was used to develop the groups or group distribution that made up the classifications for the modifying factors, age and race. Under the rules of a regression analysis, a minimum sample size of 30 is necessary in order to have a reliable equation in the regression model (Tabachnick & Fidell, 2007). Due to the small sample sizes of the race groups (e.g., one Asian; ~4 Indian) and age groups (e.g., ~16 participants in the 30-34 group; ~8 in the 35-39 group; ~14 in the 50-54 group), the sample distribution of each category did not exceed 30. Likewise, the covariates of age and race were not used in these regression analyses. In the regressions that follow, a negative correlation, as well as
negative predictors are significant findings for these analyses. SPSS REGRESSION and SPSS EXPLORE aided and evaluating the assumptions for each of the regression analyses that follow.

**Tooth brushing behavior.** A standard pairwise multiple regression was performed between routine brushing behavior as a dependent variable and perceived severity, perceived susceptibility, perceived benefits of brushing, and brushing knowledge as independent variables. The $R$ for regression (.067) was significantly different from zero, $F(4, 252) = 4.553, p = .002$. The adjusted $R^2$ value of .053 indicates that more than 5.3% of the variability in brushing behavior is predicted by the four independent variables. For the regression coefficient that differed significantly from zero, 95% confidence limits were calculated. The 95% confidence limits for brushing benefits were .090 to .348.

The four independent variables, in combination, contributed an additional minute amount (-1.990 X $10^5$) in shared variability. Altogether, 6.7% (5.3% adjusted) of the variability in brushing behavior was predicted by knowing scores on these four independent variables. The size and direction of the relationship between brushing behavior and benefits to brushing suggest that an increase in brushing benefits increases their likelihood or frequency of brushing their teeth.

Partial values are adjusted correlations, or adjustments made to each predictor variable for the presence of the other significant predictor variables. Essentially, this correlation tells us what will happen with each significant variable (which serves as a predictor) when controlling for all other significant predictors. When controlling for these variables, these partial values can represent the magnitude and direction of the
correlation. The partial value for brushing benefits (.209) did not increase in value from zero-order values (.245); the value did decrease among predictor values, as brushing (decreased .035) benefits. Furthermore, the Variance Inflation Factor (VIF) looks at the relationship between predictors. VIF values above 2.8 would suggest an issue with multicolinearity. The VIF for brushing benefits (1.08) lends to the conclusion that there are few problems with multicolinearity as implied from the VIF values, but nothing to be concerned about. The table (Table 4.7) below presents the correlations among the dependent variable, brushing behavior and the three independent variables. A second table (Table 4.8) presents the B and β weights, from the regression.

Table 4.7

*Research Question 3: HBM Oral Hygiene Data Correlations among Brushing Behavior and Regression Independent Variables*

<table>
<thead>
<tr>
<th></th>
<th>Brushing</th>
<th>Perceived Brushing Benefits</th>
<th>Perceived Severity</th>
<th>Perceived Susceptibility</th>
<th>Brushing Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Brushing Benefits</td>
<td>.245***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.108*</td>
<td>.273***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-.044</td>
<td>-.034</td>
<td>.163**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brushing Knowledge</td>
<td>.090</td>
<td>.151**</td>
<td>-.093</td>
<td>-.179**</td>
<td></td>
</tr>
</tbody>
</table>

*Note. Brushing behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = p < .05, ** = p < .01, *** = p<.001* 

Table 4.8 presents the B and β weights, from the regression.
Table 4.8

Research Question 3: Independent Variables Multiple Regression on Brushing Behavior

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>B</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Brushing Benefits</td>
<td>.22</td>
<td>.19</td>
<td>3.33</td>
<td>.001***</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.06</td>
<td>.06</td>
<td>.88</td>
<td>.38</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-.04</td>
<td>-.01</td>
<td>-.53</td>
<td>.593</td>
</tr>
<tr>
<td>Brushing Knowledge</td>
<td>.06</td>
<td>.06</td>
<td>.89</td>
<td>.372</td>
</tr>
</tbody>
</table>

Note. Brushing behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = p < .05, ** = p < .01, *** = p < .001

Flossing behavior. An additional standard pairwise multiple regression was used to assess the second behavior in research question two. This regression occurred between flossing behavior as the dependent variable, and perceived flossing benefits, perceived severity, perceived susceptibility, and flossing knowledge as the independent variables. The R for regression (.020) was not significantly different from zero, F(4, 252) = 1.313, p = .273. The adjusted R² value of .005 shows that more than 0.5% of the variability in flossing behavior is predicted the four independent variables. Of the four regression coefficients, none differed significantly from zero, revealing they are not significant predictors of flossing behavior. Two tables presented below, display the results from the regression analysis; the first table (Table 4.9) presents the correlations among the independent variables and Flossing behavior, and the second table (Table 4.10) presents the B and β weights, from the regression.
Table 4.9

*Research Question 3: HBM Oral Hygiene Data Correlations among Flossing Behavior and Regression Independent Variables*

<table>
<thead>
<tr>
<th></th>
<th>Flossing</th>
<th>Perceived Flossing Benefits</th>
<th>Perceived Severity</th>
<th>Perceived Susceptibility</th>
<th>Flossing Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Flossing Benefits</td>
<td>.085</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-.008</td>
<td>.103</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>.047</td>
<td>-.021**</td>
<td>.163</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flossing Knowledge</td>
<td>.111*</td>
<td>.493***</td>
<td>-.101</td>
<td>-.270***</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Flossing behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 3.5 = Between once a week and 2-3 times per week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 4.10 presents the B and $\beta$ weights, from the regression.

Table 4.10

*Research Question 3: Independent Variables Multiple Regression on Flossing Behavior*

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>B</th>
<th>t</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Flossing Benefits</td>
<td>.031</td>
<td>.031</td>
<td>.424</td>
<td>.672</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-.024</td>
<td>-.024</td>
<td>-.354</td>
<td>.724</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>.083</td>
<td>.083</td>
<td>1.240</td>
<td>.215</td>
</tr>
<tr>
<td>Flossing Knowledge</td>
<td>.118</td>
<td>.118</td>
<td>1.546</td>
<td>.122</td>
</tr>
</tbody>
</table>

*Note.* Flossing behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 3.5 = Between once a week and 2-3 times per week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = $p < .05$, ** = $p < .01$, *** = $p < .001$
Routine dental exams. A standard pairwise multiple regression was performed for the third analysis, between routine dental exam behavior as a dependent variable, and dental exam benefits, perceived severity, perceived susceptibility, and dental exam knowledge as independent variables. The $R$ for regression (.008) was not significantly different from zero, $F(4, 236) = .465, p = .761$. The adjusted $R^2$ value of -.009 indicates that more than .9% of the variability in routine dental exam behavior is predicted by the four independent variables. None of the four regression coefficients differed significantly from zero, concluding that the predictors of routine dental exam behavior are not significant predictors of this behavior. The two tables below display the results from the regression analysis; the first table (Table 4.11) presents the correlations among the independent variables and Dental Exam behavior, and the second table (Table 4.12) presents the $B$ and $\beta$ weights, from the regression.
Table 4.11

**Research Question 3: HBM Oral Hygiene Data Correlations among Routine Dental Exam Behavior and Regression Independent Variables**

<table>
<thead>
<tr>
<th></th>
<th>Routine Dental Exams</th>
<th>Perceived Dental Exam Benefits</th>
<th>Perceived Severity</th>
<th>Dental Exam Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Dental Exam Benefits</td>
<td>-.027</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-.061</td>
<td>.248***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-.048</td>
<td>.141*</td>
<td>.163**</td>
<td></td>
</tr>
<tr>
<td>Dental Exam Knowledge</td>
<td>-.404</td>
<td>.377***</td>
<td>-.037</td>
<td>-.079</td>
</tr>
</tbody>
</table>

*Note.* Routine Dental Exam behavior was coded as 1 = Never, 2 = Every 2-5 years, 2.5 = Between every 2-5 and every 2 years, 3 = Once every 2 years, 4 = Once a year (Every 12 months), 5 = Every 6 months (2 times a year), 6 = Every 3 months; * = \( p < .05 \), ** = \( p < .01 \), *** = \( p < .001 \).
Table 4.12 presents the $B$ and $\beta$ weights, from the regression.

### Table 4.12

*Research Question 3: Independent Variables Multiple Regression on **Routine Dental Exam Behavior***

<table>
<thead>
<tr>
<th></th>
<th>$B$</th>
<th>$B$</th>
<th>$t$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Dental Exam Benefits</td>
<td>.012</td>
<td>.012</td>
<td>.155</td>
<td>.877</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>-.058</td>
<td>-.058</td>
<td>-.838</td>
<td>.402</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>-.044</td>
<td>-.044</td>
<td>-.653</td>
<td>.514</td>
</tr>
<tr>
<td>Dental Exam Knowledge</td>
<td>-.050</td>
<td>-.050</td>
<td>-.670</td>
<td>.503</td>
</tr>
</tbody>
</table>

*Note.* Routine Dental Exam behavior was coded as 1 = Never, 2 = Every 2-5 years, 2.5 = Between every 2-5 and every 2 years, 3 = Once every 2 years, 4 = Once a year (Every 12 months), 5 = Every 6 months (2 times a year), 6 = Every 3 months; $^* = p < .05$, $^{**} = p < .01$, $^{***} = p < .001$

**Toothpick behavior.** Last, a standard pairwise multiple regression was performed between toothpick behavior as a dependent variable and perceived toothpick benefits, perceived severity, perceived susceptibility, and toothpick knowledge as independent variables. The $R$ for regression (.060) was significantly different from zero, $F(4, 252) = 4.043, p = .005$. The adjusted $R^2$ value of .045 indicates that more than 4.5% of the variability in toothpick behavior is predicted by perceived toothpick benefits, perceived severity, perceived susceptibility, and toothpick knowledge as independent variables. One regression coefficient differed significantly from zero, toothpick benefits. The 95% confidence limits were calculated for toothpick benefits, and are as follows: - .001 to .304.
The three independent variables, in combination, contributed another small amount in shared variability, \( p < .001 \ (p = 0.000170) \). Altogether, 6.0% (4.5% adjusted) of the variability in toothpick behavior was predicted by knowing scores on these four independent variables. The size and direction of the relationship between toothpick behavior and benefits to using a toothpick suggest that higher toothpick benefits increases their likelihood of using a toothpick more often.

Partial values (i.e., semipartial) are adjusted correlations, or adjustments made to each predictor variable for the presence of the other significant predictor variables. Essentially, this correlation tells us what will happen with each predictor variable when controlling for all other predictor variables. When controlling for these variables, these partial values can represent the magnitude and direction of the correlation. There was only one significant predictor for this regression. The partial value for toothpick benefits (.129) shows a decrease in value from zero-order values (decrease of .087) benefits. Furthermore, the VIF value below 2.8 (1.45 for toothpick benefits) suggests few problems with multicollinearity, or that we have not violated the multicollinearity assumption. Below, there are two tables that present the statistics for the current toothpick regression. The first table (Table 4.13) presents the correlations among the independent variables and Toothpick behavior. The second table (Table 4.14) presents the B and \( \beta \) weights, from the regression.
Table 4.13

**Research Question 3: HBM Oral Hygiene Data Correlations among Toothpick Behavior and Regression Independent Variables**

<table>
<thead>
<tr>
<th></th>
<th>Toothpick</th>
<th>Perceived Toothpick Benefits</th>
<th>Perceived Severity</th>
<th>Perceived Susceptibility</th>
<th>Toothpick Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Toothpick Benefits</td>
<td>.216***</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.078</td>
<td>.081</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>.128*</td>
<td>.278***</td>
<td>.163**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toothpick Knowledge</td>
<td>.153*</td>
<td>.490***</td>
<td>-.100</td>
<td>.057</td>
<td></td>
</tr>
</tbody>
</table>

*Note.* Toothpick behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 3.5 = Between once a week and 2-3 times per week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = p < .05, ** = p < .01, *** = p < .001

Table 4.14 presents the B and β weights, from the regression.

Table 4.14

**Research Question 3: Independent Variables Multiple Regression on Toothpick Behavior**

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>B</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived Toothpick Benefits</td>
<td>.152</td>
<td>0.152</td>
<td>1.954</td>
<td>.051</td>
</tr>
<tr>
<td>Perceived Severity</td>
<td>.062</td>
<td>0.062</td>
<td>.937</td>
<td>.349</td>
</tr>
<tr>
<td>Perceived Susceptibility</td>
<td>.071</td>
<td>0.071</td>
<td>1.052</td>
<td>.294</td>
</tr>
<tr>
<td>Toothpick Knowledge</td>
<td>.081</td>
<td>0.081</td>
<td>1.010</td>
<td>.315</td>
</tr>
</tbody>
</table>

*Note.* Toothpick behavior was coded as 1 = Less often or never, 2 = Twice per month, 3 = Once a week, 3.5 = Between once a week and 2-3 times per week, 4 = 2-3 times per week, 5 = Once a day, 6 = Two or more times a day; * = p < .05, ** = p < .01, *** = p < .001
**Combined results for research question 3.** Combining the results from all four oral hygiene behaviors and the predictors variables (i.e., HBM variables), we see which variables are considered to be stronger predictors of behavior in the present study. For flossing behavior and dental exams none of the independent variables served as strong predictors of this behavior. For brushing behavior, only one significant independent variable, tooth brushing benefits, was found to be a strong predictor of this positive oral hygiene behavior. The same applies for the positive oral hygiene behavior, use of a toothpick; toothpick benefits was found to be the only significant predictor of the use of a toothpick to clean the teeth and gums.

Among the four positive oral hygiene behaviors analyzed in this research question, two behaviors each had one strong predictor of that particular behavior. Brushing benefits for tooth brushing behavior was found to be the strongest predictor, as indicated by the strongest squared semipartial correlation (.209). The second strongest predictor of behavior was found to be toothpick benefits for predicting toothpick behaviors (squared semipartial correlation of .129). Furthermore, both predictors of these positive oral hygiene behaviors yielded to be the positive benefits associated with performing the behavior.

**Research Question 4**

Research question four is a two-part question. The first part of this research question asked as follows: *Do people who use recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who use a non-recommended behavior?* To answer this question, a MANOVA was performed to uncover any effects between the independent variables on different dependent variables. The independent
variable for this MANOVA included individuals who perform a combination of oral hygiene behaviors recommended by the SADA (2012; brushing, flossing, and going to the dentist) and a non-recommended oral hygiene behavior (toothpick); the dependent variables included perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, perceived benefits of using a toothpick, perceived susceptibility, perceived severity, and recommended and non-recommended oral hygiene knowledge.

Brushing, flossing, and dentist exams were the three behaviors recommended by the SADA (2012) and toothpick behaviors was the non-recommended behavior used to answer this question. For the purpose of this analysis, the behaviors measured whether or not the individual performed the given behavior (recommended or non-recommended) frequently rather than routinely. Routine behavior is measured using the SADA (2012) recommendations. Frequent behavior is measured in the following way: The ordinal behavior questions were used to measure the recommendations. For brushing, toothpick, and flossing behaviors, the following answer choices were recoded to one, “performs the behavior”: Once a week, 2-3 times per week, once a day, and two or more times a day; less often or never and twice per month were recoded to zero equals “does not performs the behavior.” Routine dental exams was recoded so that, every 2-5 years, once every 2 years, once a year (every 12 months), every 6 months (2 times a year) and 1 equals “performs the behavior,” and never or other was recoded to zero equals “does not performs the behavior.” As mentioned in Chapter 3, this variable was transformed into a new, dichotomous variable, those who met and did not meet the recommendations set by the ADA for the specific positive oral hygiene behavior.
Using the summative index that was developed by adding together brushing, flossing, and routine dental exams behavior, new variables were made, splitting the data sample into the following six groups: a.) Performed three recommended behaviors and no toothpick behavior, b.) Performed three recommended behaviors and toothpick behavior, c.) Performed one to two recommended behaviors and no toothpick behavior, d.) Performed one to two recommended behaviors and toothpick behavior, e.) Performed zero recommended behaviors and no toothpick behavior, and finally, f.) Performed zero recommended behaviors and toothpick behavior. Of the six groups, only three had a sample size of at least 20 participants in them. According to Tabachnick and Fidell (2007) larger sample sizes should confirm robustness of data; having a sample size of at least 20 in each cell should decrease the likelihood of violations of multivariate normality which is vital for a MANOVA. The three groups which included a sample size over 20, included: a.) Performed three recommended behaviors and toothpick behavior, b.) Performed one to two recommended behaviors and toothpick behavior, and c.) Performed one to two recommended behaviors and no toothpick behavior.

Prior to the MANOVA analysis, a Pearson-Product-moment Correlation analysis was performed to see the relationship between the seven dependent variables. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a large, positive correlation between perceived brushing benefits and perceived flossing benefits, \( r = .58, n = 257, \ p < .001 \), with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of the benefits of flossing the teeth. There was a medium, positive correlation between perceived brushing benefits and perceived dental exam benefits, \( r = \).
with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of the benefits of going to the dentist.

There was a medium, positive correlation between perceived flossing benefits and perceived benefits of dental exams, \( r = .42, n = 257, p < .001 \), with stronger perceptions of the benefits of flossing the teeth associated with stronger perceptions of the benefits of going to the dentist. This finding reveals that the benefits of performing one positive oral hygiene behavior (e.g., flossing the teeth) is associated with high beliefs of the benefits towards performing other positive oral hygiene behaviors (e.g., going to the dentist). Additionally, a medium, positive correlation was present between perceived flossing benefits and knowledge of recommended and non-recommended oral hygiene, \( r = .35, n = 257, p < .001 \). Furthermore, the positive correlation between perceived flossing benefits and knowledge of recommended and non-recommended oral hygiene reveals that strong perceptions of the benefits of flossing the teeth are associated with higher knowledge of recommended and non-recommended oral hygiene.

Next, a one-way between-groups multivariate analysis of variance was performed to investigate recommended and non-recommended oral hygiene behavior differences in oral health beliefs (brushing benefits, flossing benefits, dental benefits, etc.). The independent variable was the groups of individuals who perform a combination of recommended oral hygiene behaviors (brushing, flossing, and going to the dentist) and a non-recommended oral hygiene behavior (toothpick), while the seven dependent variables were perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, perceived benefits of toothpick, perceived susceptibility, perceived severity, and combined recommended and non-recommended oral hygiene knowledge.
Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Checking for multivariate normality revealed potential outliers. The Mahalanobis distance (30.48) exceeded the critical value for seven dependent variables (24.32) which could mean that there are multivariate outliers in the data file. Further investigation of the data revealed that one participant had a Mahalanobis distance score greater than the critical value. The one outlier had a pooled score of higher than the Mahalanobis distance after averaging all five imputation outlier scores. Since there was only one person/outlier and their score was close to the critical value score, this participant remained in the data set.

The next multivariate analysis was the Levene’s Test of Equality of Error variance. The results from this analysis revealed that one of the variables (i.e., perceived severity) recorded a significant value less than .05 ($p = .007$). We can assume equal variances among all independent and dependent variables, except for perceived severity. Due to this violation of assumption among the variable, perceived severity, Tabachnick and Fidell (2007) recommend using a more conservative alpha level (e.g., .025) for determining the significance for this variable in the univariate F-test.

Statistical significance was not found in differences of the HBM predictors among the three groups of recommended and non-recommended behaviors. First, for the MANOVA's multivariate tests, the Pillai’s Trace coefficient was used to determine if there are statistically significant differences among the groups of recommended and non-recommended behaviors on a linear combination of the seven dependent variables, perceived brushing benefits, perceived flossing benefits, perceived dentist benefits,
perceived benefits of using a toothpick, perceived severity, perceived susceptibility, and recommended and non-recommended knowledge. Since the Levene's test revealed a violation of the test’s assumption, Pillai's Trace provides a more robust analysis of the data. The Pillai’s Trace test for recommended and non-recommended Behaviors (.094), with a significance value of $p = .140$ is more than .05. These findings reveal that there are no statistically significant differences between the three groups of behavior combinations (1-2 recommended behaviors and toothpick behavior, 1-2 recommended behaviors and no toothpick behavior, and 3 recommended behaviors and the use of a toothpick); there were no statistically significant differences found between recommended and non-recommended behaviors groups on the seven dependent variables, flossing benefits, brushing benefits, dentist benefits, toothpick benefits, perceived severity, perceived susceptibility, and combined recommended and non-recommended knowledge, $F(14, 413) = 1.46, p=.140$; pooled Pillai’s Trace = .094; partial eta squared = .047. The independent variable, combination of recommended and non-recommended behavior groups, accounts for a large proportion of this analysis total variance (nearly 94%). Due to the result from this analysis revealing no significant multivariate differences between the combinations of recommended and non-recommended behavior groups on the seven dependent variables, this MANOVA is complete.

A more conservative alpha level was set for determining significance for the univariate F-test, a Bonferroni adjusted alpha level in the upcoming analyses. An alpha of .007 will be used as the alpha level since we have seven dependent variables ($\alpha = .05/7 = .007$). The Tests of Between-Subjects Effects revealed that none of the seven dependent variables recorded a significance value less than the cut-off, Bonferroni adjusted
significance value of .007. Since no reliable multivariate differences were found between the recommended and non-recommended behavior groups on the seven dependent variables, no further analyses are reported for this research question.

The second part of research question four (4b) asked the following: *Do people who meet the guidelines set by the SADA for recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who do not meet the recommendations?* To answer this question, a MANOVA was performed to uncover the effect of different independent variables such as groups of individuals who meet one to two, all three, or zero recommended oral hygiene behaviors (e.g., brushing, flossing, and going to the dentist), on different dependent variables, such as perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, perceived susceptibility, perceived severity, and oral hygiene knowledge. This MANOVA will determine whether one’s perceptions vary as a function of the number of oral hygiene recommendations that they meet by revealing the mean differences and statistical significance of oral health beliefs among the three different recommendation groups (e.g., meeting one to two recommendations, meeting all three recommendations, and meeting zero recommendations).

Prior to the MANOVA analysis, a Pearson-Product-moment Correlation analysis performed to see the relationship between the six dependent variables. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a large, positive correlation between perceived brushing benefits and perceived flossing benefits, $r = .58$, $n = 257$, $p < .001$, with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of
the benefits of flossing the teeth. There was a medium, positive correlation between perceived brushing benefits and perceived dental exam benefits, $r = .38, n = 257, p < .001$, with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of the benefits of going to the dentist.

A medium, positive correlation was also found between perceived flossing benefits and perceived benefits of dental exams, $r = .42, n = 257, p < .001$, with stronger perceptions of the benefits of flossing the teeth associated with stronger perceptions of the benefits of going to the dentist. Additionally, a medium, positive correlation was present between perceived flossing benefits and knowledge of recommended oral hygiene, $r = .42, n = 257, p < .001$. Within this finding, strong perceptions of the benefits of flossing the teeth were associated with higher knowledge of oral hygiene behaviors recommended by the SADA (2012).

Next, a one-way between-groups multivariate analysis of variance was performed to see if individuals in the three oral hygiene recommendation groups (meeting zero recommendations, meeting 1-2 recommendations, and meeting all three recommendations) report differences in oral health beliefs (brushing benefits, flossing benefits, dental benefits, etc.). The independent variable was recommendation groups while the six dependent variables were brushing benefits, flossing benefits, dental benefits, perceived severity, perceived susceptibility, and knowledge of recommended oral hygiene behaviors. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Checking for multivariate normality revealed potential outliers. The Mahalanobis distance (22.46) exceeded the critical value for six
dependent variables (30.44) which could mean that there are multivariate outliers in the
data file. Further investigation of the data revealed that one participant had a
Mahalanobis distance score greater than the critical value. Since the data is a multiple
imputed data set, the one outlier had a pooled score of higher than the Mahalanobis
distance after averaging all five imputation outlier scores. Because there is only one
person and their score is just shy of the critical value, the decision was made to leave this
person in the data set. Additionally, the Levene’s Test of Equality of Error variance
revealed that none of the variables recorded significant values for the Levene's Test of
Equality of Error Variances, therefore we can assume equal variances among the
independent and dependent variables.

Statistical significance was not found in differences of the HBM predictors among
the three recommended behavior groups. First, for the MANOVA's multivariate tests, the
Wilks' Lambda coefficient was used to determine if there are statistically significant
differences among the number of recommended behaviors on a linear combination of the
six dependent variables, perceived brushing benefits, perceived flossing benefits,
perceived dentist benefits, perceived severity, perceived susceptibility, and recommended
knowledge. Since the Levene's test revealed no violation of assumption, the Pillai's trace
was not used. The Wilks' Lambda test for recommended behaviors (.950) is translated
into an F value (1.067). The Wilks' lambda test gives a direct estimate of the amount of
total variance explained among these variables; it tells us that the independent variable,
recommended behaviors, accounts for a moderate proportion of this analyses total
variance (nearly 95%) of the total variance. The significance (.390) tells us that there are
no reliable multivariate differences between the groups of recommended behaviors on the
six dependent variables, flossing benefits, brushing benefits dentist benefits, perceived severity, perceived susceptibility, and knowledge of SADA recommended behaviors. Therefore, there was not a reliable multivariate difference between the three recommended behavior groups on the six dependent variables, $F(6, 249) = 1.07, p = .390; \text{pooled Wilks’ Lambda} = .95; \text{partial eta squared} = .025$. The independent variable, the three oral hygiene recommendations accounted for a large proportion of this analyses’ total variance (nearly 95%).

Moving forward, a more conservative alpha level was set for determining significance for the univariate F-test, a Bonferroni adjusted alpha level. An alpha of .008 will be used as the alpha level since we have six dependent variables ($\alpha = .05/6 = .008$). The Tests of Between-Subjects Effects revealed that zero of the six dependent variables recorded a significance value less than the cut-off; the Bonferroni adjusted alpha level. Therefore, there are no significant differences among the three oral hygiene recommendation groups for any of the dependent variables (i.e., HBM predictors). Since no reliable multivariate differences were found among the three recommended behavior groups on the six dependent variables, no further analyses is reported for this research question.

**Research Question 5**

*What are the primary barriers to positive oral hygiene behaviors, a.) Brushing the teeth, b.) Flossing the teeth, c.) Routine dental exams, and d.) Using a toothpick?* To answer this particular research question, separate frequencies were run for each behavior’s barriers (i.e., cost, pain, convenience, and forgetfulness). Respondents were also able to respond to this question by selecting a response that noted that they do not do
the particular behavior asked in the question (e.g., flossing the teeth, using a toothpick, etc.). Often, participants responded with more than one barrier to enacting a particular behavior, thus the dichotomous variables for the oral hygiene behaviors were used to assess this research question. Likewise, the sum percentage for the multiple barriers (i.e., sum percentage of the four barriers for each behavior) to enacting a behavior may exceed 100%.

When asked about the barriers to brushing the teeth twice a day, the estimated barriers were as follows: 6.8% for cost, 6.3% for pain, 41.8% for convenience, and 42.6% for forgetfulness. Furthermore, 1.2% (n = 4.4) of participants reported that they did not brush their teeth twice a day. The largest barrier to brushing the teeth was found to be forgetfulness with convenience being the second largest barrier. For flossing behavior, the reported barriers to flossing daily were as follows: cost (5.1%), pain (8.2%), convenience (27.2%), and forgetfulness (27.6%). Additionally, 34.34% (n = 88.2) of responders reported that they do not floss daily. When asked to report a barrier that impedes participants from visiting the dentist once a year, the barriers were identified as: cost (24.8%), pain (20%), convenience (22.5%), and forgetfulness (14.4%). Just over one fifth (20.2%) of the participants in the present study reported that they do not visit the dentist once a year. The barriers to routine dental exams were rather evenly distributed, with around one fifth of the total sample population responding to one of these four barriers (e.g., cost, pain, convenience, and forgetfulness).

Next, we look at the barriers to enacting a non-recommended behavior (i.e., using a toothpick). For the use of a toothpick, respondents reported barriers to using a toothpick to clean the teeth and gums as: cost (3.4%), pain (11.2%), convenience
(29.6%), and forgetfulness (19.1%). Of these barriers, convenience was also found to be the largest barrier to enacting the behavior of using a toothpick to clean debris from the teeth and gums. Additionally, 37.1% claimed they did not do this behavior.

Overall, for the three recommended oral hygiene behaviors, flossing behavior was noted as the behavior most frequently (i.e., 34.3% reported not doing this behavior) not performed by the sample participants. Forgetfulness was the largest barrier for both brushing (42.6%) and flossing (27.6%) behaviors. Cost was the largest barrier for routine dental exams (24.8%). Convenience was found to be the most frequently reported barrier for both non-recommended oral hygiene behavior, the use of a toothpick (29.6%).

**Research Question 6**

Research question six is divided into two parts. The first part asks: *Do race groups (African/Black, Coloured, and White) differ in terms of oral health outcomes such as brushing beliefs and flossing beliefs?* To answer this research question, a MANOVA was employed. A MANOVA is similar to an ANOVA in that both analyses assess whether there are mean differences among groups on a dependent variable occur due to chance. The difference between these two analyses is that an ANOVA assesses these means on a single dependent variable while a MANOVA assesses the mean differences among groups on multiple dependent variables. For the purpose of research presented in this dissertation, a MANOVA is fitting for uncovering the effect of different independent variables, such as race, on different dependent variables, such as perceived brushing benefits and perceived flossing benefits. A MANOVA will answer whether a combination of the benefits towards the recommended oral hygiene behavior measures (e.g., brushing benefits, flossing benefits) vary as a function of racial groups. A
MANOVA will uncover the mean differences and statistical significance of oral health beliefs among different groups (e.g., African/Black, White, and Coloured).

Prior to the MANOVA analysis, a Pearson-product-moment correlation analysis performed to see the relationship between brushing benefits and flossing benefits. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity, and homoscedasticity. There was a large, positive correlation between the two variables $r = .58, n = 257, p < .001$, with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of the benefits of flossing the teeth.

Next, a one-way between-groups multivariate analysis of variance was performed to investigate race group (African/Black, Coloured, and White) differences in oral health beliefs (brushing benefits and flossing benefits). The independent variable was race while the two dependent variables were brushing benefits and flossing benefits. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Checking for multivariate normality revealed potential outliers. The Mahalanobis distance (14.56) exceeded the critical value for two dependent variables (13.82) which could mean that there are multivariate outliers in the data file. Further investigation of the data revealed that one participant had a Mahalanobis distance score greater than the critical value. Since the data is a multiple imputed data set, the one outlier (ID 91) had a pooled score of 14.50 after averaging all five imputation outlier scores. Because there is only one person and their score is just shy of the critical value, the decision was made to leave this person in the data set. Additionally, Levene’s test of
equality of error variance revealed that the significance value for brushing benefits to be less than .05 (\(p = .037\)), thus indicating a violation of the assumption of equality of variances. Moving forward, a more conservative alpha level is set for determining significance for the univariate F-test, a Bonferroni adjusted alpha level. An alpha of .025 will be used as the alpha level since we have two dependent variables (\(\alpha = .05/2 = .025\)).

Statistical significance was found between the three race groups and brushing beliefs as well as flossing beliefs. First, Pillai's Trace coefficient was used to determine the statistically significant difference among the race groups Africans/Blacks, Coloureds, and Whites on a linear combination of the two dependent variables. Since the Levene's test revealed a violation of assumption, the Pillai’s trace coefficient for the independent variable, race, was used over the Wilks’ Lambda multivariate test because the Pillai's trace coefficient provides a more robust analysis of the data. The Pillai's trace coefficient was translated into an \(F\) value and provides a direct estimate of the amount of total variance explained among these combined dependent variables. There was a reliable multivariate difference between the three race groups on both flossing benefits and brushing benefits, \(F(2, 251) = 11.55, p < .001\) (which is less than the conservative alpha level of 0.025); pooled Pillai’s Trace = .170; partial eta squared = .085. The independent variable, race, accounts for a moderate proportion of this analysis’ total variance (nearly 17%).

When the results for the two dependent variables were considered separately, both variables revealed a statistical significant difference. The Bonferroni adjusted alpha level (\(\alpha = .025\)) was used to assess both MANOVA analyses for the separate dependent variables. First, statistically significant differences were seen between the three race
groups and brushing benefits, $F(2, 248) = 8.54, p < .001$, partial eta squared = .064. Likewise, 6.4% of the variance in brushing benefits is explained by race. The generally-accepted criteria for determining the effect size of the partial eta squared follows Cohen's standards (1988, pp. 284-7; see SPSS book pages 295 and 254); an effect size of .064 reveals a medium effect. Since the data size is rather large ($N = 257$), small differences can become statistically significant in multivariate evaluations like the one presented above. The effects size revealing a medium effect, rather than a small effect, further provides justification for the statistical significance between the three race groups and their perceived brushing benefits.

After assessing the mean scores for brushing benefits, Whites reported slightly higher levels of perceived brushing benefits ($M = 4.66, SD = .41$; standardized $M = .455$) than Coloured ($M = 4.42, SD = .75$; standardized $M = .113$) and African/Blacks ($M = 4.25, SD = .67$; standardized $M = -.220$). Although brushing benefits between the different race groups (African/Black, Coloured, and White) were found to be statistically significant, the difference between the mean scores were actually very small. For brushing benefits, the difference between African/Black and Coloured was less than two scale points (.17). The difference between Coloured and White revealed a slightly larger difference between the means (.24) compared to African/Blacks and Coloureds. Last, African/Black and Whites differed between their means the most (.41).

A statistically significant difference was also found between the three race groups (Black, Coloured, and White) and flossing benefits, $F(2, 248) = 24.30, p < .001$, partial eta squared = .164. For flossing benefits, 16.4% of the variance is explained by race. Cohen's criteria for determining the effect size of the partial eta squared (1988, pp. 284-7;
see SPSS book pages 295 and 254) concludes a large effect. Again, with a large data set small differences often become statistically significant in multivariate evaluation; the effects size revealing a large effect (.164), rather than a small effect (.01), further provides justification for statistical significance for flossing benefits among the different race groups.

An inspection of the mean scores for flossing benefits indicated that Whites also reported higher levels of perceived flossing benefits ($M = 4.20, SD = .71$; standardized $M = .546$) than Coloured ($M = 3.95, SD = .89$; standardized $M = .229$) and African/Black ($M = 3.28, SD = .92$; standardized $M = -.403$). Flossing benefits were found to be statistically significant among the three race groups, but the difference between their mean scores were actually very small. The means between different race groups for flossing benefits were found to be slightly larger than the brushing benefits. First, the difference between Coloured and Whites revealed the smallest difference for the flossing groups (.25). Next, the difference between the means of the African/Black and Coloured flossing benefits was less than 7 scale points (.67). Last, the largest difference between means belongs to the African/Black and White group (.92).

Since the independent variable has three groups (African/Black, Coloured, and White), it was necessary to complete a one-way ANOVA with post-hoc tests for the significant dependent variables (Brushing Benefits and Flossing Benefits) found in the MANOVA. Due to the minor violations of variance noted above, the one-way ANOVA with post-hoc tests will be analyzed using the adjusted Bonferroni alpha level (0.025).

A one-way between groups analysis of variance was used to explore the impact of race on levels of perceived beliefs of brushing benefits and perceived beliefs of flossing
benefits, as measured using a five-point Likert scale. Participants self-identified as a member of a particular racial group (African/Black, Coloured, and White). There was a statistically significant difference at the p < .025 adjusted alpha level in perceived beliefs of brushing benefits in the three race groups, $F(2, 248) = 8.54$, $p < .001$. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effects size for eta squared, was the same as the MANOVA, .064, yielding a medium effect. Post-hoc comparisons using the Tukey HSD test indicated that the mean score for African/Blacks (M = 4.25; SD = .67) was significantly different from Whites (M = 4.66; SD = .41), with a mean difference of .42. Furthermore, in terms of perceived beliefs of brushing benefits, Coloureds (M = 4.42; SD = .75) did not differ significantly from African/Blacks or Whites.

There was also a statistically significant difference at the p < .025 adjusted alpha level in perceived beliefs of flossing benefits in the three race groups, $F(2, 248) = 24.30$, $p < .001$. Despite reaching statistical significance, the actual difference in mean scores between the groups was quite small. The effects size for eta squared, was the same as the MANOVA, .164, yielding a large effect. Post-hoc comparisons using the Tukey HSD test specified that the mean score for African/Blacks (M = 3.28; SD = .92) was significantly different from Coloureds (M = 3.95; SD = .89), with a mean difference of .67. Additionally, the mean score of Whites (M = 4.2; SD = .71) was significantly different from African/Blacks (M = 3.28; SD = .92), with a mean difference of .92. Last, the Coloured race did not differ significantly from the Whites race in terms of flossing benefits.
Do race groups (African/Black, Coloured, and White) differ in terms of the oral health outcome, toothpick beliefs? This question looked at the oral hygiene beliefs of the non-recommended behavior, toothpicks, in terms of race. To answer this research question, an ANOVA was employed. An ANOVA will compare the variance between the three race groups with the variability within each of these groups; if there are differences in mean scores (for the benefits of toothpick benefits), an ANOVA will help determine if these differences vary as a function of the three race groups. An ANOVA will uncover the mean differences and statistical significance of oral health beliefs among different groups (e.g., African/Black, White, Coloured).

A one-way between-groups analysis of variance was performed to investigate race group (African/Black, Coloured, and White) differences in oral health beliefs (toothpick benefits). The independent variable was race while the dependent variable was toothpick benefits. Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance-covariance matrices, and multicollinearity. Checking for multivariate normality revealed potential outliers. The Levene’s test for homogeneity of variances revealed a significance value greater than $p < .05$ level ($p = .90$); a significance level over .05 means there was no violations of homogeneity of variance. Results of the between-groups and within-groups analysis revealed no statistical significance at the $p < .05$ level in toothbrush beliefs for the three race groups (African/Black, Coloured, and Whites). $F(2, 248) = 1.66, p = .90$.

To recap the results from above, the first MANOVA and ANOVA revealed significant difference between the means of African/Blacks and Whites in terms of brushing benefits. Practical significance for these findings shows that on average, Whites
hold higher perceived beliefs towards brushing benefits (e.g., beliefs that brushing the teeth helps prevent cavities, gum disease, etc.), compared to African/Blacks. The same rings true in terms of the flossing beliefs; results above showed that on average, Whites hold stronger beliefs towards the benefits of flossing (e.g., beliefs that flossing the teeth helps prevent cavities, gum disease, etc.). In addition to Whites holding stronger beliefs towards the benefits of flossing beliefs compared to African/Blacks, the mean for Coloured was also on average higher than African/Blacks. For the second part of research question six, an ANOVA revealed no reliable differences between the three race groups and toothpick. Practical significance for this analysis reveals that among the sample population of the three race groups, not one group differs in terms of beliefs of the benefits of the positive oral hygiene behavior using a toothpick.
CHAPTER 5: DISCUSSION

The purpose of this study was to conduct an exploratory study in South Africa which uncovered the health beliefs that surround oral hygiene behaviors. A secondary purpose of this study was to provide formative research for guiding future health communication campaigns on oral health and hygiene in South Africa. The purpose of this chapter is to provide readers with a more thorough discussion of the present research study. This chapter is divided into five sections: a.) Review of procedures, b.) Summary of results and implications, c.) Discussion of my experiences as a researcher in a foreign country, d.) Explanation of potential challenges from the present study, and e.) Recommendations for future research, including future oral health campaigns in South Africa.

Review of Procedures

The subjects included in this study were a convenience sample of participants from and living in South Africa during the time of research (summer of 2012). Participants were recruited from a variety of South African organizations and groups, including non-profit organizations and the field placements sites that the primary researcher was assigned while living and studying in Port Elizabeth, South Africa; Port Elizabeth, South Africa is located in the Eastern Cape. Field placement sites included House of Resurrection, Missionville Care Center, and Grassroots Soccer. Additional recruitment of participants occurred within the local communities. The final sample of participants included 257 South Africans between the ages of 18–75 years ($X = 28.77$, $SD = 14.35$). Of the participants, just over 35% were males and 50.82% completed some
secondary school. Just under 58% of these participants reported that they did not have medical aid that covered all or a portion of the costs associated with dental care.

Data collection methods included developing a relationship with the organization and asking permission to complete research on their premises. Individuals were then asked if they were willing to complete a survey that asks about their oral health beliefs and behaviors, in an effort to uncover beliefs that surround such behaviors. If individuals agreed to participate in the study, they were provided with a pencil or pen and a paper survey and asked to fill out the questionnaire. When reading in English was a challenge to participants, the primary researcher read aloud to them. All participants in this study completed the OHBS and were included in the analyses. The OHBS examined the health-related beliefs that surround oral hygiene behaviors such as brushing the teeth, flossing the teeth, visiting the dentist, and using a toothpick to clean the teeth and gums.

The theoretical constructs within the Health Belief Model, as well as oral hygiene behaviors and an oral hygiene knowledge scale were measured by OHBS items. Constructs from the Health Belief Model included the beliefs surrounding the benefits of brushing and flossing the teeth, going to the dentist, and using a toothpick to clean the teeth and gums. The theoretical constructs of perceived susceptibility and severity were also measured to see the beliefs participants held toward the severity of oral health related problems or disease and their susceptibility toward obtaining an oral health related problem or disease. Research questions in this study sought to examine South Africans’ beliefs towards oral health behaviors in order to guide future health communication campaigns on oral health and hygiene in this culture.
Summary of Results and Implications

The following section will outline and discuss the major findings and practical importance for each of the six research questions. Additionally, practical and theoretical implications of the findings of this study will be discussed in terms of recommendations for future research in this area of study.

Research question 1. *What are the frequencies of the positive oral hygiene behaviors, a.) Brushing the teeth, b.) Flossing the teeth, c.) Routine dental exams, and d.) Use of a toothpick, among the South African population?* The mean score for brushing revealed that on average participants brushed between two or more times a day and once daily. Of those individuals who responded to this question, just under 25% responded with brushing their teeth once daily; less than 4% indicated that they brushed their teeth either two to three times per week or twice per month. With that said, nearly 25% of the sample population are capable of performing the recommended behavior of brushing two to three times a day because they already do so once a day. If we concentrate on increasing the pro-oral health behavior among this population, we may be able to raise the percentage of people who meet the recommendations set by the SADA (2012). The significance of the results concluded on flossing behavior are similar to brushing. That is, nearly 23% of the studied population indicated that they floss at least once a day, which meets the recommendations set by the SADA (2012); nearly 45% stated that they do not do this behavior and just shy of 33% of participants indicated that they do this behavior but not as frequently as directed by the SADA. By focusing on the individuals who are capable of performing the behavior (i.e., 33% of the sample population for this
question), it may be possible to increase the percentage of participants whom meet the flossing recommendations.

When determining which population of people to target for the behaviors of brushing and flossing the teeth, it is important to consider the ethical dilemmas that surround targeting and segmenting specific populations of people for a health campaign (Guttman, 2011). When designing health communication campaigns of various sizes (e.g., community projects or national mass media efforts, etc.) that aim to promote an individual’s health by altering his or her health behaviors, beliefs, and/or attitudes, ethical dilemmas are bound to surround many decisions related to the intervention (Guttman, 2011). Ethical issues can inundate any or all processes of an intervention, from determining the program goal(s), identifying the target audience, and designing, implementing, and evaluating the program. Despite the beneficial intentions of the intervention, ethical concerns are bound to arise, causing challenges for the communication effort. As such, Vincent Barry, author of Moral Aspects of Health Care (1982) wrote that “individual moral choices are frequently not between obvious right and wrong, good and bad, but between actions and values that contain elements of both” (p. 89). In all, it is vital to be sensitive to potential ethical concerns surrounding an intervention while preserving the good-natured efforts aimed at helping a community of individuals.

Guttman and Salmon (2004) point out that pragmatic significance should be at the forefront of all public health communication efforts; these efforts should include the identification and analysis of the ethical dilemmas surrounding the campaign. Moreover, Guttman (2011) and Guttman and Salmon (2004) address the pragmatic implications to
addressing ethical issues; Guttman (2011) argues, “Interventions that are sensitive to ethical concerns are more likely to gain the trust and respect of intended populations and collaborators” (p. 633). That is, identifying these ethical dilemmas makes the researcher(s) more aware of the stigmas and concerns associated with the health behavior that is specific to the target audience and environment. Being more aware of these concerns provides opportunity for a deeper connection with the audience; thus, they are more likely to gain the trust of the intended population(s) and collaborators. During the formative research stages of an intervention, both quantitative and qualitative data can provide important insights on the target audience. Formative efforts could include focus groups or thorough interviews with members of the target audience or pilot testing potential messages to see if they have intended or unintended effects on the key variables. The formative research opportunities provide the data to make necessary changes before full implementation of the campaign/intervention. As Roberto, Murray-Johnson, and Witte (2011) point out, formative research efforts help with developing interventions that are culturally sensitive in developing countries. These ideas extend to that of the formative research efforts presented in this study; this study was completed in the developing country, South Africa, and these research efforts may aid in creating culturally-sensitive programs or communication efforts surrounding the area of oral health and hygiene in both developing and developed countries.

With the results from the present study, particularly in research question one, ethical concerns could emerge when considering segmenting or targeting particular populations for a communication intervention (e.g., targeting participants who self-identified as brushing their teeth once daily). Guttman (2011) points out that three ethical
considerations are apparent when discussing segmenting and targeting a population: utility, needs, and fairness. Behavior change is a process that includes moving through many stages of change; as such, it often requires behavioral awareness and/or motivation, assistance, or support from others (e.g., doctors, friends, family, health educators, etc.; National Cancer Institute, 2005). Because barriers (e.g., time, money, resources, etc.) may limit the total reach of participants within an intervention, researchers may choose to focus their campaign efforts on one or more groups or segments of a population; this focus may include a utilitarian approach such as targeting individuals who hold a higher degree of readiness to change (e.g., participants who self-identified as brushing their teeth once a day; Guttman, 2011) or those who have the greatest need for change even if that means they hold a low degree of readiness to change (e.g., participants who self-identified as never brushing their teeth; Des Jarlais, Padian, & Winkelstein, 1994). Campaigns will achieve a stronger impact (i.e., change on the targeted belief or behavior; McGuire, 2001) with messages designed to target the segment of the population that is favorably predisposed (Atkin & Salmon, 2010). Segmenting and targeting a particular group or groups within a given population (e.g., those who are capable of performing the oral hygiene behaviors, brushing and flossing) reflects a choice of fairness which involves moral judgment influenced by equity and utility because these individuals may serve to influence those who do not perform these given oral hygiene behaviors. In all, the campaign has the potential to reach multiple segments of the population.

In addition to allowing utility, need, and fairness (i.e., ethical considerations; Guttman, 2011) to guide moral judgment of the communication campaign, Guttman also postulates there are three ethical concerns associated with segmenting and targeting an
audience. For the ethical concerns surrounding audience segmentation, first, segmentation of a population may lead to or reinforce existing norms and/or consensus among its members. Second, those who are not included in the communication effort may feel excluded or left out. Third, targeting or segmenting a particular group within a community “will not help change the position of socioeconomically marginalized groups” (Guttman, 2011, p. 636). If the campaign seeks to advance the well-being of individuals who are more likely to adopt the recommendations set by the campaign, focus groups and interviews with individuals from marginalized groups might provide useful insight for researchers and community members; taking the insights from the less receptive audience and coupling them with what is known about the favorably disposed audiences may yield “broadly applicable, multitargeted messages that use diverse appeals and optimally ambiguous recommended actions” (Silk, Atkin, & Salmon, 2011, p. 206) to target multiple audiences (Atkin & Salmon, 2010). Including messages that target both audiences increase compliance with the campaign recommendations due to the voices of marginalized group members being heard. These efforts may also be known as a “culturally centered approach” (Guttman, 2011, p. 636) and may aid in removing some stigma surrounding community norms and feelings of exclusion as well as potentially shift the levels of social class among a community (Guttman, 2011).

Qualitative focus groups may serve as a way to collect data on the target population in an effort to develop messages for future campaigns. Holding focus groups with individuals who are similar to the target audience for the campaign, may help with developing messages that resonate with the target audience. This method requires the researcher to be very involved with the participants in order to understand as much as
possible surrounding the knowledge, beliefs, and behaviors, which surround the topic of the focus group specific topic (Lindlof & Taylor, 2002). Lindlof and Taylor (2002) explain how researchers use focus groups as a "tool for probing people’s responses to media messages or their experiences with products, services, and candidates" (pp. 181-182). Furthermore, Guttman (2000) explains that focus groups provide researchers with a "basis for the development and selection of persuasive appeals" (p. 206). That is, focus groups are often helpful when trying to understand the specific activities, language, and beliefs that are found common among a group of individuals or behavior. The researcher learns more about the target audience and their behaviors by asking them both directive (i.e., structural) and non-directive (i.e., open-ended) type questions. These questions aid in facilitating free-flowing discussion that surrounds the specific behavior being investigated (Lindlof & Taylor, 2002). In all, focus groups allow the researcher the opportunity to discuss various topics with the target audience in order to develop messages that will more effectively resonate with the audience.

An article by Guttman and Soloman (2004) explains that, although social equity is an ethical challenge when considering targeting a given population, "resources can be maximized by ‘targeting’ relatively large segments of the population who are most likely to attend to the message and adopt it recommendations” (pp. 535-536). Taking a utilitarian approach (Guttman, 2011) to segmenting the population could result effective public health outcomes (McLeroy, et al., 1995). Guttman and Soloman explain how a domino effect may display by targeting larger populations who are at moderate risk rather than those who are at high risk.
Urging large population segments, who are at moderate risk, to adopt risk-reducing practices, can serve to influence those who are at high risk and that by including broader segments of the population in the overall message, the intervention may promote values of solidarity and reduce the likelihood of stigmatization and labelling of those considered at ‘high risk’. (2004, p. 536)

Here we see that although we are targeting those who are more likely to change their behavior, in doing so, we can potentially influence those who are at a higher or highest risk to change their behavior. This indirect effect could limit the ethical concerns associated with segmenting a population by potentially changing community norms, integrating all groups into health communication campaign, and possibly help reposition socioeconomic groups (i.e., marginalized groups; Guttman, 2011). Overall, these efforts could yield powerful influences on the overall effects of the campaign (e.g., the behavioral outcome) on both the high risk population and the individuals with the higher degree of readiness to change.

Now that we have covered the rationale regarding targeting and segmenting specific populations of individuals for the specific behaviors of brushing and flossing the teeth, it is time to move on to the third oral hygiene behavior, routine dental exams. The SADA (2012) recommends routine dental exams; the term routine is not specified as to how often one should visit the dentist for routine exams. As mentioned in Chapter 4: Results, routine is interpreted in this study as once a year. Among the studied population, 57% met the suggested recommendation of once a year dental exams. For the remaining participants (43%) who do not meet the recommendations, it may be beneficial to increase the awareness of medical aid and what benefits are associated with it. It could
also be beneficial to help eliminate some of the stigma that surrounds dentists and oral care. First, many medical aid plans in South Africa do include partial or full coverage of dental services. Many people who have medical aid are not aware of their benefits and only associate benefits and coverage around medical services (e.g., going to the doctor, prescription costs, etc.). They see dental services as something that is not covered under their plan; services for which they need to pay additional fees. Likewise, during my experiences in South Africa there was a situation where I was working at a community center and a gentleman had a toothache. Another co-worker asked if he was going to go see the dentist and the gentleman with the toothache said that he could pull his tooth out for free and not have to take off work to have it done. He proceeded to go to the bathroom with his pliers and he pulled out his own tooth. Since he worked at the community center, he not only had some or full coverage for dental care under his medical aid, but he also was physically at the facility where the local dentist was employed. If he knew he options as far as treatment and coverage, he may have been persuaded to seek oral care from the local dentist. Going to the dentist rather than pulling his own tooth could also reduce the risk of infection at the site of tooth removal. In all, it would be helpful if health communication campaigns aimed were at addressing the benefits and services associated with medical aid (i.e., socialized medicine; Department of Health Republic of South Africa, 2013), and that way individuals would know that their coverage includes some or all dental treatment (Department of health Republic of South Africa, 2013). These efforts may help reduce the barriers associated with seeing both dentists and oral care providers.
Before future campaign efforts focus on educating South Africans on the benefits and services associated with their medical aid, it is vital that researchers consider what Guttman (2000) explains as, “The Promises Dilemma” (p. 201). The promises dilemma relates to interventions that emphasize good health as the reward for adopting a positive behavior (e.g., visiting the dentist at least once a year). The dilemma facing campaigns that promise a positive reward for such behavior, risk the possibility that the resources available will not be able to strengthen the needs of the community. In other words, if the purpose of a campaign is to increase the number of individuals who visit the dentist once a year, it is vital to assure that there are enough dentists in the near-by communities that will be able to reach the target audience and fulfill their needs. Additionally, if individuals are not able to travel to the dentist, and there are no services in place to transport them from their communities to the dentists’ offices, campaigns should work to reduce these barriers in order to not raise expectations that the campaign cannot meet.

In 2005, WHO estimated that the dentist-to-population ratios in African countries are approximately 1:150,000 (see Petersen et al., 2005). The relative lack of dentists and dental personnel in the African countries may reduce residents’ ability to practice healthier oral hygiene behaviors (Petersen et al., 2005). The lack of resources available for South Africans to seek adequate oral health care poses huge barriers to preventative care as well as treatment of oral health problems; these limited resources also serve as an ethical dilemma for researchers who strive to increase the frequency of individuals who go to the dentist for treatment.

Understanding the dilemma of promises that could potentially impact campaigns efforts is vital when developing and implementing messages that relate to the resources
and services available to the target audience. Knowing what resources are in place, how many people can access these resources, and how many individuals need these services, is vital in order to reduce the risk of making promises that may or may not be beneficial or realistic to the target audience. Therefore, expectations are not escalated to a level that cannot be fulfilled in an efficient and economic manner (Guttman, 2000).

Last, the results for toothpick behavior were not as clear as those for brushing, flossing, and going to the dentist. Additionally, the SADA (2012) does not set recommendations for this behavior, making it difficult to analyze the findings in terms of a set standard by an accredited organization; the SADA does suggest the use of a toothpick to remove food debris that may gather in the tooth and gum line. Statistical findings of this research question reveal that the largest reported frequency of this behavior (35.3%) reported less often or never enacting this behavior. As a researcher in South Africa, I did observe that many restaurants provided toothpicks on their tables where patrons gathered to eat their meal; these toothpicks were located in the same caddy or container as the sugar and coffee creamers. Practical significance reveals that more research in the area of the use of a toothpick as an oral hygiene mechanism to clean the teeth and gums of South Africans is needed in order to understand fully the capacity of this behavior in the South African context.

Research question 2. The second research question asked the following: What is the level of knowledge regarding oral health and effective oral hygiene practices among this sample population of South Africans? An index referred to the SAKnowledgeScale was used to measure the oral hygiene knowledge of the South African population. The SAKnowledgeScale consisted of 18 questions about oral health and oral hygiene
behaviors. All 18 items were calculated together to form the summative SAKnowledge index in order to measure the oral health related knowledge score for each participant.

The mean knowledge score of 10.2 correct answers yields a 68% score on the knowledge index. From a South African academic perspective, a 68% is on the lower end of a “B” passing grade revealing substantial achievement regarding the subject matter of oral hygiene. When examining this data, a 32% gap remains in the knowledge of oral hygiene among this population. This gap in the knowledge base shows the need for educational efforts to help increase the knowledge of oral hygiene. Although knowledge was not found to be a predictive factor of behavior in this present study, increasing this populations’ oral hygiene related knowledge may help in increasing positive oral hygiene behaviors. Healthy People 2020 is a government program that sets 10-year national objectives on a plethora of health topics that aim at improving the health of Americans; these objectives serve as measurable benchmarks to monitoring health status and progress over time. More specifically, Health People 2020 strives to increase the public’s awareness and knowledge of the determinants of health and health related problems; these determinants and problems often relate to oral health and hygiene. For instance, Health People 2020 states that the lack of awareness of the need for oral health care can limit a person’s use of preventive behaviors (e.g., brushing, flossing, going to the dentist, etc.; U.S. Department of Health and Human Services, 2013). One way in which Healthy People aims to increase the awareness of positive oral hygiene practices is through evidence-based interventions and resources such as consumer information. Specific information that strives to increase one’s knowledge of positive oral hygiene is linked to the oral health objectives page on HealthyPeople.gov. These resources are available to
both consumers and health professionals and they aid in future improvements among this population in terms of their knowledge of oral hygiene. Example consumer resources include information on websites that provide consumers with basic information about tooth decay, prevention steps, links to additional information and resources on healthy oral health care.

Although the efforts of HealthyPeople.gov are developed for improving the health of Americans, similar efforts could be implemented in South Africa. It is vital to increase the number of educational efforts, such as consumer resources, that are in place in the South African community centers and educational systems. Similar to those of Healthy People 2020, these efforts could help fill the gap in knowledge related to oral hygiene. The more knowledge that the target population acquires on the topics of oral hygiene (e.g., brushing, flossing, dental exams, etc.) the more likely they are to apply this knowledge for the practical application of oral health skills in the future.

More specifically, the areas of chewing sticks and toothpicks were the most frequently missed questions on the OHBS knowledge scale. The frequency of missed questions among chewing stick behavior reinforces the need for more information and research on this topic. More research and information on the non-recommended behavior, chewing stick will aid in developing valid questions that assess the behavior, chewing stick. Although these would be great areas for consumer information to center on, the lack of information on the prevalence of these behaviors in this area makes it difficult to justify the need for educational information focusing on increasing the behavior. Of the oral hygiene behaviors (e.g., brushing, flossing, and routine dental exams) recommended by the SADA (2012), the questions about flossing behavior
were the most frequently missed questions. The question most frequently (~37%) missed on OBHS asked, true or false, “People can reduce their risk of getting gum disease by flossing their teeth.” The second most frequently (~34%) missed question asked, true or false, “People can reduce their risk of getting cavities by flossing their teeth.” These questions in respect to dental exams were the second most frequently missed behavior (~18% for cavities and 22% for gum disease). The frequency of incorrect answers for, “people can reduce their risk of getting cavities by brushing their teeth” (~13%) and “people can reduce their risk of getting gum disease by brushing their teeth” (~20%) were missed less frequently than the same questions that addressed both flossing and routine dental exams. These data tell us that oral health communication efforts that focus on addressing the positive benefits of flossing the teeth and routine dental exams may help in educating the target population of South Africans on this subject matter. Furthermore, Bates (2005) explains, in his study on the Surgeon General’s My Family Health Portrait Program, that environmental and behavioral risk factors for disease should be included in educational programs. Bates’ study concludes that, although this health education program was successful in helping patients understand their risk factors associated with genetics and family history, more information must be disseminated about the environmental and behavioral factors that contribute to the development of diseases. A major limitation of this program was its failure to include environmental and behavioral factors in addition to its sole purpose, to increase education of and awareness of family history and risk factors associated with genetically-linked health conditions. Education on all areas surrounding a health issue (e.g., heritable diseases) will help further inform the individual by painting a clearer picture of the disease rather than serving as an
incomplete idea of health problem at hand (Bates, 2005). Health education and communication efforts that aim to increase the knowledge related to both behavioral and environmental factors that contribute to oral diseases may aim at educating on both the individual and environmental factors that influence oral health and hygiene and contribute to oral health diseases (e.g., cavities, gum disease, etc.). Furthermore, increasing the knowledge of flossing the teeth and routine dental exams may help indirectly influence the frequency of these behaviors.

**Research question 3.** The third research question asked the following: *Using the HBM, what is the best predictor (perceived benefits, perceived susceptibility, perceived severity, and knowledge of the specific oral hygiene behavior) of positive oral health behaviors (brushing behavior, flossing behavior, routine dental exams, using a toothpick)?* Regression analyses were used to determine if health-related beliefs are predictive of behavior. Four positive oral hygiene behaviors were evaluated with three health beliefs and one modifying factor. Findings revealed that brushing and toothpick behaviors can be predicted by their corresponding oral hygiene belief. Furthermore, brushing benefits was found to be the best and only predictor of tooth brushing behavior. Statistical significance for this finding is that higher beliefs towards the benefits of using a toothbrush to clean their teeth and gums increases one’s likelihood or frequency for which they brush their teeth. The same idea as addressed in the tooth brushing behavior also applies to toothpick use. That is, toothpick benefits was the best and only predictor of toothpick behavior. Statistical significance reveals that as beliefs towards the benefits of toothpicks increase, so does the frequency of this behavior.
Both toothbrush and toothpick behaviors were found to be predicted by the benefits associated with each behavior. For flossing and routine dental exams behavior, none of the independent variables were found to be strong predictors of these behaviors. For flossing and dental exam behavior, the practical significance for this finding reinforces the need for more research on these behaviors so researchers can learn more about this target population and their views and beliefs toward these positive oral hygiene behaviors. Future research in the area of oral health beliefs and oral hygiene behaviors in South Africa may consider developing or adopting a scale that measures one’s SES in order to measure whether SES is predictive of positive oral hygiene behaviors.

Health-related beliefs are influenced by many factors including knowledge of the subject matter, the information available within a particular environment, and personal experience (Friedman, et al., 2008; Smyth, et al., 2007). Past research studies have shown that knowledge influences beliefs and in turn can shape behavior (Hochbaum, 1954; Rosenstock, 1974). To make better sense of the results for research question three and the significant findings, two correlations were performed in order to see if knowledge was associated with perceived benefits of the specific behavior. First, to see if brushing knowledge was associated with perceived benefits of brushing the teeth, a Spearman Rank Order Correlation (rho) was performed between the two variables brushing knowledge and perceived benefits of brushing. These two variables were standardized and transformed to adjust for normality but due to their non-parametric properties, a Spearman rho analysis was performed. There was a small, positive correlation between these two variables, \( \rho = .185 \), \( n = 257 \), \( p = .003 \), with higher knowledge of brushing behavior being associated with holding higher beliefs of the benefits of brushing the
teeth. Additionally, brushing knowledge helps to explain 3.4% of the variance in the participants’ sum score of perceived benefits of brushing the teeth. The second correlation analysis was completed to see if toothpick knowledge was associated with perceived benefits of using a toothpick to clean the teeth and gums. A Pearson correlation was performed between the two variables toothpick knowledge and perceived benefits of using a toothpick. There was a medium, positive correlation between these two variables, \( r = .490, n = 257, p < .0001 \), with higher knowledge of toothpick use being associated with holding higher beliefs of the benefits of using a toothpick to clean the teeth and gums. Additionally, toothpick knowledge helps to explain 24% of the variance in the participants’ sum score of perceived benefits of using a toothpick to clean the teeth and gums.

Practical significance of the statistically significant results presented above tells us that both toothpick and brushing benefits were found to be positive predictors of behavior; brushing benefits for brushing behavior and toothpick benefits for toothpick behavior. Individuals who believe strongly in the positive benefits of tooth brushing care, brush their teeth more frequently; and it also explains that lower beliefs towards the benefits of brushing the teeth is predictive of less frequent brushing behavior. Furthermore, 75% of the studied population correctly answered all three brushing knowledge questions, indicating high knowledge of brushing the teeth. Since brushing knowledge was not found to be a positive predictor of brushing behavior while the benefits towards brushing the teeth was found to be a positive predictor of the same behavior, more research is needed to understand how knowledge influences beliefs. Specifically, future research should look into what level of knowledge (i.e., high, low,
etc.) influences oral hygiene beliefs and to what degree does knowledge influence these specific oral health beliefs.

The same ideas that were present above about toothbrush behavior also resonate with that of toothpick behavior; people who believe strongly in the positive benefits of toothpick care, use a toothpick their more frequently to remove food and debris from the tooth and gum line and it also explains that lower beliefs towards the benefits of toothpick care is predictive of less frequent use of a toothpick. In terms of knowledge only 9.3% of the studied population correctly answered all three toothpick knowledge questions, indicating lower knowledge of toothpick behavior. Toothpick knowledge was not found to be a positive predictor of toothpick behavior while the benefits towards using a toothpick to clean the teeth and gums was found to be a positive predictor of the same behavior. Since this was the case for two oral hygiene behaviors (i.e., toothbrush and toothpick), more research is needed to understand how knowledge influences beliefs. Specifically, since brushing knowledge was high and toothpick knowledge was low, it would be helpful for future research if we knew what level of knowledge (i.e., high, low, mid-range, etc.) positively influences oral hygiene beliefs and to what degree does knowledge influence these specific oral health beliefs. Implementing health communication campaigns that aim at increasing the perceived benefits of positive oral hygiene behaviors may aid in increasing the frequency of which one enacts them. Until more is known about non-recommended oral hygiene behaviors (i.e., toothpick), recommendations for future research includes focusing on increasing the perceived benefits of recommended oral hygiene behaviors (i.e., brushing, flossing, and routine dental exams). Campaigns that target the positive benefits of oral care, including
preventing cavities and gum diseases, as well as obtaining fresh breath, clean teeth, and a confident smile may help increase knowledge and in turn influence behavior.

**Research question 4.** Research question four is broken down into two research questions. The first asked: *Do people who use recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who use a non-recommended behavior?* For the first part of research question four, the independent variable included a combination of recommended oral hygiene behaviors and a non-recommended oral hygiene behavior; groups included: a.) Performed one to two recommended behaviors and toothpick behavior, b.) Performed one to two recommended behaviors and no toothpick behavior, and c.) Performed three recommended behaviors and toothpick behavior. The dependent variables were perceived brushing benefits, perceived flossing benefits, perceived dental exam benefits, as well as perceived benefits of using a toothpick, perceived susceptibility, perceived severity, and recommended and non-recommended oral hygiene knowledge. Although no reliable multivariate differences were found between the three groups of recommended and non-recommended oral hygiene behaviors and oral hygiene beliefs, there were other important findings from this research question. These findings are explained below.

The three groups of combined recommended and non-recommended oral hygiene behavior groups were not found to differ statistically among the seven dependent variables; we can take away that regardless of the combination of behaviors that a person may enact, they do not differ among their beliefs towards these behaviors and/or their level of knowledge. Although the strength of beliefs and the level of knowledge may not be the same among all three groups, there is no reliable difference among the three
groups in the multiple belief and knowledge variables. Thus the strength of beliefs and/or the level of knowledge does not serve to influence one combination of behaviors over another combination of behaviors. Furthermore, since beliefs were not found to differ significantly among a combination of different behaviors, researchers in this area of study may not need to focus on segmenting the target population in terms of the behaviors that they perform. Segmenting the population has been criticized as being an ethical concern among health communication scholars (Atkin & Salmon, 2010; Barry, 1982; Guttman, 2011; Guttman & Salmon, 2004; Silk, et al., 2011). These results show that it may not be necessary or effective to segment and target the population by the number of positive oral hygiene behaviors they enact.

Four statistically significant associations were discovered among dependent variables. First, a large, positive correlation was found between brushing benefits and perceived flossing benefits. The practical significance behind this finding reveals that those who hold stronger beliefs towards the benefits of brushing teeth also hold stronger perceptions towards the benefits of flossing the teeth. Therefore, educational efforts should aim at increasing the awareness of both the benefits of brushing and flossing the teeth because most individuals’ associate positive benefits with both of these oral hygiene behaviors. Second, a medium, positive correlation was identified between brushing benefits and dental exam benefits. Of the participants included in this research study, those with higher perceptions towards the positive benefits of brushing the teeth also held stronger perceptions towards the benefits of going to the dentist. Third, stronger perceptions of flossing benefits was found to be associated with stronger perceptions of the benefits of going to the dentist. Combined, these three findings tell us that people
who hold strong beliefs towards the benefits of brushing the teeth see the connection between the benefits of multiple oral hygiene behaviors. That is, brushing the teeth and flossing and/or going to the dentist all aid in attaining healthy oral care. Furthermore, those who see the benefits in flossing the teeth, also see the benefits in brushing and going to the dentist. Oral health communication efforts with the goal of increasing oral health beliefs associated with positive oral health behaviors should encourage the use of and the benefits of, more than one positive oral hygiene behavior. An example campaign that targeted multiple behaviors is the nationwide campaign implemented by the United States Department of Health and Human Services and the Centers for Disease Control and Prevention, called the, Choose Your Cover Campaign (Jorgensen, Wayman, Green, & Gelb, 2000). The multiple behaviors targeted in this campaign included seeking shade, covering skin with layers of clothing, wearing sunglasses, applying sunscreen, and wearing a hat. These campaign efforts revealed that in order to influence multiple behaviors, health communication efforts must be sustained over long periods of time in order to establish the importance of such behaviors in the minds of the target audience (Jorgensen, et al., 2000)

In addition to the three associations identified above, stronger perceptions of flossing benefits was found to be associated with higher knowledge of recommended and non-recommended oral hygiene behaviors. Using the foundation of the HBM (Hochbaum, 1954; Rosenstock, 1974), knowledge aids in shaping beliefs, validates the present association among HBM variables. Increasing the knowledge of both recommended and non-recommended oral hygiene behaviors may lead to an increase in the beliefs associated with the positive benefits of oral hygiene behaviors, specifically
flossing behavior. Figure 5.1 presents the associations between the modifying factor, knowledge and the HBM variables, recommended oral hygiene beliefs.

**Figure 5.1.** Discussion of Research Question 4: Correlations among **Recommended** and **non-Recommended** Knowledge and HBM Variables

*Note.* The arrow represents the connection between the two variables (one on each side of the arrow). A thick arrow represents a high, positive correlation while a thin arrow represents a medium, positive correlation between the two variables.

Choosing either of these four variables to focus campaign and/or educational efforts on may ultimately have an effect on all other oral hygiene beliefs and/or modifying factors. While flossing beliefs had the most associations among variables (e.g., brushing beliefs, dental exam beliefs, and recommended & non-recommended knowledge), brushing benefits also has the strongest connection between brushing and flossing beliefs. It may be a helpful for researchers to focus campaign efforts around increasing either brushing or flossing beliefs, or both variables. Efforts that aim at increasing one or both of these HBM variables may strongly impact the beliefs of the other two HBM variables, dental exam beliefs and recommended and non-recommended knowledge.
The second part of research question four asked, *do people who meet the guidelines set by the SADA for recommended oral hygiene behaviors differ in terms of oral hygiene beliefs compared to those who do not meet the recommendations?* This MANOVA analysis determined whether one’s perceptions vary as a function of the number of oral hygiene recommendations (set by the SADA) that they meet; this analysis revealed mean differences and statistical significance of oral health beliefs (six dependent variables including flossing benefits, brushing benefits, dental exam benefits, perceived severity, perceived susceptibility, and knowledge of recommended oral hygiene behaviors) among the different groups (e.g., meeting one to two recommendations, meeting all three recommendations, and meeting zero recommendations).

The three groups made up of individuals who fall within the oral hygiene recommendation set by the SADA (2012) were not found to differ statistically among the six dependent variables. We can take away that oral hygiene perceptions do not vary as a function of the number of oral hygiene recommendations that the individual meets. There is no reliable difference between the multiple belief and knowledge variable and these three recommendation groups (i.e., independent variable). Thus the strength of beliefs and/or the level of knowledge does not serve to influence the number of oral hygiene behaviors one enacts and the number of recommendations that person meets. Furthermore, since beliefs were not found to differ significantly among a combination of different recommendations, researchers in this area of study may not need to focus on segmenting the target population in terms of the number of recommendations for oral hygiene behaviors that one performs. Similar to the discussion for part one of research question four, it has been criticized by past scholars that segmenting the population and
targeting specific health behaviors poses an ethical concern on the research study (Atkin & Salmon, 2010; Barry, 1982; Guttman, 2011; Guttman & Salmon, 2004; Silk, et al., 2011). Since the number of recommendations that one meets for positive oral hygiene behaviors does not differ statistically due to the strength of one’s perceptions towards oral hygiene behaviors and knowledge, there is no dire reason for future research efforts to target a specific health belief or modifying factor, per the HBM. Furthermore, these findings do suggest that future researchers aim to increase the beliefs of the benefits of positive multiple oral hygiene behaviors; increasing the beliefs of one positive oral hygiene behavior may have an effect on the beliefs associated with additional, related oral hygiene behaviors. Ultimately, these beliefs in the benefits of such behaviors may aid in predicting oral hygiene behaviors, overtime.

Although the MANOVA did not reveal statistically significant findings for this portion of research question four, there were four statistically significant associations among the six dependent variables. The first three positive correlations were the same as the correlations from the first part of research question four; positive correlations were found between brushing benefits and perceived flossing benefits (a large, positive correlation), between brushing benefits and dental exam benefits (a medium, positive correlation), and between flossing benefits and the benefits of going to the dentist (a medium, positive correlation). The practical significance behind these findings reveal that those who hold stronger beliefs towards the benefits of brushing and flossing the teeth as well as going to the dentist also hold stronger perceptions towards the benefits of other oral hygiene behaviors. Therefore, educational efforts could aim at increasing the awareness of the benefits of brushing, flossing, or going to the dentist since most
individuals associate positive oral hygiene benefits of one behavior (e.g., brushing, flossing, going to the dentist) with another oral hygiene behavior (e.g., brushing, flossing, going to the dentist). Combined, these three findings tell us that people who hold strong beliefs towards the benefits of brushing the teeth see the connection between the benefits of multiple oral hygiene behaviors aiding in the maintenance of healthy oral care (see Table 5.0 Discussion of Research Question 4: Correlations among HBM variables). Oral health communication efforts with the goal of increasing oral health beliefs associated with positive oral health behaviors should encourage the use of and the benefits of more than one positive oral hygiene behavior.

The four associations identified in part two of research question four include the following: a medium, positive correlation between perceived flossing benefits and knowledge of recommended oral hygiene behaviors. Again, the HBM explains (Hochbaum, 1954; Rosenstock, 1974) that knowledge aids in shaping one’s beliefs towards a health behavior; the present association among HBM variables speaks to the underlying research for the HBM model. Increasing the knowledge of recommended oral hygiene behaviors may lend to increase the beliefs associated with the positive benefits of oral hygiene behaviors, specifically flossing behavior. *Figure 5.2 presents the associations between the modifying factor, knowledge of recommended oral hygiene behaviors and the HBM variables, beliefs of the benefits of recommended oral hygiene behaviors.
Figure 5.2. Discussion of Research Question 4: Correlations among **Recommended** Knowledge and HBM Variables

*Note.* The arrow represents the connection between the two variables (one on each side of the arrow). A thick arrow represents a high, positive correlation while a thin arrow represents a medium, positive correlation between the two variables; *Figure 5.2* includes the variable, knowledge of recommended oral hygiene oral hygiene behaviors, while *Figure 5.1* includes the variable, knowledge of recommended and non-recommended oral hygiene behaviors.

Nearly 95% of the analyses’ total variance was explained by the three recommendation groups for oral hygiene behaviors. Due to the findings of this research question, future health campaigns in South Africa focusing on increasing the frequency of oral hygiene behaviors (e.g., brushing, flossing, and going to the dentist) in an effort to encourage meeting the oral hygiene recommendations set by the SADA (2012), may not choose to focus on increasing knowledge of oral hygiene or specific oral hygiene beliefs. Rather, choosing to focus one of three perceived benefits or knowledge variables may ultimately have an effect on all other oral hygiene beliefs of benefits and/or modifying factor, knowledge. While flossing beliefs has the most associations among variables (e.g., brushing beliefs, dental exam beliefs, and knowledge or recommended oral hygiene behaviors), brushing benefits also has the strongest connection between brushing and flossing beliefs. It may be a helpful for researchers to focus campaign efforts around
increasing either brushing or flossing beliefs, or both variables. Efforts that aim at increasing one or both of these HBM variables may strongly impact the beliefs of the other two HBM variables, dental exam beliefs and knowledge of recommended oral hygiene behaviors. Ultimately, these beliefs may have an effect on behavior per the HBM. Furthermore, the data from research question four suggests a path for structural equation modeling (SEM) that future research could test. Employing a SEM approach on these variables would help determine if there is a pattern among these variables (Byrne, 2010; Tabachnick & Fidell, 2007).

An overarching finding for parts one and two of research question four includes missing associations among the dependent variables (i.e., combined recommended and non-recommended behaviors and recommendation groups) and the HBM constructs, perceived severity and perceived susceptibility. We know that perceived susceptibility refers to beliefs about the likelihood of developing a health condition while perceived severity is the belief about the seriousness of the health condition, as well as its consequences. Together these two HBM constructs determine an individual’s perceived threat towards a health condition. The conclusions above about the associations between the HBM variables, perceived benefits of brushing, flossing, and routine dental exams and Rimer and Glanz’s (2005) explanation of perceived benefits representing an individual’s perceptions towards the usefulness of taking positive action to reduce risk or serious consequences associated with the behavior may serve to justify the absent association between perceived severity and susceptibility. That is, the HBM theorizes that beliefs about whether or not an individual is susceptible to a health condition, and their perceptions towards the benefits of trying to avoid a health problem, influence their
readiness to act on behavior change (Rimer & Glanz). Thus, high associations between the benefits of multiple positive oral hygiene behaviors show that high beliefs towards the benefits of the positive oral hygiene are not strongly associated with one’s feelings towards the severity of and how susceptible they are to an oral health problem. These findings align with those of Carpenter’s (2010) meta-analysis of the HBM constructs. Future campaigns in this area of research should take Carpenter’s suggestion that campaign efforts aim to increase the knowledge of risk factors associated with diseases (e.g., oral health diseases), in order to may motivate individuals to make better decisions about their overall health (e.g., oral health).

**Research question 5.** The fifth research question asked: *What are the primary barriers to positive oral hygiene behaviors, a.) brushing the teeth, b.) flossing the teeth, c.) routine dental exams, and d.) using a toothpick?* Participants chose all responses that applied when answering this question; in some cases, the sum percentage for barriers to each behavior exceeds 100%. One overarching finding worthy of highlighting from research question five applies to all five oral hygiene behaviors. The highest or second-highest barrier for these behaviors was noted as inconvenience. For both non-recommended behaviors, inconvenience was found to be the most frequently responded barrier. For the recommended behaviors, inconvenience was a close second most frequently responded barrier. In addition to inconvenience as being an overarching barrier among all behaviors, forgetfulness was also noted as a top barrier among behaviors except for routine dental exam behavior. For brushing and flossing, forgetfulness was the most frequently responded barrier and for the non-recommended behaviors, it was the second-most frequently responded barrier. Finally, the most
frequent barrier for routine dental exams was marked as cost. Future research in this area should investigate the cues to action associated with each of these four oral hygiene behaviors; cues to action may help shed light on the barrier, forgetfulness.

Overall, the most frequently noted barrier to all oral care was expressed by participants was inconvenience. Since each of these oral hygiene behaviors can be considered “goods” (i.e., they require specific items in order to do the behavior; e.g., floss for flossing, toothbrush and toothpaste for brushing the teeth, etc.), Berry and colleagues (2002) explain convenience goods as “intensively distributed products that require minimal time and physical and mental effort” (p.1). It is not surprising that inconvenience was expressed by participants as a barrier to care; inconvenience is a well-known barrier to many health-related behaviors. A research study conducted on the barriers to accessing dental care concluded the lack of and insufficient dental coverage or medical aid, inability to find a dentist who accepts their specific insurance, waiting for coverage to take effect, and perceived poor quality of care for both the uninsured and underinsured to be the most recognized barriers to seeking oral health care from a dental professional (Schrimshaw, Siegel, Wolfson, Mitchell, & Kunzel, 2011). Past studies that investigated the drivers of inconvenience in terms of nutrition found that the most influential inconvenience demands included the lack of time, too much stress, limited skills, and social norms (Candel, 2001; Scholderer & Grunert, 2005). Studies on exercise found the most common barriers included lack of time, laziness, more important priorities, and a lack of motivation (Ebben & Brudzynski, 2008; Louw, Van Biljon, & Mugandani, 2012).
In each of the studies listed above, the idea of the behavior not being convenient (e.g., limited time, difficult to complete, etc.) surrounds many of these barriers to enacting the specific behavior. Future oral hygiene studies should look at ways in which it is possible to reduce the idea of time and inconvenience as a barrier to enacting oral hygiene behaviors by emphasizing the limited amount of time it takes to brush and floss the teeth each day. For example, the ADA (2012) recommends that one brush their teeth for between two and three minutes, twice a day (See Ad Council & Partnership for Healthly Mouths Healthy Lives, 2012; Attin & Hornecker, 2005; Soderlund, 2012). For flossing the teeth, the ADA recommends doing so at least once a day and the time it may take varies per person (i.e., size of the mouth, amount of teeth, amount of debris within the teeth and gum line, etc.). The SADA does not give specific time designated to performing positive oral hygiene behaviors, brushing and flossing the teeth, thus the ADA’s guidelines are used as a reference point (since both organizations’ guidelines align regarding the frequency one should enact each behavior). It may be beneficial to show, in comparison to brushing and flossing the teeth, other activities which require an equal amount or more time to perform (e.g., pray, make a sandwich, listen to your favorite song, read or write an email, fill up your gas tank, tweet, send Facebook message, watch a music video, etc.). These types of messages may reinforce the idea that brushing and flossing the teeth takes as much as or less time than many activities that we make time for each and every day. Another message tactic might tackle the behavior recommendation of brushing the teeth twice a day and express this reminder in terms of other behaviors that one may not do more than once a day. For instance, there are some things that in most circumstances, one would not do twice in one day (e.g., washing their
car, washing/drying the same load of laundry, fix your bed, eat lunch, etc.). On the other hand, there are behaviors that you should do two or more times a day (e.g., brushing your teeth, eat, use the restroom, drink water, blink your eyes, etc.). Making a connection between the behaviors that we do more often in any given 24 hour period and brushing the teeth more than once a day, may help reinforce the importance of this behavior and help reduce the barriers (e.g., time or convenience) one associates with enacting it.

In addition to the two ideas offered above, future campaigns could provide individuals with the resources necessary to enact behaviors that were noted as being inconvenient. Providing participants with floss that they can using daily to floss their teeth, and a toothbrush and toothpaste for twice daily brushing of the teeth, may help make these items more convenient to the consumer. As noted in the paragraphs above, Berry and colleagues (2002) explain that behaviors that require specific goods or products may be seen as inconvenient among the consumer. Providing participants with the products that are necessary for enacting positive oral hygiene behaviors may help reduce the inconvenience barrier.

Another way campaigns could decrease the idea of positive oral hygiene behaviors being associated as an inconvenience includes aiming to increase brushing behavior by reducing the perceived barriers of brushing the teeth. A device known as the “Twooth Timer” may help individuals get accustomed to and get in the routine of brushing their teeth for at least two minutes. Manufactured by The Twooth Timer Company (2013) and endorsed by the ADA (2013a), the Twooth Timer is a timer in the shape of a tooth that was originally made for children; the fun shape and two minute mechanical bell timer makes brushing the teeth seem more like a game, making this
behavior more appealing as fun for kids (ADA, 2013a; The Twooth Timer Company, 2013). Having a tooth-timer helps individuals get in the habit of brushing their teeth for at least two minutes. Having this timer out on the bathroom sink also aids as a visual reminder, a cue to action (HBM construct), to make time to brush your teeth. Although this product was designed with children in mind, this concept could also be used for adolescents and adults. A more appealing design or device may include application that could be downloaded on a mobile device and used to time or count down the time they should spend brushing their teeth. In all, these three health communication strategies can be used to help encourage and motivate positive oral hygiene behavior, brushing, and brushing for at least two minutes twice a day.

**Research question 6.** The last research question, number six is a two-part research question. Research question 6a asked the following: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of recommended oral health beliefs (Brushing benefits and flossing benefits)? A MANOVA analysis was employed in order to see if a combination of recommended beliefs vary as a function of racial groups. As uncovered in research question four, a large, positive correlation was identified between brushing and flossing benefits ($r = .58$, $n = 257$, $p < .001$), with stronger perceptions of the benefits of brushing the teeth associated with stronger perceptions of the benefits of flossing the teeth.

Statistical significance was found between the three race groups and brushing beliefs as well as flossing beliefs. There was a reliable, multivariate difference between the three race groups on both flossing benefits and brushing benefits. The independent variable, Race, accounts for a moderate proportion of this analyses total variance (17%).
When the results for the two dependent variables (i.e., brushing and flossing benefits) were considered separately, both variables revealed a statistically-significant difference between the three race groups and brushing benefits. The independent variable, Race, accounts for a small proportion of this analyses total variance (6.4%). Furthermore, significant differences were found between Whites and Coloured and Whites and African/Blacks; Whites reported slightly higher levels of perceived brushing benefits ($M = 4.66$, $SD = .41$) than Coloured ($M = 4.42$, $SD = .75$) and African/Blacks ($M = 4.25$, $SD = .67$).

A statistically significant difference was also found between the three race groups and perceived flossing benefits; 16.4% of the variance in flossing benefits can be explained by race. Highest levels of perceived flossing benefits were discovered among Whites ($M = 4.20$, $SD = .71$), than Coloureds ($M = 3.95$, $SD = .89$), and the lowest levels of perceived flossing benefits was among those who self-identified as African/Black ($M = 3.28$, $SD = .92$).

A one-way ANOVA with post-hoc tests for the significant dependent variables (i.e., Brushing Benefits and Flossing Benefits) was used to explain the impact of race on levels of perceived beliefs of brushing benefits and perceived beliefs of flossing benefits. There was a statistically significant difference for perceived beliefs of brushing benefits in the three race groups. The mean score for African/Blacks ($M = 4.25; SD = .67$) was significantly different from that of Whites ($M = 4.66; SD = .41$), with a mean difference of .42; Coloureds ($M = 4.42; SD = .75$) did not differ significantly from African/Blacks or Whites in terms of perceived beliefs of brushing benefits.
A statistically significant difference in perceived beliefs of flossing benefits was found among the three race groups. The mean score for African/Blacks (M = 3.28; SD = .92) was significantly different from that of Coloureds (M = 3.95; SD = .89), with a mean difference of .67. Whites (M = 4.2; SD = .71) were found to be significantly different from African/Blacks (M = 3.28; SD = .92), with a mean difference of .92. Last, just like the results from brushing benefits and race, individuals who self-identified as Coloured did not differ significantly from those who self-identified as White in terms of flossing benefits.

Among both brushing and flossing benefits and the different race groups, participants who self-identified as members of the Coloured race did not differ significantly from those who self-identified as members of the White race. In terms of race, there are differences in the mean scores of the perceived benefits of brushing and flossing but not among participants who self-identified as White and Coloured. Practical significance of these findings tells us that one’s race does not directly influence the perceived benefits of brushing and flossing the teeth among the White and Coloured populations. The same idea as presented above also applies to perceived benefits of brushing the teeth and the Coloured and African/Black races. No statistically significant difference was observed between the mean scores of brushing benefits among these two race groups. Practical significance of this finding lends to one’s race (e.g., Coloured and African/Black) not directly influencing their perceived benefits of brushing the teeth. Additionally, among both brushing and flossing benefits and the three race groups, a significant difference in these mean scores was observed between the African/Black and White race groups. Practical significance of these findings tells us that one’s race
(African/Black and White) does directly influence their perceived benefits of brushing and flossing the teeth. The same idea applies with flossing and the African/Black and Coloured races; practical significance for this finding expresses that one’s race (African/Black and Coloured) also directly influence their perceived benefits of flossing their teeth. Future research may look at why these findings were apparent among the race groups in South Africa, and more specifically, if different race groups have explicit cultural beliefs that influence oral hygiene behaviors.

Future studies that aim to increase the perceived benefits of the benefits of flossing the teeth may want to consider targeting different race groups. Targeting different race groups would require the researcher and/or research team to develop campaign materials that are specific to and sensitive towards each race group. More specifically, efforts toward increasing the perceived benefits of flossing among the African/Black population may be more beneficial than the other two race groups, since statistically significant differences were observed between this race group and both Coloureds and Whites; the mean score for flossing benefits was the lowest among the African/Black race (M = 3.28; SD = .92). The same recommendation applies for flossing benefits as for brushing benefits, as the mean score for brushing benefits among the African/Blacks race group was the lowest among all three races (M = 4.25; SD = .67).

Researchers should be aware of Guttman’s (2000) discussion of justice or fairness when dealing with campaigns that target specific populations, such as African/Blacks over Coloureds and Whites. Guttman stresses the need to consider how resources and costs (e.g., of oral health care) may vary among different groups (i.e., races) within a given population. Since all South Africans have medical aid that pays for some or all of
their dental expenses (i.e., socialized medicine; Department of Health Republic of South Africa, 2013), oral health-related coverage is distributed among all South Africans; free or reduced coverage is not benefiting or privileging one race over the other. Furthermore, future research efforts that target African/Blacks should also consider the historical differences in education among the African/Black race. During the Apartheid movement, educational systems were racially differentiated (Fiske & Ladd, 2005); funding was a contributing factor to the quality of education among schools. More specifically, schools that Whites attended during the Apartheid had more than ten times the funding than the schools that African/Blacks attended (Fiske & Ladd, 2005). Inequalities between races and their corresponding educational systems remain a problem in present-day South Africa. Knowledge of the recommended oral hygiene behaviors may help explain the beliefs associated with positive oral hygiene behaviors. Educational efforts that focus on increasing the knowledge of positive oral hygiene behaviors among the South African Africans/Black race may aid in increasing the beliefs associated with these behaviors.

Suggestions for future research endeavors that aim to target specific race groups in an effort to increase their perceived benefits of either brushing and/or flossing behaviors include being educated on the history surrounding race, race groups, and segregation in South Africa. Both understanding the history behind race and being up-to-date with the current stances on race in South Africa will help in developing materials that are appropriate and sensitive towards the target population. For instance, individuals from South Africa take much pride in being African, specifically, South African. Asante (2008) suggests that research conducted in Africa should help the Africans by taking an “Afrocentric” approach to the research. Asante defines Afrocentricity, stating it is “The
ideological centerpiece of human regeneration, systematizing our history and experience with our own culture at the core of existence” (p. 49). Taking an Afrocentric view towards designing and implementing the campaign may result in mass appeal and retention of participants who self-identify as African/Black. An Afrocentric view would include putting the person at the center of the research project because to an African, the self is the center of the world (Asante, 2008). Although an Afrocentric view requires focusing the research study around the participants, the researcher(s) must also recognize the economic and structural constraints within each particular region of South Africa. Researchers should be aware of the resources available to participants and strive to make positive improvements in increasing the availability of and decreasing costs of oral hygiene materials (tooth brush, dental floss, dental professionals, etc.).

The second part of research question six, 6b asked: Do race groups (e.g., African/Black, Coloured, and White) differ in terms of non-recommended oral health beliefs (Toothpick benefits)? This question assessed non-recommended oral hygiene beliefs by race group. A MANOVA was used answer this research question in order to see if a combination of the benefits measures (e.g., toothpick benefits,) varies as a function of race (e.g., African/Black, White, Coloured).

Findings from this portion of the sixth research question revealed no reliable multivariate differences between the three race groups on toothpick benefits. Although there were multivariate differences between brushing and flossing benefits and the three race groups (i.e., results to research question 6, part 1), no reliable multivariate differences were found between the three race groups on toothpick benefits. Practical significance for this analysis reveals that among the sample population of the three race
groups, not one group differs in terms of beliefs of the benefits of the positive oral
hygiene behavior using a toothpick (i.e., non-recommended oral hygiene behavior). It
would be beneficial to understand more about toothpick behavior and how this behavior
is perceived among the South African population. During my time in the field, I
experienced many situations where toothpicks were readily available for use to clean
teeth and gums; most every restaurant conveniently kept toothpicks at the center of the
customer’s table (next to the sugar and condiment holder). It would be beneficial to
understand if this is the case in most restaurants or food shops located in both the urban
and rural areas of South Africa, especially near the townships and government-funded
communities were the majority of participants reside (e.g., African/Blacks and
Coloureds). Also, if participants do not frequently dine at restaurants they may not be
aware of this item or use it frequently enough to understand the benefits associated with
its use. Future health communication campaign efforts may benefit from addressing
perceived beliefs of recommended behaviors (e.g., brushing benefits, flossing benefits,
etc.) since the data found multivariate differences among these variable and the race
groups, African/Black, White, and Coloured.

Data Collection in a Foreign Country

This section will document my experiences with data collection in Port Elizabeth
and surrounding communities in South Africa during the summer of 2012. I will briefly
touch on the benefits and challenges to data collection in this area so that future
researchers can benefit from my experiences. Last, I will end with an overall observation
form my experiences.
Benefits. There were many reasons why one would like to conduct research in South Africa. This section only scratches the surface on a few of these reasons, including the friendly nature of the people in South Africa, diversity of populations to study, and ease of a convenience and snowball sample.

In South Africa, particularly the Port Elizabeth area where I conducted the majority of my research, the people are for the most part, extremely friendly. This does not come as a shock, as the city is known as the “Friendly City.” Likewise, collecting data in this area was exciting because many people wanted to talk with me about my research, asking questions about why I am interested in oral hygiene, why I am not going to be a dentist, and if I would return to South Africa one day in the future to make sense of my findings and implement a program to help increase positive oral care. It was nice to see that people actually took an interest into what I was doing.

The Port Elizabeth area of South Africa is a metropolitan area full of different populations of people, including different Nelson Mandela Metropolitan University campuses that can be found around the city. Why having a population of this kind is a positive for a research study of this stature is because of the large possibility for different associations that can be made with people and organizations; these associations lead to references in other areas of town that can help to increase the size of the sample. In my case, I was able to meet a few people whom offered names of contacts at different organizations, and even made phone calls to inform the contacts, in advance, of me reaching them. Playing off of the first positive, friendly people, many individuals that I met were more than willing to recommend populations for me to use for my sample. A
few even offered to help me conduct these recruitment/collection sessions. The diversity of participants’ extends to race, sex, education level, income level, and age.

In addition to the friendly nature of the people in Port Elizabeth, South Africa, the convenience and snowball sample design make for ideal methodology for outside researchers. By outside researchers, I mean someone who is not familiar with or originally from South Africa. Because I did not know anyone in South Africa before I arrived, I used a convenience method in terms of how I initially found people to participate in my study. I started with the hotel I was staying in, and then asked them to refer others whom might be willing to fill out a questionnaire. Additionally, I used three of our program placement sites (as mentioned in Chapter 1) as a starting point for data collection. Often these organizations offered names of others whom I could contact in order to have a larger sample to study. In all, these resources added a large sample size of n = 257; well over my target sample size of n = 130.

Challenges. Akin to most research studies, there were a few unforeseen challenges while collecting data in South Africa. These challenges included, but are not limited to, participant’s fear of the unknown, hesitation to reveal age, the language barrier, social desirability, and length of the survey. These challenges are presented in order to help guide future research and researchers by offering suggestions or ideas to think about before completing similar studies in this area of South Africa.

Due to the post-Apartheid system in South Africa, many people (e.g., Blacks, Coloureds, etc.) were hesitant to participate in activities that may ask them to reflect on their health or overall health status; this is mainly the case because they are afraid of the unknown. To them, I could be a government worker or someone that is trying to get
information about them so that they could be denied rights as a South African. When I sensed these hesitations, I would kindly note that my study was anonymous and that it would in no way be linked back to them and used against them, that only myself and my committee would be aware of the findings. Most of the time, this did not help ease their nerves. I understand that many South Africans have been through a lot in the past few years (i.e., Apartheid history) and I respect the fact that they are just scared of the unknown. With that, I would tell them to have a great day and not push the envelope much more. My suggestion for future researchers that may experience similar hesitations among participants would be to have someone that is local to that area (e.g., key person in community) accompany the researcher during data collection. This way, if issues emerge regarding a participant’s hesitation about revealing information related to the contents in or context of the study, the community member can help alleviate concerns. Likewise, having a community member who speaks the local language or dialect would also help with making translations between the researcher, participant, and/or research instrument (e.g., OHBS), when necessary.

Similar to women in the United States, many South African women were hesitant to give up their age on the survey. I would have to check each survey to make sure that this question was filled out, and if it was missing, I would kindly joke with the woman about why I was asking her age. I would reassure her that no one would know that this survey (pointing to her survey) is associated with her. Reassuring the woman that their age would not be associated with them outside of the context of the study, or linked back to them (as there was no way to identify participants with their survey), helped for the most part. Future researchers should consider adopting the age categories noted by the
South African Census (Statistics South Africa, 2012). The South African Census groups age groups by every four years. The age question in the demographics section of OHBS should be amended to ask participants to select which group best describes their age: 0-4, 5-9, 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49, 50-54, 55-59, 60-64, 70-74, 75-79, 80-84, and 85-119.

The language barrier was a limitation that I did not foresee being as large of an issue as it really was. I knew coming into the study that many people spoke and/or understood English. However, depending on the population of participants, English was very hard for them to read. When situations arose, I turned to reading the questionnaire to either one person or the entire group. A few times my accent distracted the participants; it either made it difficult for them to understand my English or they acquired an interest in the somewhat different accent than they were generally used to hearing. In order to alleviate these distractions, when possible someone from the area who was proficient in English would read the OHBS to the participants instead of me reading it to them. Example words or phrases that were often needed clarification included: a.) Floss was a term that I often needed to explain and describe, and b.) The term barrier was a foreign concept and I often needed to replace this word with a synonym, such as something that stops or obstructs one from doing the given behavior (e.g., brushing the teeth, flossing the teeth, etc.). Recommendations for future researchers in South Africa (especially American-born researchers) would include having a translator with you during data collection in order to translate words or sayings that are not commonly used in the area (e.g., words or sayings on OHBS, etc.). Having a translator that is specific to
each area of town would be extremely beneficial due to many different dialects that vary from one community to the next in South Africa (specifically the Eastern Cape).

Social desirability, or the participants’ conscious or unconscious need to look good by answering questions in a socially-desirable way (Gliner & Morgan, 2000), is another noted limitation to this study. The behavior questions in OHBS specifically warrant the need to discuss this threat to validity. Each behavior question was measured in two ways: 1.) Categorical measure (e.g., “I brush my teeth” answered by selecting a frequency on a categorical measure) and 2.) Dichotomous measure (e.g., “I brush my teeth at least twice a day” answered by selecting either yes or no). When participants reported using the categorical scale, they seemed to self-report that they enact these behaviors (e.g., brushing, flossing, going to the dentist, and using a toothpick) less often than they reported that they enact the behaviors on the dichotomous measure. Since these behaviors reflect on one’s hygiene and one can be seen as undesirable if reported less frequent behavior, social desirability or the participant wanting to be seen as doing what experts/researchers recommend that they do, may have persuaded participants to over-report the frequency of which they engage in these oral health behaviors. Since this is a systemic bias to the data, it does not affect the reporting of this data in this research project. Future research studies should be aware of this threat to validity and consider open responses for questions relating to frequency of behavior; additional limitations do come along with open-ended questions. These limitations include not providing comparable data across a sample and time involved in coding and preparing data entry for multiple responses (Gliner & Morgan, 2000).
The length of the survey was another limitation for my study. Many times, people would see the two double-sided pages and get overwhelmed and say that they did not have enough time to answer that many questions. I would kindly inform them that it would not take too terribly long, and that I would appreciate their help with my study. I also showed them how many of the questions seemed to repeat with different behaviors. Furthermore, when I pilot tested the survey, on average it only took a participant about 5-7 minutes to complete. This was not the case with all samples in South Africa. While some participants spent between 10 to 15 minutes completing the OHBS questionnaire, others took much longer to complete it. In most cases, participants took between 45 minutes to one hour to completely answer all questions on the OHBS. The length of time it took a person to complete the survey usually depended on their reading comprehension in English (i.e., their level of literacy) and their ability to read and understand the language used to ask each question on the OHBS.

Future researchers may aim to shorten OHBS by only including the HBM variables/constructs that are specific to recommended oral hygiene behaviors (e.g., brushing, flossing, routine dental visits). Using the current version of OHBS, a study that addresses only the recommended behaviors and corresponding HBM variables would include 53 questions, plus demographic questions (the OHBS used in this dissertation research included 82 questions plus demographic questions). Likewise, focusing on only three behaviors, rather than four, allows room for questions regarding cues to action and self-efficacy (two HBM constructs not included on the OHBS due to length of survey being too long) to be added/applied to each behavior on OHBS. For a breakdown of questions in OHBS by topic, see Table 3.0 in Chapter 3: Methodology.
Next, early on in data collection, it became clear to me that there may be a threat to the validity of the questions assessing chewing stick beliefs and behavior. As such, these beliefs and behaviors were not included in the research questions that originally aimed to assess chewing stick beliefs and behaviors. Reflecting on the data collection process, there were many times when participants inquired about a chewing stick, asking me what a chewing stick was. A few times when this happened other participants in the room would say something about a chewing stick being a piece of chewing gum. When this happened, I would clear up but the misconception and explain what a chewing stick actually was. It is unknown as to whether or not participants who did not hear these conversations were responding to the questions about chewing stick behavior in terms of using a chewing stick (i.e., the intended behavior included on OHBS) or if they were referring to using a piece of chewing gum to clean the teeth and gums of food debris; participants could have also associated this item with another object that was not brought to my attention.

There were two situations during data collection when participants reflected on their experiences with a chewing stick. One participant stated that they remember using a chewing stick at their grandmother’s house when they were younger; they remember staying the night at grandmother’s house and going outside to fetch a limb/chewing stick to clean their teeth each morning and night. This individual said that they no longer use a chewing stick, rather they use the product recommended by the SADA, a toothbrush. Another participant stated that they never used a chewing stick but they did recall their grandparents using them; this individual referenced the chewing stick behavior as being outdated or irrelevant to their generation. Future researchers should investigate the
narratives behind chewing stick behavior and also assess whether or not chewing stick behavior is prevalent in more rural or urban areas of South Africa.

These experiences, as well as the gap in knowledge on the use of the chewing stick in South Africa (“Brushing up on alternative ways to floss,” 2007; Irish Times, 2007; J. M. Al-Ansari, 2007; Wu, Darout, & Skaung, 2001), confirm the need for more information about the non-recommended chewing stick behavior; more information on this topic is necessary in order to fully understand who, if anyone, may still enact such behavior. Likewise, it would be valuable to understand different terms used to describe this behavior. For instance a decorative dental encasement, also known as grillz, grills, fronts, plates, golds, shines, and caps (ADA, 2006; Cruz & Dalmas, 2007) is an oral accessory made of gold, diamonds, and other jewels which covers one or more tooth and can be permanently fastened to the teeth or can pop on and off the tooth/teeth (ADA, 2006; Hollowell & Chiders, 2007). The point being made here is that referring to these decorative dental encasements among the population of people who use them (e.g., some adolescents) may yield confusion or false results among users. Using the correct terminology, such as grills, fronts, or plates may serve to provide more accurate findings of users and non-users among the target population. Therefore, understanding the verbiage used to describe the use of a chewing stick to clean the teeth and gums may serve to produce better-written questions about chewing sticks and behaviors surrounding this object to be included on future versions of the OHBS in South Africa. Better-written questions will help with future assessments of current trends in oral hygiene behaviors in South Africa; these efforts may help determine if this indigenous behavior has died out or is no longer being practiced among people living in South Africa (consider both urban
and rural areas of South Africa). It may also be a behavior that is common particularly among a specific age group of South Africans. Assessing the different groups in terms of chewing stick behavior may shed light on more specific populations who enact this positive oral health behavior to clean their teeth and gums.

In addition to uncovering more information about the non-recommended behavior, chewing stick, future researchers in South Africa that aim to study non-recommended oral hygiene behaviors may want to investigate the use of and availability of toothpicks in the South African context. It is possible that this indigenous behavior has died out or is no longer being practiced among people living in South Africa (city vs. rural). It may also be a behavior that is common among a particular age group of South Africans, an age group that was not addressed in the study presented in this paper.

Another challenge within the presented dissertation research includes the scales used to measure variables within OHBS. In order for future researchers to be able to conduct SEM-style analyses, independent variables must be continuous observed indicators (at least three) which measure a latent variable. The independent variables used in this present study (in research question three, specifically), are ordinal-level continuous-scales variables (e.g., brushing frequency, flossing frequency, etc.) rather than ratio-level scales. Recommendations for future research include developing and testing a new scale to measure these variables. In addition to the three behavior questions being assessed on a new scale (e.g., brushing, flossing, and going to the dentist), questions assessing additional HBM constructs, such as cues to action and barriers, should also adopt a ratio-level scale of measurement. Example scales for these questions include a five-point Likert-scale ranging from strongly disagree (1) to strongly agree (5; Klassen,
Example questions may include, “On most days, you brush your teeth twice, daily,” “On most days, you floss at least once, daily,” “On average, you visit the dentist at least twice a year,” etc. Each question would be asked using a five-point Likert scale and participants would be asked to respond with how much they agree with the statement (ranging from strongly disagree—to—strongly agree). Barrier-type questions could also be assessed on the same scale as the ratio-level behavior questions. Example barrier questions could include, “A barrier to brushing the teeth twice a day is time,” “A barrier to brushing the teeth twice a day is convenience,” “A barrier to brushing the teeth twice a day is pain,” etc. These questions can be repeated using additional barriers and/or behaviors (e.g., time and flossing; time and going to the dentist, etc.).

The final recommendation for future research in the area of oral hygiene beliefs and behaviors in South Africa, which served to be a barrier to conducting the research presented in this dissertation, includes the use of incentives. Singer and Couper (2008) explain that refusal to participate in research studies include isolation from one’s society, as well as concerns about privacy and confidentiality regarding the topic of the study (see Groves & Couper, 1998; Singer, 2003; Singer, Van Hoewyk, & Neugebauer, 2003). Monetary incentives are often used as a way to recruit and motivate participants, thus increasing the volume of participation in a study (singer and Couper, 2008). Future researchers who have difficulty recruiting participants for a study (both survey and qualitative interviews) may consider using monetary incentives to entice participants to take part in the study. Overall, the challenges presented above are outlined in a way to
help improve and strengthen future research conducted on and researchers who study, oral hygiene beliefs and behaviors among South Africans.

**Overall Observation.** Future campaign planners in the area of oral hygiene beliefs and behaviors among South Africans may consider utilizing campaign efforts that rely less on information-heavy communicative materials (e.g., education public service announcements, handouts, booklets, etc.) and more on using entertainment strategies to communicate healthy messages (Davenport Sypher, McKinley, Ventsam, & Valdeavellano, 2002; Dutta-Bergman, 2005; Singhal & Rogers, 2002). In an environment where the researcher aims to alter or increase the level of beliefs among a population, materials that are highly informative tend to resonate with people who already hold a high belief on that specific topic. What is typically observed is selectivity in message reception and processing; those who already hold a strong belief towards the topic end up learning more and increasing their beliefs while others may not notice the message and ultimately do not learn from it. This process contributes to the increasing gap in literacy between diverse populations (Dutta-Bergman, 2004; 2005; Hadi, 2001). Implementing an educational, entertaining campaign may appeal to multiple populations with a variety of beliefs on the health topic. For instance, incorporating oral health messages into ritual chants or dances may help spread the message in an entertaining way. Including these messages in entertainment programs that are likely to be viewed by the target audience may also help increase awareness of the target behavior (Davenport Sypher, et al., 2002; M. J. Dutta-Bergman, 2005; Singhal & Rogers, 2002).

After doing this study in the both the United States and in South Africa, one thing that stands out to me the most is the attention to minute details that those in South Africa
paid attention to while completing their surveys. For instance, when responding to the questions, very frequently I had participants ask if they could use a pen instead of a pencil (because the directions said pencil), they also wanted to know how they should indicate their answer on the paper, either via a tick mark, circle, or an X; specific directions were particularly important to my participants in South Africa. Last, in the schools, I found that many students completed their survey with a ruler so that they could make straight lines for their tick marks and they would also often use either use white out or an ink pen eraser to correct any mistakes that they made, rather than scratching them out. This observation stands out to me because in my studies in the states, I rarely had students ask if they can use a pen instead of a pencil. Many US students scratched out mistakes and wrote over their scratched out answer with the new answer. Furthermore, I have never seen one use a ruler to make straight indicators for their answers to their questions. I perceived the South Africa population as one that takes pride in their work and wants to make the best impression possible. This was likely related to the high social desirability response mentioned in the previous section, *challenges*.

Before I started my study, I feared I would not be able to reach my large target of \( n = 130 \) participant living in South Africa. In all, I more than doubled that goal, ending with nearly \( n = 290 \) participants. I encourage other doctoral students who are completing their dissertation researchers to branch out of their college population and utilize other populations for study that speak to you; for me, it was the South African experience.

**Implications for Future Research/Future Direction**

Mentioned in the introduction, one’s culture can shape an individual’s behaviors and beliefs (Ting-Toomey, 2005; Witte & Morrison, 1995) and individual perceptions
can be influenced by learned systems of meaning (e.g., structure, environment, culture, economics, etc.). Each of these factors (e.g., structure, culture) affects behavior and influences behavior change (Ting-Toomey, 2005).

There are multiple levels of change associated with behaviors. For instance, each component of culture and understanding can be influenced by a variety of contexts, including structural and individualistic contexts (Dutt-Bergman, 2005). The present research study focused on the individual level of change due to oral hygiene behaviors relating mostly to individuals enacting these behaviors by themselves. Due to the lack of significant findings among the data, future studies may benefit from trying a different approach to the research; possibly a culturally-centered approach. It may be valuable to see how the interpersonal or familial levels of change affects the target behaviors by seeing if interactions between people or family members influence oral hygiene behaviors and beliefs. Addressing the structural level of behaviors may aid in implementing preventative campaigns within schools or religious systems. Furthermore, a campaign may choose to focus on the local community or government level of change in an effort to increase one’s awareness of their benefits to medical aid plans, increase the number of oral hygiene clinics within a community, or provide transportation to and from one’s community to an oral hygiene clinic.

South Africa is a country full of rich culture that may aid in shaping health beliefs—specifically oral health beliefs. Cultural beliefs are important because of their influence on an individual; these learned systems of meaning may aid in shaping individual behavior. Although uncovering individual cultural beliefs that surround oral hygiene did not shed much light on the oral hygiene behaviors among South Africans, it
did bring us one step closer to understanding one level of behavior change, the individual level. For example, just over 71% of the sample population reported brushing their teeth two or more times a day while nearly 23% reported flossing their teeth at least once a day.

Although oral behaviors are considered actions enacted by the individual, the beliefs surrounding these behaviors (thus influencing the frequency for which they occur), may be influenced by a larger context such as a community of people (Dutta-Bergman, 2005). Taking a culture-centered approach to the research, rather than an individual approach “locates the culture at the center of theorizing about communication processes” (M. J. Dutta-Bergman, 2005, p. 116) such as oral hygiene beliefs and behaviors. A culture-centered approach tackles the problem from within the culture, using a community-based approach to explain the problem. Focus groups or team building that center on the social-construction of meaning within a culture are the key forms of methodology that surround this direction towards looking at communication surrounding oral hygiene behaviors. Taking a cultural-centered approach to the research, using theories such as the Theory of Reasoned Action (TRA) and Theory of Planned Behavior (TPB) may aid in determining how or why powerful others serve to influence behavior (Martin Fishbein & Cappella, 2006; McKenzie, et al., 2005) at the cultural level.

The TRA was introduced in 1967 by Martin Fishbein and Icek Ajzen to explore the relationship between attitudes and behavioral intentions involved with behavior change (Fishbein & Ajzen, 1975). The TPB was later developed in 1988 as an extension of the TRA, which included the concept of perceived behavioral control, which is one’s belief in their personal control over performing the behavior (Fishbein, 1990). Both
theories are often combined together to include the theoretical constructs of behavioral intention, attitude, subjective norm, and perceived behavioral control (McKenzie, et al., 2005). Today, the TRA/TPB is known as the Integrated Behavior Model (Glanz, Rimer, & Viswanath, 2008).

Behavioral intention is one’s professed probability of behavioral performance. This is the most important determinant of one’s behavior (Montano & Kasprzyk, 2002). The TRA/TPB hypothesizes that one’s aim to perform a given behavior is influenced by their attitude toward the behavior and their beliefs surrounding whether or not they feel people in their life approve or disapprove of the behavior (i.e., subjective norms; McKenzie et al., 2005). Attitude can be a direct or indirect measure of the evaluation of the behavior. Each measure or attitude has a value attached to the outcome or attribute of the behavior. Subjective norm is measured by how well individuals approve or disapprove of them performing the behavior, also known as one’s normative belief. Subjective norms are slanted by their motivation to comply with others’ opinions. Lastly, perceived behavioral control incorporates the idea that motivation and ability determine behavior performance. This construct accounts for outside factors not within control of the individual, which may affect their intentions and behavior (Montano & Kasprzyk, 2002).

Incorporating the idea of subjective norms into a formative research study will help determine if the idea of subjective norms and their influence on the individual correlate with oral hygiene behaviors. Subjective norms relating to oral hygiene behaviors could include the relationship between the behavior and peer influence, familial influence, the importance of being liked, and physical motivation (Koerber, et
al., 2006; Sniehotta, Soares, & Dombrowski, 2006). For instance does the individual brush their teeth because their peers approve of this behavior? Or how much does the individual agree or disagree that most of their family thinks it is important to floss their teeth in order to protect oneself from gum disease? Understanding the connection between the behavior and the person, through subjective norms, may help determine if enacting the behavior is in result to the motivation they have to comply with the accepted behavior and how likely they are to enact this behavior on a day to day basis.

Although this model measures behavior on the individual level, TRA/TPB aims to make sense of the behavior by understanding why or how people do what they do. Additionally, M. J. Dutta-Bergman (2005) explains that individualistic messages developed using the TRA that center around the idea of behavior change “might fundamentally counter the values of the collective” (p. 107). The importance of culture may be relevant to these behaviors and enacting them is simply due to the fact that it is respected and is a culturally-acceptable behavior. The idea of subjective norms influencing behavior then leads into the idea of social influences moving to a larger cultural context of community (M. J. Dutta-Bergman, 2005).

In addition to the application of a culture-centered approach to uncovering the subjective norms that surround individual oral hygiene behaviors, it is also important to uncover the structural resources such as access to resources and constraints that may impede one from acting in a healthy way. This approach to the research is known as the structure-centered approach and it aims at targeting the social networks surrounding the individual. These social networks include the groups of people in their life (e.g., family, friends, co-workers, etc.) as well as the environments including infrastructures and
resources that aid to or serve as a barrier to positive oral health care (M. J. Dutta-Bergman, 2005). M. J. Dutta-Bergman (2005) explains that “structure defines, limits, shapes, and constrains the nature of communicative practices” (p. 114) and “structural resources and the access to such resources might be central to the development of an understanding of health communication in many Third World countries or resource-starved areas such as inner cities” (p. 109). These ideas apply well to the area for which this research study was conducted; South Africa is a developing country and the place of study in South Africa occurred within an inner-Metropolitan city. Using a structure-centered approach may help better understand the marginalized voices uncovered using the culture-centered approach (M. J. Dutta-Bergman, 2005). Identifying the significant interlinkages between economics and oral hygiene behaviors in South Africa, future oral health campaigns in this area may choose to offer skills training and educational sessions as well as free and reduced oral hygiene products and services as a way to target and reach their population all while utilizing the means of the area. Before these efforts can take place, more formative research is needed on the structural context of oral health and hygiene in South Africa. Research methods such as participant observation and focus groups are key methods in “deciphering and unraveling the meaning of structures that circulate within cultures” (M. J. Dutta-Bergman, 2005, p. 110). This approach to the research study, models that of Davenport Sypher and colleagues (2002). Their social constructionist-approach to the data “demanded an understanding of the local knowledge before conducting a meaningful, large-scale audience survey” (Davenport Sypher, et al., 2002, p. 202). Taking a qualitative stance to the formative research using focus groups to gather information about structure of the area and the socioeconomic inequalities that
play a part in shaping the oral health and oral health-related beliefs of South Africans. These efforts may aid in developing meaningful survey questions about structure and resources in South Africa related to oral health and hygiene; these questions could be added to OHBS in order to make a stronger evaluation of oral health-related beliefs.

The most effective way to treat oral health-related problems is through prevention (Broadbent et al., 2006). Oral health education for the adult South African population is needed to ensure that they are aware of the risks and the prevention of oral diseases (Coalition of National Health Education Organizations [CNHEO], 2001; USDHHS, 2000). Throughout interventions and health promotion programs, patient education is important for adoption of informed lifestyle choices among individuals (Alperin & Miner, 1993). Since the 1950s, public health workers have discussed the importance of individuals taking initiative in their own healthcare practices (Glanz, Rimer, & Lewis, 2002). Incorporating the assessment tool, OHBS, along with additional measures using the TRA/TPB (i.e., subjective norm) and structure that surrounds the culture and behavior into a study on oral hygiene may help provide a deeper understanding of the cultural beliefs surrounding South African’s oral health behaviors. This may pave the way for programs to help these individuals improve their oral hygiene and reduce their risks of oral health related problems through education by identifying South African’s oral health related knowledge, beliefs, and behaviors.

The guiding theory for this study was the HBM; the HBM is a well-established model that has been used by researchers since the 1950s and the U.S. Government since the 1970s (Hockbaum, 1954; Rosenstock, 1974). The HBM has been applied to a magnitude of health topics, including HIV/AIDS (Airhihenbuwa & Obregon, 2000), sun
behaviors (Hill et al., 2002; Wood, 2011), contraception (Larsson et al., 2004), influenza vaccination (Blue & Valley, 2002), and osteoporosis prevention (Schmieger et al., 2007). Additionally, the HBM has been applied to a magnitude of health topics in various African countries, including barriers to condom use in sub-Saharan Africa (Hounton, Carabin, & Henderson, 2005), East Africa (Volk & Koopman, 2001), South Africa (Ndiokwelu, 2004), and South Africa (Mashegoane et al., 2004). Since the HBM has been a useful model for predicting a variety of behaviors among many cultural contexts, there was no need to further test this model, thus a quantitative study deemed appropriate for the dissertation research presented above.

**Future campaign recommendations.**

Oral diseases are of high prevalence, severity, and public interest due to their impact on individuals and society, especially in South Africa (Hobdell, et al., 2004; Petersen, 2004). This study was innovative because it was the first of its kind to explore the oral health beliefs of South Africans; this study used the OHBS to understand their oral health behaviors and beliefs—efforts that move closer to predicting behaviors. Findings from this study serve as formative research that can inform future oral hygiene campaigns in South Africa by understanding what beliefs influence South Africans’ oral hygiene behaviors. Taking these findings and using them to implement future campaign work may serve as a platform to help increase the proportion of South Africans who enact positive oral hygiene behaviors such as brushing the teeth, flossing the teeth, and routine dental exams. Recommendations for future research suggest using focus groups to strengthen the language used to explain and describe oral hygiene behaviors assessed within the OHBS. Additionally, focus groups would be helpful in uncovering specific
cultural beliefs that surround each positive oral hygiene behavior. Knowing specific cultural beliefs, we can then better assess specific oral hygiene behaviors in the context of South African culture. These ideas align with the research by Chao and So (2011) who focused their Jade Ribon Campaign work around the results from their formative research efforts; these efforts aided in developing culturally specific and sensitive health campaigns (Liver Cancer and Hepatitis) for their target audience of Asian and Pacific Islanders. Their comprehensive approach to health campaigns utilized symbolism (e.g., Jade color which represents good luck and longevity and deflects negativity; Chinese characters symbolizing people), as well as ethnic preferences and sources of community and information, in order to design campaigns tailored to the target audience.

Using the data from this research study and information gleaned from focus groups studies, future campaign work in South Africa should focus on increasing the knowledge of positive oral hygiene behaviors. Past research studies have shown that knowledge influences beliefs and in turn can shape behavior (Hochbaum, 1954; Rosenstock, 1974). If campaigns focused on increasing the oral hygiene related knowledge of South Africans, this knowledge may in turn, influence beliefs. As such, stronger beliefs towards the benefits of positive oral hygiene behaviors has been shown to influence or predict behavior (Rimer & Glanz, 2005).

The HBM states that modifying factors, including knowledge of a behavior, may influence health perceptions (Champion & Skinner, 2008). The results of research presented in this paper showed a 32% gap in knowledge of positive oral hygiene behaviors. This statistic shows a clear need for health communication efforts to focus on the education and promotion of health behaviors. Snyder (2007) states that behavior
change is not feasible without knowledge change. He argues that future campaigns should focus on “knowledge, beliefs, and communication behaviors that are advocated in campaign messages, to further our understanding of the behavior change process” (p. S38). Petersen and colleagues (2008) add to this argument stating that “oral health-related behaviours are associated with… knowledge towards oral health care” (p. 82). Thus the research from Snyder and Petersen and colleagues supports my recommendations for future campaign works in South Africa to focus on using health education strategies to educate the population about healthy oral behaviors. Educational efforts should stress the knowledge of the behavior, specifically the “how to” the “when to” knowledge (Snyder, p. S37) and “why” knowledge in an effort to increase the likelihood of, as well as support the sustainable behavior change.

Educational efforts may include informative billboards or commercials that aim to increase the level of knowledge regarding the positive benefits of brushing, flossing, and going to the dentist. Social media could also be used to increase knowledge of oral hygiene by having health-related organizations (e.g., WHO, SADA, the South African Government, etc.) tweet or post on Facebook oral-health related facts. Followers of these organizations would then be updated with a news post that contained informative material. If the message is short and simple, the reader is more likely to read it; if the organization tweets or posts a link to an article, the reader may not be as likely to read and comprehend the message within the article. Overtime, campaign efforts that aim to uses short, specific messages through means of social media may aid in increasing one’s knowledge of oral hygiene. Furthermore, using the data presented in this study as a baseline, future campaign efforts that aid in increasing oral hygiene-related knowledge
can use this data as a way to evaluate their campaign work. In all, educational efforts that
aim to increase the knowledge of healthy oral hygiene behaviors may aid in improving
South Africans’ overall oral hygiene and in turn, reduce their risk of oral health-related
problems later in life.
References


_{Journal of Marketing, 66}(3), 1-17.


Byrne, B. M. (2010). *Structural equation modeling with AMOS: Basic concepts, applications, and programming* (2nd ed.). Ottawa, Ontario, Canada: Routledge.


Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model 
variables in predicting behavior. *Health Communication, 25*, 661-669. doi:
10.1080/10410236.2010.521906.


Rimer & K. Viswanath (Eds.), *Health behavior and health education: Theory, 

public awareness campaign to improve Asian and Pacific Islander health. *Journal 
of Communication in Healthcare, 4*, 46-55. doi: 10.1179/175380611X129500339-
90214.


*Language systems in South Africa and their parallels to the linguistic struggle of 
blacks in the U.S.* Retrieved September 2, 2012, from

http://www.stanford.edu/~jbaugh/saw/Tracy_Language_&_Ebonics.html


http://strategyleader.org/profiles/coloured.html


APPENDIX A: DEFINITION OF TERMS

The following list of defined oral health terms and concepts are used throughout the proposed study.

**Barriers:** Physical and psychological costs of the advised action or behavior (McKenzie, et al., 2005).

**Behavior:** Any action undertaken by an individual (McKenzie, et al.).

**Behavioral intention:** Individuals perceived likelihood of acting on a particular behavior (Glanz, Rimer, & Lewis, 2002).

**Beliefs:** A state of mind one has towards trust or confidence in someone or something (N. K. Janz, et al., 2002a; I. Rosenstock, Strecher, & Becker, 1988).

**Caries:** The loss of tooth mineral over time followed by bacterial invasion within the tooth (Caries, 2012).

**Chewing Stick:** Chewing sticks or *Miswak* is a common practice in the Asian and African countries. They are pencil-sized sticks from various plants including twigs from the *Salvadora persica* plant and branches from the Neem tree. These organic materials are chewed on one end until they become frayed like the end of a modern toothbrush. The brush-end of the stick is used to clean the teeth in a manner similar to the use of a toothbrush (Al Sadhan & Almas, 1999; Hooda, et al., 2010). The conventional meaning of chewing stick or Miswak is “stick used on teeth and gums to clean them” (Al Sadhan & Almas).

**Culture:** A learned system of meanings that promotes a particular sense of community and shared identity among a group of people; culture is a complex frame of reference.
which consists of patterns of beliefs, behaviors, norms, traditions, values, symbols, and meanings that are shared among a group or community (Ting-Toomey, 2005).

**Flossing:** Using a thin string made from nylon that is either waxed or un-waxed, and inserting it between the teeth to remove food debris and plaque (American Dental Association, 2012 [ADA]).

**Gingival Recession:** Exposure of the root of the tooth, resulting from a shift in the alignment of the gum tissue (ADA).

**Gingivitis:** The first stage of periodontal disease brought on by bacteria in dental plaque build-up in the teeth (ADA).

**Health Belief Model (HBM):** A health behavior stage theory that is used to motivate people towards better health decision making (N. K. Janz, et al.; I. Rosenstock, et al., 1988).

**Knowledge:** The amount of information or understanding one has subject manner (N. K. Janz, et al.; I. Rosenstock, et al., 1988).

**Mandibular Labrette:** Lip piercing (Kapferer, Benesch, Gregoric, Ulm, & Heienz, 2007).

**Oral Health:** Being free of chronic mouth and facial pain, cancer (e.g., oral and throat), oral sores, birth defects (e.g., cleft lip and palate), periodontal disease (i.e., gum disease), tooth decay and tooth loss, as well as other diseases and disorders that may affect the mouth and oral cavity (WHO, 2011).

**Oral Hygiene:** The process of keeping a clean and healthy mouth (ADA).

**Oral Piercings:** Punctured tissue in the oral cavity as a form individual decorative design (Kapferer, et al.).
**Periodontal Disease:** Bacterial infection involving bone loss around the teeth and gum area (ADA).

**Peri-Oral:** Refers to tissues of or around the mouth (ADA).

**Reliability:** The consistency of a series of measurements (McKenzie, et al.).

**Self-efficacy:** Confidence in one’s ability to take actions and overcome barriers (N. K. Janz, et al.; I. Rosenstock, et al., 1988).

**Toothpick:** A slender piece of wood with pointed ends used to remove particles of food debris lodged between the teeth (Toothpick, 2012).

**Uvula:** The fleshy extensions of the soft palate in the mouth which hangs above the tongue at the entrance to the throat (Kapferer, et al.).

**Validity:** Measure used to critic the quality of instrumentation (McKenzie, et al.).

**Ventral Mucosa:** Mucous membrane which lines the front of the body cavity particularly the oral cavity (Kapferer, et al.).