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Sarah R. Beddow  
*Bethel University*

Chelsea V. Domeier  
*Bethel University*

Karien Wilson  
*Bethel University*

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THE KNOWLEDGE AND ATTITUDE OF BETHEL'S UNDERGRADUATE POPULATION  
ON SUN PROTECTIVE BEHAVIORS

A MASTER'S PROJECT SUBMITTED TO THE GRADUATE FACULTY  
GRADUATE SCHOOL BETHEL UNIVERSITY

BY

SARAH R. BEDDOW, PA-S

CHELSEA V. DOMEIER, PA-S

KARIEN WILSON, PA-S

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF  
MASTERS OF SCIENCE IN PHYSICIAN ASSISTANT

JUNE 2016

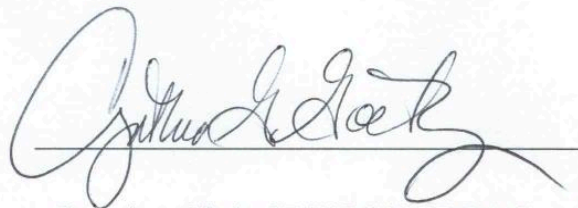
BETHEL UNIVERSITY

THE KNOWLEDGE AND ATTITUDE OF THE BETHEL'S UNDERGRADUATE  
POPULATION ON SUN PROTECTIVE BEHAVIORS

SARAH R. BEDDOW, CHELSEA V. DOMEIER, KARIEN WILSON

JUNE 2016

GRADUATE RESEARCH APPROVAL:



Committee Chair: CINDY GOETZ, PA-C



Committee Member: LISA NASER, PA-C

## ABSTRACT

**OBJECTIVES:** To compare the attitude and knowledge of health science majors versus non-health science majors of the Bethel University undergraduate population.

**BACKGROUND:** Despite public education about the use of sunscreen and skin cancer protection, researchers are still finding a gap in public knowledge. Sun exposure education is crucial and must happen during childhood and adolescence because these are the times people receive the most UV exposure. Repeat sunburns during childhood can double an individual's risk of developing melanoma in adulthood.

**METHODS:** This was a pre-experimental design single evaluation via a survey. The following research questions were investigated in our research project: how educated is the Bethel University undergraduate population on using sunscreen as skin cancer prevention and what are their sun protective behaviors?

**RESULTS:** We surveyed 212 Bethel University undergraduate students to determine their knowledge and behaviors regarding skin cancer risk factors, prevention, and sunscreen usage. When comparing “Knowledge Questions,” it was found that there is no statistical significance regarding sun protective behaviors when comparing health science majors with non-health science majors based on the average scores.

**CONCLUSION:** The study investigated the research question regarding the education of Bethel University undergraduate students on skin cancer prevention as well as their sun protective behaviors. The study found there is not statistical significance between the sun protective knowledge and behaviors when comparing health science and non-health science majors. Results are consistent with previous studies on this topic.

## ACKNOWLEDGEMENTS

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## TABLE OF CONTENTS

	PAGE
ABSTRACT.....	3
ACKNOWLEDGEMENTS.....	4
TABLE OF CONTENTS.....	5
LIST OF TABLES.....	8
LIST OF FIGURES.....	9
LIST OF APPENDICES.....	10
CHAPTERS	
1. INTRODUCTION	
Background.....	11
Statement of Problem.....	14
Purpose of Study.....	15
Significance of the Problem.....	15
Research Question.....	15
Definitions.....	16
2. LITERATURE REVIEW	
Introduction.....	17
Knowledge about Sunscreen.....	18
Proper Technique for Application of Sunscreen.....	19
The Population's Knowledge and Attitude on Sun Protective Behaviors.....	19

Inclusive Studies on the Topic.....	24
Effective Media Campaigns of Sun Protective Measures.....	27
Conclusion and Knowledge Gap.....	28

### 3. METHODOLOGY

Study Design.....	30
Population.....	30
Data Instrumentation.....	31
Validity and Reliability.....	32
Data Storage.....	32
Data Analysis.....	33
Limitations/Delimitations.....	33

### 4. RESULTS/DATA ANALYSIS

Analysis of Student Demographics.....	33
Analysis of “Knowledge Questions”.....	34
Non-Health Science Major vs. Health Science Major Students.....	37
Female Non-Health Science Major vs. Female Health Science Major Students.....	37
Male Non-Health Science Major vs. Male Health Science Major Students.....	38
All Female vs. All Male Students.....	38
Female Non-Health Science Major vs. Male Non-Health Science Major Students.....	38
Female Health Science Major vs. Male Health Science Major Students.....	38

## Pre-Health Emphasis vs. No Emphasis Within the Health Science Major

Students.....38

Analysis of the “Behavior Question”.....38

### 5. DISCUSSION & CONCLUSION

Summary.....46

Limitations.....48

Further Research.....48

Conclusion.....50

REFERENCES.....52



**LIST OF TABLES**

TABLE 1.....	33
Demographics of the 212 Bethel University undergraduate students surveyed	
TABLE 2.....	46
Percentage of students reporting to not wear sunscreen	

## LIST OF FIGURES

FIGURE 1.....	35
Responses from “Knowledge Questions” section of the Bethel University undergraduate student survey	
FIGURE 2.....	37
Responses from “Knowledge Questions” section of the Bethel University undergraduate student survey broken down by major and gender	
FIGURE 3.....	39
Question 1 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 4.....	40
Question 2 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 5.....	41
Question 3 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 6.....	42
Question 4 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 7.....	43
Question 5 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 8.....	44
Question 6 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	
FIGURE 9.....	45
Question 7 responses from “Behavior Questions” section of the Bethel University undergraduate student survey	

**LIST OF APPENDICES**

APPENDIX A: Permission to Conduct Survey.....	55
APPENDIX B: Informed Consent.....	57
APPENDIX C: Survey Tool.....	59
APPENDIX D: Bethel University IRB Approval .....	64

## Chapter 1: Introduction

The intent of chapter one is to introduce the background and purpose of the research study. The purpose of this study is to determine the level of understanding of Bethel University's undergraduate population on skin cancer risk factors, skin cancer prevention, and the efficiency of sunscreen use. The chapter includes: background information of the problem, purpose of the study, significance of the problem, and research question.

### Background

Skin cancer is the most commonly diagnosed cancer in the Western world (American Cancer Society, 2014). According to the American Cancer Society, over 3.5 million Americans are diagnosed with basal cell and squamous cell skin cancer per year, along with 76,000 new diagnoses of the more serious skin cancer, melanoma (American Cancer Society, 2014). Of the basal and squamous cell carcinomas, keratinocyte skin cancer is the most commonly occurring cancer among the white population and has the most serious health risks (Neale, William, & Green, 2002). Keratinocyte cancers are mainly caused by UV radiation and continued sun exposure. In adults, this contributes to keratinocytic cells progressing to neoplasia (Neale et al., 2002).

Ultraviolet (UV) radiation from the sun leads to sunburn and photoaging. The UV spectrum extends from 290 nm to 400 nm. The UV spectrum can be broken down into more detailed categories of ultraviolet A I (UVA I) (340 to 400 nm), ultraviolet A II (UVA II) (320 to 340 nm), and UVB (290 to 320 nm) (Wang, Stanfield, & Osterwalder, 2008). The UV radiation of concern is ultraviolet A (UVA), which does not filter through the ozone layer and, therefore, accounts for about 95% of the UV radiation that reaches the earth's surface (Wang et al., 2008). Ultraviolet A radiation is not dependent on the weather and stays constant, despite cloudy

weather condition or differing angles of the sun. Ultraviolet A has a much longer wavelength than UVB and is able to penetrate the skin deeper, reaching the basal surface of skin and causing damage to growing cells. Ultraviolet A's interaction with cells eventually leads to the initiation of skin cancer (Wang et al., 2008).

Despite common strategies to protect against UV exposure, such as sunscreen, protective clothing, and avoiding the sun, the public's knowledge about UV radiation is limited and people assume that sunscreen will provide full UV coverage based on the SPF value. Sun protection factor (SPF) is most commonly displayed on sunscreen bottles as a measurement of the protection against sunburn. Sunburn is the body's response to UVA II and UVB rays (Wang et al., 2008).

Most non-melanoma skin cancers are caused by cumulative, long-term UV skin exposure which can easily be prevented by use of sunscreen, avoidance of tanning beds, and personal behavior changes including: usage of natural shade, usage of protective clothing and hats, and minimization of sun exposure between 10:00am-3:00pm (Koh, 1995). Sun exposure education is crucial and must happen during childhood and adolescence because these are the times people receive the most UV exposure (Koh, 1995). Sunburn in childhood can double an individual's risk of developing melanoma in adulthood (Day, Wilson, Hutchinson, & Roberts, 2014a). However, many factors have an influence on whether individuals use sunscreen for skin cancer protection. Understanding not only the science behind sunscreen recommendations but also the different psychological influences that impact people's decision making to use or not to use sunscreen is important as well.

Through the subsequent years, UV exposure has been on the rise with adolescents' desire to obtain a tanned appearance (Day et al., 2014a). Adolescent attitude toward protection against

UV radiation is a problem when a person's priority is the instant gratification of a tanned appearance with little thought to skin damage effects later in life (Blashill, Williams, Grogan, & Clark-Carter, 2014). The practice of tanning in young men and women comes from a societal belief that a tanned appearance is leaner and more attractive (Blashill et al., 2014). A negative appearance perception can increase the desire to be tan, thereby, decreasing the use of sunscreen and putting those subjects at an increased risk of skin cancers (Blashill et al., 2014). With skin cancer rates increasing throughout the years, education has increased regarding the damage from UV rays. However, even with the increase in education, little improvement exists in compliance for decreasing sun exposure and the usage of proper protection during sun exposure (Felts, Burkke, Vali-Smith, & Whetstone, 2010). Despite data supporting an increased awareness of skin damage from UV ray exposure, there is little change in behaviors of the high-risk group of adolescents (Felts et al., 2010).

Sunscreen compliance decreases because people find sunscreen greasy, inconvenient, and often has skin irritant side effects (Teramura et al., 2014). Thickness of application plays a major factor in a sunscreen's greasy feeling (Teramura et al., 2014). The thickness of sunscreen used in determining the product's SPF factor and its efficiency is  $2.0 \text{ mg/cm}^2$  (Teramura et al., 2014). However, one study showed that the majority of people use half or less than half of the recommended amount, thereby decreasing the effectiveness of the product against UV radiation (Teramura et al., 2014). When applying sunscreen, the guidelines recommend to double the amount originally applied in order to achieve maximal and expected SPF efficacy (Teramura et al., 2014). Unwanted application side effects of sunscreen can make it an unpopular choice of sun protection, especially for young adults.

Potential toxicities of some sunscreens available to consumers (inorganic and organic products) may also be a deterrent for many people in choosing to use them (Maier & Korting, 2005). Inorganic products commonly contain zinc oxide and titanium dioxide. Their disadvantages include their white visual appearance on skin and a thicker consistency (Maier & Korting, 2005). However, they are more advantageous than organic products due to their stability, broad-spectrum protection, and low toxicity (Maier & Korting, 2005). Organic products commonly contain oxybenzone and, while they do not have a negative appearance upon application, they do display higher toxicity (Maier & Korting, 2005). Highlights of the unwanted toxicities caused by sunscreens frequent social media and news websites and create a confusing assortment of information for consumers to consider (Maier & Korting, 2005).

Despite public education about the use of sunscreen and skin cancer protection, researchers are still finding a gap in public knowledge (Wang & Dusza, 2009). The general public has a superficial understanding about sunscreen, but lack a deeper knowledge, especially when regarding the differences between SPF and UVA claims on sunscreen bottles. Individuals that lack sunscreen knowledge might be less motivated to practice sunscreen usage. Furthermore, individuals who are motivated and actively using sunscreen, but lack knowledge, might be using their sunscreen inappropriately. By providing the public with accurate, in depth knowledge and information about sunscreen, behavioral patterns might change (Wang & Dusza, 2009). Further research is needed in assessing the public's gap in knowledge in order to provide the appropriate information.

### **Statement of Problem**

As awareness of risk factors for skin cancer increase, there is not a correlated change with usage of sunscreen and other UV protection measures. Examining why there is not an increase of

sunscreen compliance in the adolescent population is important in order to change educational methods for this population.

### **Purpose of the Study**

The main purpose of this study is to examine the Bethel University undergraduate population attitude on application of sunscreen usage, compliance of sunscreen use, and timing of usage in order to determine if different educational methods need to be reformed and implicated for the young adult population.

### **Significance of the Problem**

Skin cancer not only provides a significant problem in the health of individuals but it is also an economic problem as well. Melanoma costs the U.S. economy \$8 billion per year (Federman, Kisner, Viola, 2013). This amount does not include the value of life lost from melanoma to society, estimated to cost \$15.1 billion per year (Federman et al., 2013). This is a total of \$23.1 billion annually. Many of these costs could be prevented by proper skin protection as adolescents (Federman et al., 2013). Not only is there a financial burden of skin cancer, a personal loss exists, as well. Skin cancer takes an emotional and physical toll on the patients and their family members. Efficient education of sunscreen and other sun protective behaviors is needed to alleviate much of the financial and societal burdens of skin cancer.

### **Research Question**

The following research question will be investigated: how educated is the Bethel University undergraduate population on using sunscreen as skin cancer prevention and what are their sun protective behaviors? We want to determine this population's level of knowledge regarding: recommended sunscreen use, skin cancer risk, and SPF levels. We will attempt to answer: does this specific population use sunscreen, and if they do, what level do they use; which



factors contribute to the level of SPF used; under what activities and timing requirements does the population use sunscreen; and if the population practices tanning. We will also obtain demographic information to determine each participant's age, gender, race/ethnicity, tendency to tan, and personal/family skin cancer history.

### **Definitions**

Ultraviolet (UV) radiation – radiation from the sun that leads to sunburn and photoaging (Wang et al., 2008).

Ultraviolet (UV) spectrum – extends from 290 nm to 400 nm (Wang et al., 2008).

Ultraviolet A (UVA) – extends from 340 nm to 400 nm. Not filtered through the ozone layer and accounts for 95% of the UV radiation that reaches the earth's surface (Wang et al., 2008). UVA has a much longer wavelength and penetrates the skin deeper, reaching basal surfaces of the skin and causes damage to growing cells (Wang et al., 2008). Not required on sunscreen labels in the United States (Wang et al., 2008).

Ultraviolet B (UVB) – extends from 290 nm to 320 nm (Wang et al., 2008). Ultraviolet B rays causes sunburn (Wang et al., 2008).

Sunscreen – topical lotion designed to block and absorb UV radiation (Wang & Dusza, 2009). Sunscreen has the potential to decrease risk for cancer and interruption photoaging (Wang & Dusza, 2009).

Sun protection factor (SPF) – displayed on sunscreen bottles as a measurement of the protection against sunburn (Wang et al., 2008).

Organic sunscreen products – contain oxybenzone and do not have a negative appearance upon application, but they display higher toxicity (Maier & Korting, 2005).

Inorganic sunscreen products – contain zinc oxide and titanium dioxide. Their disadvantages include their visual appearance on skin and a thicker consistency (Maier & Korting, 2005).

Keratinocyte cancers – mainly caused by UV radiation and continued sun exposure (Neale et al., 2002). Contributes to keratinocytic cells progressing to neoplasia (Neale et al., 2002).

Nonmelanoma skin cancers – caused by cumulative, long-term UV skin exposure which can be prevented by use of sunscreen, avoidance of tanning beds, and personal behavior changes including: usage of natural shade, protective clothing and hats, and minimization (Koh, 1995).

Sun Protective Behaviors: These behaviors include: avoiding intense midday sun (10 a.m.-4 p.m.) wearing tightly woven protective clothing when exposed to the sun, applying a broad spectrum high sun protective factor (SPF) sunscreen, and avoiding artificial sources of UV light including tanning booths and sun lamps (Cottrell, McClamroch & Bernard, 2005).

## **Chapter 2: Literature Review**

### **Introduction**

The purpose of this chapter is to summarize the current relevant literature related to this study about knowledge, behaviors, and attitudes of sun protective behaviors. The main intention of this research project is to examine the knowledge and behaviors of Bethel's undergraduate population on sun protective behaviors while comparing health science majors' attitudes with non-health science oriented majors. The chapter includes: general knowledge about sunscreen, proper technique for applications of sunscreen, people's knowledge and attitudes on sun protective behaviors, media campaigns on sun protective behaviors, inclusive studies on the topic, and conclusion and knowledge gap.

## Knowledge about Sunscreen

Sunscreen is an important defense against ultraviolet (UV) radiation from the sun. Overexposure to UV radiation can lead to sunburn, early signs of aging, and skin cancer. When people use sunscreen, it is generally assumed that there will be protection from the entire UV spectrum that extends from 290 – 400 nm (Wang, Stanfield, & Osterwalder, 2008). Unfortunately, sunscreen bottles in the United States only display sun protection factor (SPF) on the label and not the UV spectrum protection it offers (Wang et al., 2008).

Sun protection factor (SPF) is a measurement of the protection sunscreen offers against sunburn, caused by ultraviolet A II (UVA II) radiation (320 – 340 nm) and ultraviolet B (UVB) radiation (290 – 320 nm). There is, however, no indication about the amount of ultraviolet I (UVA I) radiation (340 – 400 nm) protection that sunscreen offers (Wang et al., 2008). Ultraviolet A rays have a deeper penetration into the skin than UVB. Ultraviolet A rays penetrate deep in the basal layer, damage proliferating cells, and, as a result, cause skin cancer (Wang et al., 2008).

In a study examining thirteen United States sunscreen products, researchers found that eight of the 13 provided medium protection against UV radiation, while only five products offered high protection, which includes UVA protection (Wang et al., 2008). Based on this study results, there is still much room for improvement in the sunscreen industry when it comes to UVA protection in sunscreen (Wang et al., 2008). Studies, discussed below, have also found a large public knowledge gap regarding photoreceptor factors, UVA versus UVB radiation, and SPF levels. Providing the public with adequate knowledge regarding UV radiation and SPF levels may help change behavior patterns regarding sunscreen usage.

### **Proper Technique for Application of Sunscreen**

The thickness of sunscreen used in determining a product's SPF factor and its efficiency is  $2.0 \text{ mg/cm}^2$ . One study has shown that most consumers are not aware of the recommended amount and, therefore, apply sunscreen in insufficient amounts (Teramura et al., 2012).

Decreased application thereby decreases the effectiveness of the product against UV radiation, sunburn, and skin cancer. The study conducted by Teramura et al. examined to which extent do three different thickness applications ( $2.0$ ,  $1.0$ , and  $0.5 \text{ mg/cm}^2$ ) of an SPF 50 sunscreen affect the actual rated SPF value. The study used 23 subjects ranging in age from 26-53. Results demonstrated that the subjects' average thickness applied was a little over  $1.0 \text{ mg/cm}^2$  (Teramura et al., 2012). While the subjects' application thicknesses varied, not one subject applied the sunscreen at the recommended thickness of  $2.0 \text{ mg/cm}^2$  (Teramura et al., 2012). The study concludes that when applying sunscreen, consumers should use double the amount they originally think is required in order to achieve maximal and expected SPF efficacy (Teramura et al., 2012). A similar study conducted by Azurdia et al. evaluated the application thickness in certain high exposure areas of skin and concluded similar results. The average thickness used was  $0.5 \text{ mg/cm}^2$  and was even less in the prominently exposed sites: posterior neck, lateral neck, temples and ears (Azurdia et al., 1999). Without proper application of sunscreen, consumers are at an increased risk for sun related malignancy, especially since sunscreen usage is a major method of sun-protection.

### **The Population's Knowledge and Attitudes on Sun Protective Behaviors**

Several studies have looked into the public's perception of the risks regarding sun exposure, especially in the college-age population. This adolescent age is targeted because skin cancer is a health concern of the distant future, which leads the younger population to be less

motivated to protect themselves (Felts et al., 2010). The majority of the population receives most of their lifetime sun exposure before the age of 21 and do not recognize the consequences of unprotected sun exposure until decades later (Cottrell et al., 2005). The knowledge of the importance of sun protective behaviors increased throughout the years but this knowledge has not been sufficient enough to change adolescents' behaviors (Felts, 2010).

As stated previously in chapter one, sunscreen usage is one of the important sun protective behaviors to prevent the development of melanoma. Studies have been completed to assess the public's behavior pattern regarding sunscreen use and the public's knowledge regarding sunscreen, but results still remain inconsistent between studies. In order to assess the public's knowledge regarding sunscreen and factors associated with sunscreen purchases, a survey regarding sunscreen knowledge was handed out to 423 individuals attending health seminars in New Jersey (Wang & Dusza, 2009). The survey investigated behavioral patterns and how those behavioral patterns were influenced by knowledge. It was hypothesized that if people have more knowledge, they will be more inclined to use sunscreen compared to those who lack knowledge (Wang & Dusza, 2009).

The survey was composed of twenty-two questions, which were divided into three different sections. The first section focused on basic demographic information such as age, sex, ethnicity, and any history of skin cancer. The second section contained questions relating to sunscreen knowledge, while the third section focused on sunscreen purchasing factors (Wang & Dusza, 2009). Sunscreen knowledge questions focused on determining general knowledge regarding sunscreen and how it relates to sunburn prevention, tanning, skin cancer prevention, signs of aging prevention, how often it should be applied, and how much should be applied (Wang & Dusza, 2009). Sunscreen purchasing factors examined features that influence people

to buy certain sunscreens compared to others such as brand, cost, and labels on sunscreen bottles. The twelve questions regarding sunscreen knowledge were quantified with a value of one for a correct response and zero for an incorrect response (Wang & Dusza, 2009). The values quantified a person's sunscreen knowledge on a scale of 1 to 12. Sunscreen knowledge with higher scores indicated a higher level of knowledge regarding sunscreen (Wang & Dusza, 2009).

The results of the study showed that the majority of people (80.6%) claim to use sunscreen on a regular basis (Wang & Dusza, 2009). Most people were aware that sunscreen should be used to prevent sunburn, but very few people (9%) knew that Ultraviolet B rays are responsible for sunburn (Wang & Dusza, 2009). When assessing the public's knowledge regarding sunscreen application, the study found that 32% of respondents were aware of the requirement to apply sunscreen 30 minutes before sun exposure (Wang & Dusza, 2009). When asked about the amount of sunscreen that should be applied, only 18% of the respondents understood that it takes approximately 1 ounce to cover the body (Wang & Dusza, 2009). The average score for the respondent's knowledge was a 4.9 out of 12 and a lack of knowledge was seen with sunscreen application and photoreceptor knowledge (Wang & Dusza, 2009).

In order to understand the reasons for low sunscreen usage compliance, the study found that the public still does not possess the appropriate knowledge and understanding regarding photoprotection and application (Wang & Dusza, 2009). The lack of knowledge, leads to a lack of motivation for people to change their behavior. It is important to educate the public to help prevent sunburn, skin cancer, and early signs of aging by having more people apply sunscreen routinely (Wang & Dusza, 2009). By providing the public with accurate, in depth knowledge and information about sunscreen, behavioral patterns might change and people might start applying sunscreen routinely (Wang & Dusza, 2009).

In a separate longitudinal study of the knowledge, attitudes and perception of risks regarding intentional sun exposure, participants were enrolled in a required personal health course at a large United States southwestern university during the fall semesters of 1990 and 2007 (Felts et al., 2010). The study focused on the Caucasian population due to the incidence of skin cancer increasing with proximity to the equator (Felts et al., 2010). The college-aged group was selected based on the following factors: 18-29 year olds are more likely to report higher incidence of sun exposure and more frequent sunburns; the age group is less likely to wear sunscreen; college students are more available to spend time in the sun between 10 a.m. and 3 p.m. compared with working adults; and populations in southern latitudes are more likely to develop skin cancer compared to adults in other geographical locations further away from the equator (Felts et al., 2010).

Felts et al.'s intended to determine if national skin cancer prevention campaigns post-1990 had been successful in increasing the awareness of harmful effects of sun exposure for the general population, especially for the young adult age group (Felts et al., 2010). Some programs initiated after the 1990 survey included: the CDC's "Choose Your Cover," the American Academy of Dermatology's "Be Sun Smart," the Weather Channel's "Rays Awareness," and the Women's Dermatologic Society's Community Outreach's "Families Play Safe in the Sun" campaigns (Felts et al., 2010). Felts specified there was no research to support the effectiveness of these programs and did not suggest these campaigns directly impacted the population's behaviors. However, these campaigns may influence the knowledge of sun prevention guidelines (Felts et al., 2010).

The research was conducted by a survey referenced as a 44-item "Sun and Skin Inventory" which included a knowledge scale, skin cancer risk assessment items, an attitude

scale, and items pertaining to sunbathing and sunscreen use behaviors (Felts et al., 2010). Felts analyzed the study from a variety of comparisons. The study concluded that the 2007 participants' knowledge of sun exposure was not significantly higher compared to the 1990 participants' knowledge. Therefore, national skin cancer campaigns, local skin cancer prevention programs, and campus wellness initiatives were not effective in changing the students' knowledge of the harmful effects of excessive and intentional sun exposure or change high risk skin cancer behaviors (Felts et al., 2010). The study also indicated the knowledge of the harmful effects of sunbathing does not correlate with living a low risk lifestyle (Felts et al., 2010). In fact, people who sunbathed generally had a higher knowledge of the harmful effects of sun exposure compared to the general group surveyed. In the 2007 survey, participants reported less positive attitudes toward tanned skin compared to the 1990 survey participants. However the people surveyed in 2007 stated they enjoyed sunbathing more compared to the people surveyed in 1990 (Felts et al., 2010). Felts concluded nearly twenty years of skin cancer intervention programs were ineffective and different methods need to be implemented in order to make a difference (Felts et al., 2010).

Another study focused on examining if a significant difference existed between melanoma knowledge and sun protective attitudes and behaviors by gender and skin type (Cottrell et al., 2005). The study was directed at undergraduate students ages 18-24 years old and enrolled at a large Midwestern University. Overall, the student population had low sunscreen compliance, low knowledge on sun protection behaviors, and possessed neither strongly positive nor strongly negative attitudes toward sun protection behaviors in general (Cottrell et al., 2005).

To see if a difference existed among the different skin types, the students classified themselves by the following skin types categories modified from the American Academy of



Dermatology. Skin type I (Fair) was classified as blonde or red hair, blue eyes, pale skin, and burn easily. Skin type II (Medium) was classified as brown or black hair, blue or brown eyes will burn if not careful, and gradually tans to light brown. Skin type III (Dark) was brown or black hair, brown eyes, dark skin, and rarely burns (Cottrell et al., 2005). Cottrell et al showed students with fair skin were more knowledgeable, had more appropriate attitudes, and practiced more general sun protective behaviors including sunscreen use compared to medium to dark skin types (Cottrell, 2005). The study also found the female students were more knowledgeable about sun protective behaviors and were better users of sunscreen compared to male students (Cottrell, 2005). However, no difference between the genders was found when examining attitudes and practice of sun protective behaviors (Cottrell, 2005).

Another study documented the differences between genders and their use of sunscreen in young adults (Abroms, Jorgensen, Southwell, Geller, & Emmons, 2003). The study conducted focus-groups with male and female young adults between the ages of 18-25 in three large United States cities. Overall, males were found to have reactive behaviors in using sunscreen, while females used sunscreen proactively and preventatively (Abroms et al., 2003). Young adult males were more likely to only use sunscreen during an extended period of time spent in the sun, and disliked the textural and fragrant properties of sunscreen (Abroms et al., 2003). On the other hand, females integrated sunscreen use into their daily makeup routines, were positively influenced by parental encouragement to use sunscreen, and were appealed to the anti-aging properties of sunscreen (Abroms et al., 2003).

### **Inclusive Studies on the Topic**

Knowledge can predict people's behavior patterns and well as provide insight regarding changes in behavior patterns (Day, Wilson, Roberts, & Hutchinson, 2014b). In an effort to

accurately measure the knowledge that college students possess regarding sunscreen and their sun-related behavior, a psychometric study was created with the Skin Cancer and Sun Knowledge (SCSK) scale, a new measurement of skin cancer knowledge (Day et al., 2014b). Sun protection, such as sunscreen, can help prevent most cases of skin cancer, yet there are still reports of people inaccurately using sunscreen or failing to use it completely (Day et al., 2014b).

Due to varying perspectives among researchers regarding the assessment of skin cancer knowledge and the influence it has on improvement of sun related behaviors, researchers created the SCSK scale (Day et al., 2014b). The SCSK scale is a comprehensive 25 item measurement of skin cancer and sun health knowledge, specifically aimed at young adults with a Western World background. Researchers intended to test the knowledge of skin cancer and how it is associated with the three sun related behaviors that include “sun protective behavior, sun exposure, and outdoor tanning” (Day et al., 2014b, p. 440).

The study was conducted with 514 undergraduate students between the ages of 18 and 26 and focused on four broad categories of skin cancer knowledge including “sun protection, skin cancer risk factors, prevalence of skin cancer, and signs of skin cancer” (Day et al., 2014b, p. 441). Demographic information from respondents were also obtained and the results were separated based on respondent’s sex. The nine item Knowledge of Sun Protection Methods (KSPM) was also incorporated into the study in order to assess knowledge of the different sun protective methods available (Day et al., 2014b). Another nine item measurement, Sun Protection Behavior Scale (SPBS), was used assess sun protection behavior when participants spent more than 15 minutes outside (Day et al., 2014b).

The study found that in young adult females, association between the three sun-related behaviors and knowledge regarding skin cancer is present (Day et al., 2014b). The study also

found that there was no association with sun-related behaviors and young adult males, due to their lack of outdoor tanning behaviors (Day et al., 2014b). Similar to other studies, Day et al. revealed that a higher understanding of skin cancer knowledge is associated with decreased sun exposure. Future research, however, is still needed to understand the relationships that influence sun-related behaviors despite people possessing skin cancer knowledge (Day et al., 2014b).

As with many topics in medicine, changing human behavior towards more healthful living is difficult to do. Public health campaigns exist to attempt to do just this. Their goal is to educate people at risk, foster desire for healthy living, and be a main source for change (Day et al., 2014a). Standardized literature reviews are a great tool to evaluate the public health campaigns effect on skin cancer. A systematic literature review conducted by Day et al. looked at the results of 34 studies reporting original data that assessed the relationship between skin cancer knowledge and sun-related behaviors. The select 34 studies were chosen from thousands found because they evaluated skin cancer knowledge specifically. Day et al. states that it is important to evaluate the relationships between skin cancer knowledge and sun protective behaviors during all developmental stages as it allows researchers to predict and minimize skin cancer incidence (Day et al., 2014a). The literature review documented that measurements and results of common behaviors, such as sun protection, sun exposure, and sun tanning varied (Day et al., 2014a). Results were mixed between studies that proved statistical significance between subjects' skin cancer knowledge and their sun-protective behaviors (Day et al., 2014a).

A second literature review published by Keeney et al. in 2009 analyzed a more extensive collection of studies that investigated the two topics separately: sun-protective behaviors, and skin cancer knowledge and attitudes. The review concluded that while there is a considerable amount of literature on the subjects, results are still inconsistent (Keeney et al., 2009). Several

studies show that there is evidence consumers are educated and knowledgeable about the skin cancer preventing properties of sunscreen, but the knowledge does not correlate and translate to positive sun-protective behaviors and sunscreen use (Keeney et al., 2009). Finally, the review identified a distinction between age groupings and different cultures in their knowledge and attitudes towards sunscreen (Keeney et al., 2009). These results are indicative that there is importance to studying both cultures and age groups separately to design campaigns and educational programs that are tailored to specific audiences.

### **Effective Media Campaigns on Sun Protective Measures**

The Australian government has completed significant research on the effectiveness of different types of campaigns, including television, radio and print media. The New Wales South (NWS) Health, an agency of New Wales South government, partnered with The Cancer Council to form a comprehensive prevention program that combats the rise of skin cancer (NSW Department, 2001). These two organizations wanted to create a program that included the following components: “policy direction and commitment to action, resources committed over time, information provided by regular monitoring and surveillance, a system for program delivery at State, Area and regional levels, research to guide interventions, evaluation to assess progress, and a skilled workforce” (NSW Department, 2001, p. 22). The government initiative was to implement effective education and awareness campaigns in a school program setting. For example, a government policy mandated students must bring SPF 30 sunscreen and hats to school when outdoor activities were scheduled (Felts et al., 2010). Other aspects of the initiative included education and resources on sunscreen application, proper UV protective clothing, marketing campaigns with free sunscreen, and avoiding high risk sun exposure behaviors (Felts et al., 2010). In order to implement these changes, government and public support was needed.

Several years after the start of the NSW Health initiative against sun exposure, a survey was conducted to see if the campaigns using television, radio, and print media were successful in lowering the of high risk sun exposure behaviors of Australians. The study focused on the sun protection methods of children under 12 years by focusing on the practices of these children's parents (Smith et al., 2002). The surveys were conducted over three consecutive summers following major sun protection campaigns from the NSW Health Department in partnership with the NSW Cancer Council (Smith et al., 2002). The surveys found that use of sunscreen, protective clothing, and shade increased following each of the mass media campaigns. However, there was a decline of sun protection behaviors after the campaign concluded, as participants reverted to the same behaviors before the campaign (Smith et al., 2002). Therefore, these surveys documented that the campaigns had a short-term effect on sun exposure behaviors and that repeated campaigns may be crucial to maintain behavior changes (Smith et al. 2002).

### **Conclusion and Knowledge Gap**

In future studies, researchers need to continue to include skin cancer knowledge as a measurement when assessing predictors of sun-related behaviors. The additional studies will allow for future assessment of any changes in the strength of the association between the two influences. Factors that impact adolescent sun behaviors, especially the decline in protection, should be focused on (Day et al., 2014a). Additionally, standardized, multi-item measures for variables are necessary to provide estimation for quantifying results and comparing to other studies. Single behaviors should not be measured alone, as it does not allow for comparisons. Young adulthood is a period when considerable skin damage can occur, yet also a period when healthy behaviors are most likely to change (Abroms et al. 2003). Therefore, it is vital to focus

on the behaviors in transition influenced by appearance, peers, media, and family that not only affect their own health, but that of their future children as well (Day et al., 2014a).

As mentioned earlier in the chapter, many studies have analyzed the knowledge, attitudes, and sun protective behaviors of college students and adolescents. In Cottrell's study, they provided a statistical analysis of the melanoma knowledge and sun protection attitudes and behaviors among students by gender and skin type. However, the study looked at a cross sectional population of undergraduate by having the participants come from required English and social studies classes and did not analyse the participants' college majors (Cottreel et al., 2005).

In the following chapters, the research project will address if a significant difference of sun protective behaviors exists between young adults in health science college majors versus non-health science majors. No previous studies have been conducted that consider the difference in behavior and attitude between the healthcare oriented and non-healthcare oriented college student populations. The study will explore whether or not there is a possible significant difference between these two groups due to their education and lifestyle. Healthcare oriented students may be more receptive to and conscious towards practicing sun protective behaviors due to their interest and knowledge in healthcare.

### **Chapter 3: Methodology**

The intent of chapter three is to introduce the study design of the research study. The purpose of this study was to determine the level of understanding of Bethel University's undergraduate population on skin cancer risk factors, skin cancer prevention, and the efficiency of sunscreen use. The intention of this chapter is to outline the methods used to conduct this research project. This chapter includes study design, population, data instrumentation, validity and reliability, data storage, data analysis, and limitations/delimitations.

## **Study Design**

This was a pre-experimental design with a single evaluation via a survey. The following research questions were investigated in our research project: How educated is the Bethel University undergraduate population on using sunscreen as skin cancer prevention and what are their sun protective behaviors? Eight knowledge questions were asked regarding recommended sunscreen use, skin cancer risk, and SPF levels. Seven behavior questions were addressed: Does this specific population use sunscreen, and if they do, what level do they use; which factors contribute to the level of SPF used; under what activities and timing requirements does the population use sunscreen; and if the population practices tanning (See Appendix B - Survey Instrument). We also obtained demographic information to determine each participant's age, gender, race/ethnicity, tendency to tan, and personal/family skin cancer history. Data from the survey was turned into quantifiable numerical values for analysis and comparisons.

Prior to the conduction of the survey, permission was gained to distribute the survey in undergraduate classes at Bethel University (See Appendix A). The survey was distributed from May 11<sup>th</sup>, 2015 to May 15<sup>th</sup>, 2015 in the science and business departments at Bethel University. Obtaining surveys from both the health science and non-health science departments allowed researchers to assess data for a correlation between understanding of skin cancer and prevention between different major groups at Bethel University.

## **Population**

Inclusion criteria for the study included: Undergraduate student (either full or part-time), age 18-25, and being a male or female student in the pre-health/science majors and business (management, accounting, finance) majors. Exclusion criteria for the study included: Education and psychology majors, and being less than 18 years old or greater than 25 years. Subjects that

completed the survey but did not meet the inclusion and exclusion criteria were not included in the study. The subjects were selected by their enrollment in the following courses at Bethel University: 5 marketing classes, 6 biological science lab classes, and 1 science class of non-health related majors. Permission was obtained from the professors of the classes including Dr. Timothy Shaw, Dr. Brain Hyatt, and Dr. Teresa DeGolier of the Biology department and Dr. Mary Ann Harris, Dr. William McVaugh, and Dr. Jay Milbrant of the Marketing/Business Department. The identity of the subjects was never released to the researchers.

The sample size goal was to receive 100 surveys from each of the two groups. The Bethel undergraduate population was selected due to a convenience of location, access to professors willing to hand out survey in class, and a sample population of college students. The survey was distributed during one class period of the Spring 2015 semester, and there was no need for future contact.

### **Data Instrumentation**

An informed consent document was completed by each student who took the survey (See Appendix C). The survey was administered at the beginning of an undergraduate class by the researchers or professor. The survey was conducted in a group setting where the participants in that specific class took it at the same time. Since the survey was given throughout several different class periods, all participants did not receive the survey at the same time. The survey was anonymous with the participants only revealing the basic demographic information previously specified. The researchers received the surveys as soon as students complete them during class. The completed surveys and informed consent forms were stored in separate closed envelopes. If the researchers were unable to be present during collection of data in the



classrooms, the class professor kept the secured envelopes in their possession until the researchers were able pick up the surveys at the end of the day.

### **Validity and Reliability**

The closed-ended questions of the survey were adapted from various previous research studies and tailored to our research questions. The questions in the survey aimed to determine the correlation between how educated the subject is on skin cancer prevention and their actual sun protective behaviors. The questions were not open-ended and asked about each subjects' own practices and history. We were confident the survey would be effective because the questions were successful in previous studies without reported reproducibility problems. Additionally, fellow students who had completed a Bachelor's degree and had some level of healthcare training reviewed the survey for validity. Finally, providing identical surveys to each participant ensured reliability.

### **Data Storage**

During the study, completed paper surveys were kept in a binder at the Bethel University Physician Assistant Program campus. At the conclusion of this study, raw survey data and statistically analyzed data results were compiled on a flash drive and stored with the Bethel University Physician Assistant Research Coordinator for security purposes; paper copies of the survey were shredded.

### **Data Analysis**

Data collected from the survey was manually transferred to Microsoft Excel to complete the data analysis. Qualitative answers from the survey questions were transferred into quantitative numerical values to calculate the means and standard deviations for each survey question. We then used these descriptive statistics to make comparisons between the student

groups' knowledge and behaviors. A 2-sample independent t-test were utilized to determine if there is a significant difference between health science majors and non-health science majors on their knowledge and attitudes of sun protective behaviors.

### **Limitations/Delimitations**

Limitations with our methods that we encountered include: subject dishonesty, low response rate, subject disinterest in the topic, unavailability of business major classes, and inconclusive results. Delimitations we placed on the study were to only include Bethel University undergraduate students ages 18-25 as subjects, and those with plans to graduate in a health emphasis major (e.g., biology) or a non-health science major (e.g., business). Subjects were high school graduates with some college education from a four-year liberal arts institution.

## **Chapter 4: Results**

### **Analysis of Student Demographics**

We surveyed 212 Bethel University undergraduate students to determine their knowledge and behaviors regarding skin cancer risk factors, skin cancer prevention, and the efficiency of sunscreen use. Of these students, 137 were health science majors, and 75 were non-health science majors (Table 1). In the health science majors, 53 of these students declared a pre-health emphasis.

Table 1: Demographics of the 212 Bethel University undergraduate students surveyed.

	<b>Health Science Majors</b>	<b>Non-health Science Majors</b>
Total	137	75
Females	102	30
Males	35	45
Average Age (years old)	19.76	21.07
Age Range (years old)	18-24	18-24
Caucasian	127	72
Asian	4	2
African American	3	1
Hispanic/Latino	3	0
Family history of skin cancer	43	23

In the health science major category, 102 students were female and 35 students were male. The average age of the students was 19.76 years old (range: 18-24 years old). The majority of students identified themselves as Caucasian (127), along with 4 identifying as Asian ethnicity, 3 as African American, and 3 Hispanic/Latino. Forty-three students (31.39%) reported a family history of skin cancer: 33 grandparents, 18 parents, 1 sibling, and 6 other. One student did not complete the “Behavior Questions” section of the survey.

In the non-health science major category, there were 30 female and 45 male students. The average age of the students was 21.07 years old (range: 18-24). The majority of students identified themselves as Caucasian (72), along with 2 identifying as Asian ethnicity, and 1 African American. Twenty-three students (30.67%) reported a family history of skin cancer: 13 grandparents, and 10 parents. Three students did not complete the “Behavior Questions.”

### **Analysis of the “Knowledge Questions”**

Analysis of the “Knowledge Questions” component of the survey reveals students with the non-health science majors answered 52% of the eight questions correctly, while health science major students answered 54% of the questions correctly (Figure 1). Analyzing each of the questions individually, more than 75% of the students in both health science and non-health science groups answered questions 1, 3, 4, and 5 correctly. Ninety-five percent of both health science and non-health science groups answered question 1 correctly: the sun is the strongest between 10:00 am to 4:00 pm (true). Ninety-six percent of non-health science majors and 97% of health science majors answered question 3 correctly: you can get sunburn in a snowy environment (true). Seventy-six percent of non-health science majors and 87% of health science majors answered question 4 correctly: if you are not usually exposed to the sun, being severely sunburned two or three times during your life will probably not increase your chances of skin

cancer (false). Eighty-one percent of non-health science majors and 83% of health science majors answered question 5 correctly: having a tan protects my skin from the sun (false).

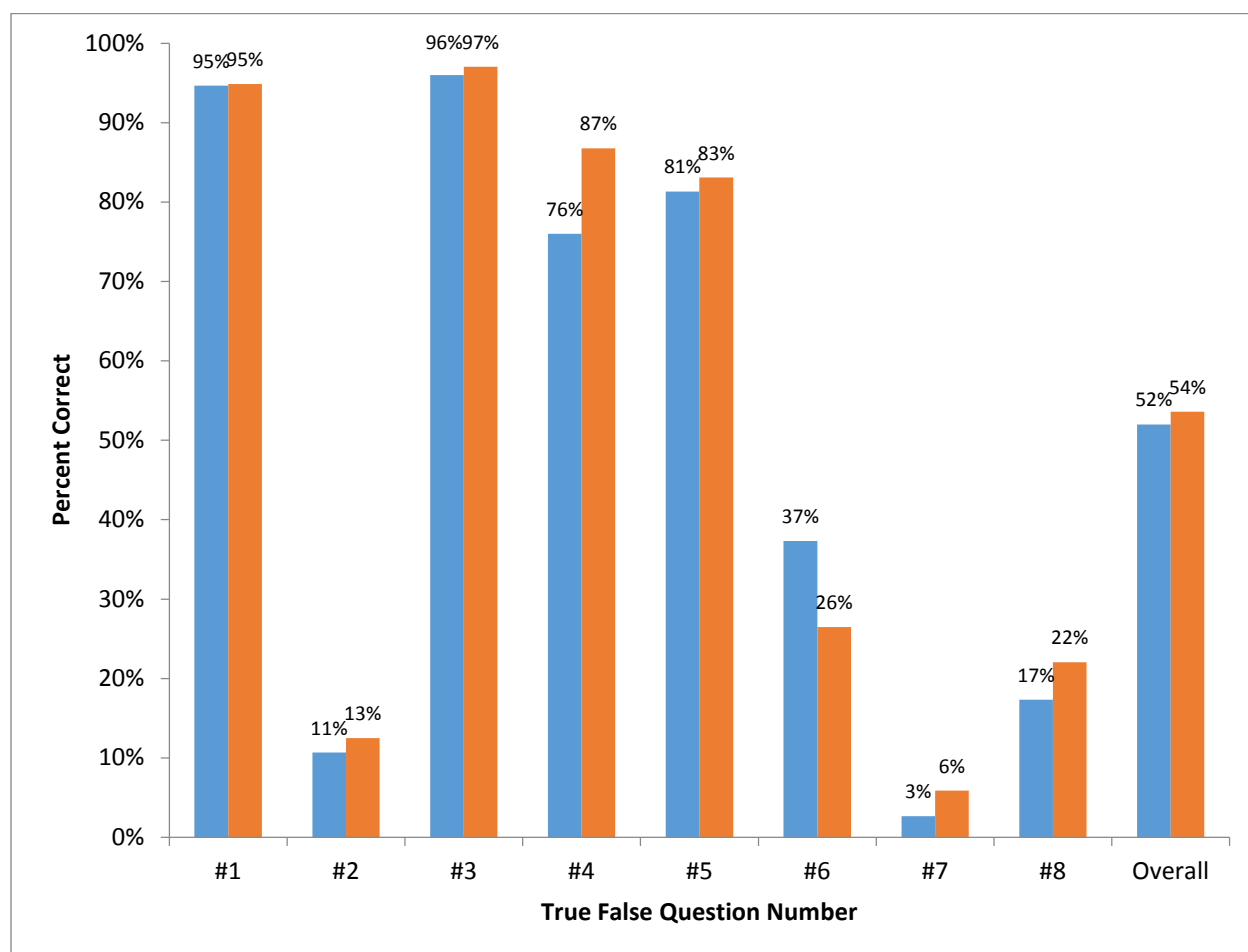


Figure 1: Responses from “Knowledge Questions” section of the Bethel University undergraduate student survey: Non-health Science Majors ■; Health Science Majors ■.

Less than 40% of students in both major groups answered questions 2, 6, 7, and 8 of the “Knowledge Questions” component of the survey correctly (Figure 1). Eleven percent of non-health science major students and 13% of health science major students answered question 2 correctly: a sunscreen with a SPF of 30 means a person can stay in the sun 30 times longer without burning than he or she could if not wearing sunscreen (true). Thirty-seven percent of non-health science majors and 26% of health science majors answered question 6 correctly: 12 teaspoons (2 oz) is the adequate amount needed for an average adult to cover their entire body

with sunscreen (false). It takes approximately 5 teaspoons (1 ounce) to cover an adult human body. Three percent of non-health science majors and 6% of health science majors answered question 7 correctly: melanoma is the most common form of skin cancer (false). Basal cell carcinoma is the most frequently occurring form of skin cancers. Seventeen percent of non-health science majors and 22% of health science majors answered question 8 correctly: which portion of UV radiation do you think is more effective at causing a sunburn (UVB). UVA radiation penetrates the human skin deeper than UVB rays, but UVB rays cause sunburn and are the primary contributor to skin cancer.

Results from the “Knowledge Questions” component of the survey were also analyzed by sex and major of the students (Figure 2). We compared results from the following groups of students to determine if the students’ average scores on the “Knowledge Questions” component of the survey were different from one another.

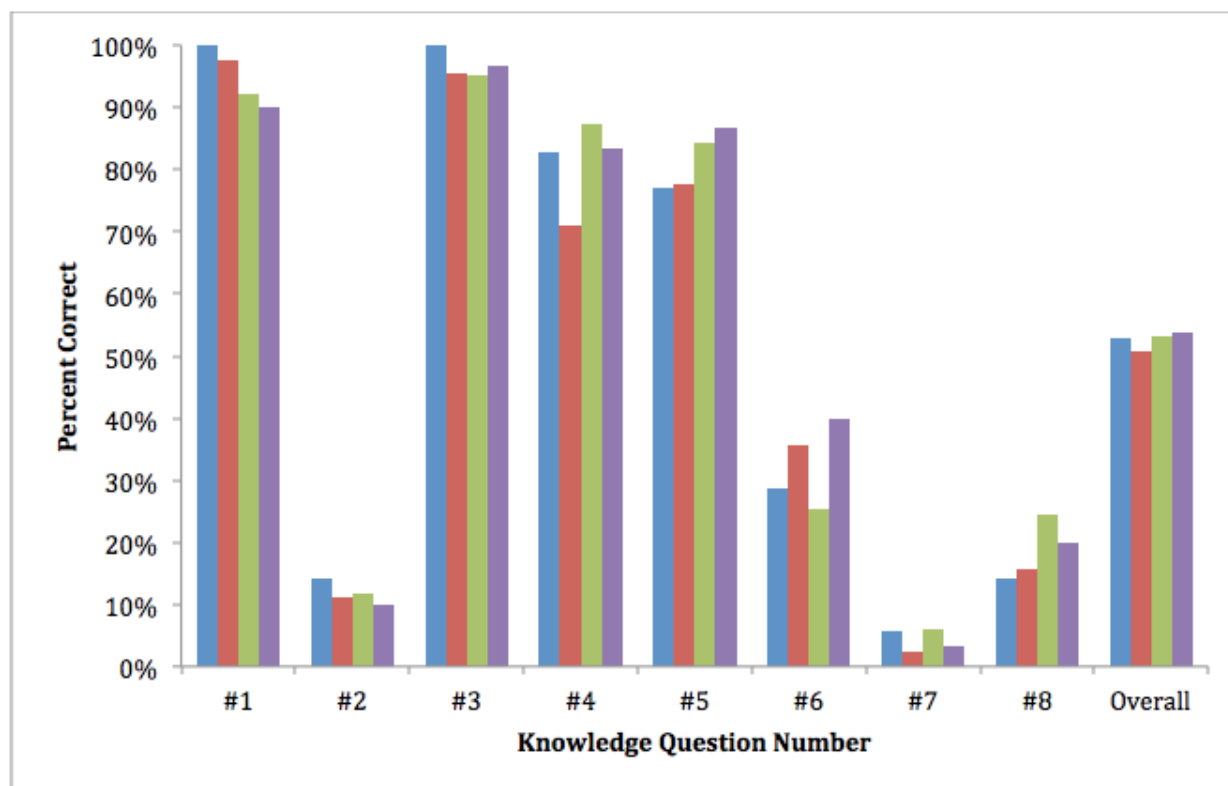


Figure 2: Responses from “Knowledge Questions” section of the Bethel University undergraduate student survey broken down by major and gender: Health Science Male ■; Non-health Science Male ■; Health Science Female ■; Non-health Science Female ■.

### Non-Health Science Major vs. Health Science Major Students

An unpaired t-test was used to compare non-health science major and health science major students’ average scores on the “Knowledge Questions” component of the survey. Based on the average scores, we found that the students’ knowledge regarding sun protective behaviors did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.8972$ ).

### Female Non-Health Science Major vs. Female Health Science Major Students

Using the same method to compare female non-health science major and female health science major students’ answers, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p=0.9838$ ).

### **Male Non-Health Science Major vs. Male Health Science Major Students**

Using the same method to compare male non-health science major and male health science major students' answers, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.9252$ ).

### **All Female vs. All Male Students**

Using the same method to compare all female students of both major groups and all male students of both major groups, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.9060$ ).

### **Female Non-Health Science Major vs. Male Non-Health Science Major Students**

Using the same method to compare female and male students within the same non-health science major group, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.8991$ ).

### **Female Health Science Major vs. Male Health Science Major Students**

Using the same method to compare female and male students within the same health science major group, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.9822$ ).

### **Pre-Health Emphasis vs. No Emphasis Within the Health Science Major Students**

Using the same method to compare only health science majors with a pre-health emphasis and those without the pre-health emphasis, we found that the results did not show statistical significance, where  $p < 0.05$  is significant ( $p = 0.8226$ ).

### **Analysis of the "Behavior Questions"**

Questions 1, 2, 5, and 6 from the "Behavior Questions" section of the survey resulted in one answer per student. The number of students answering each response was converted into a

percentage. However, questions 3, 4, and 7 produced students responding with multiple answers. Questions 3 and 7 were designed for this response (“circle all that applies”), while question 4 was not. After reviewing the survey results, we decided to accept and include multiple reported answers for question 4 to gather more information regarding sun protective behaviors.

Question 1 aimed to determine when students apply sunscreen: before going out in the sun on a sunny day, when do you apply sunscreen? The majority of students from both non-health science (47%) and health science (53%) major groups reported applying sunscreen five minutes before sun exposure (Figure 3). The least answered response was applying sunscreen 45 minutes before sun exposure. Less than one-quarter of the students in each group reported applying sunscreen 30 minutes before sun exposure, the FDA recommended timing.

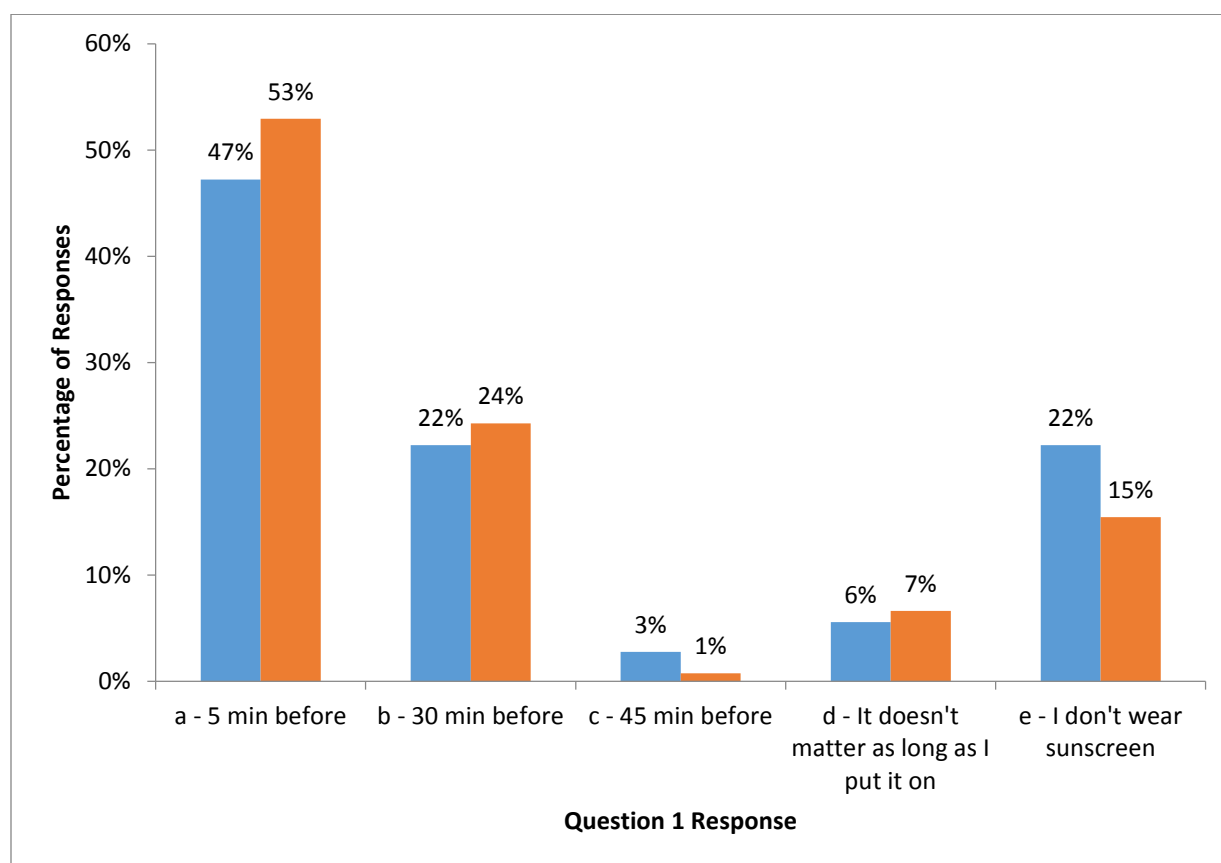


Figure 3: Question 1 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: before going out in the sun on a sunny day, when do you apply sunscreen? Non-health Science Majors ■; Health Science Majors ■.



The purpose of question 2 was to determine what level of SPF in sunscreen students used: do you wear sunscreen, and if so what level? The majority of students in both groups responded that they wear SPF 30 (Figure 4). Wearing a sunscreen with at least an SPF 30 is the recommendation from the FDA. Sunscreens with less than SPF 15 and over SPF 50 yielded the least responses. Ten percent of students in both non-health science and health science majors reported to use less than SPF 15. Ten percent of health science students and 6% of non-health science students wear sunscreens with SPF 50 or greater.

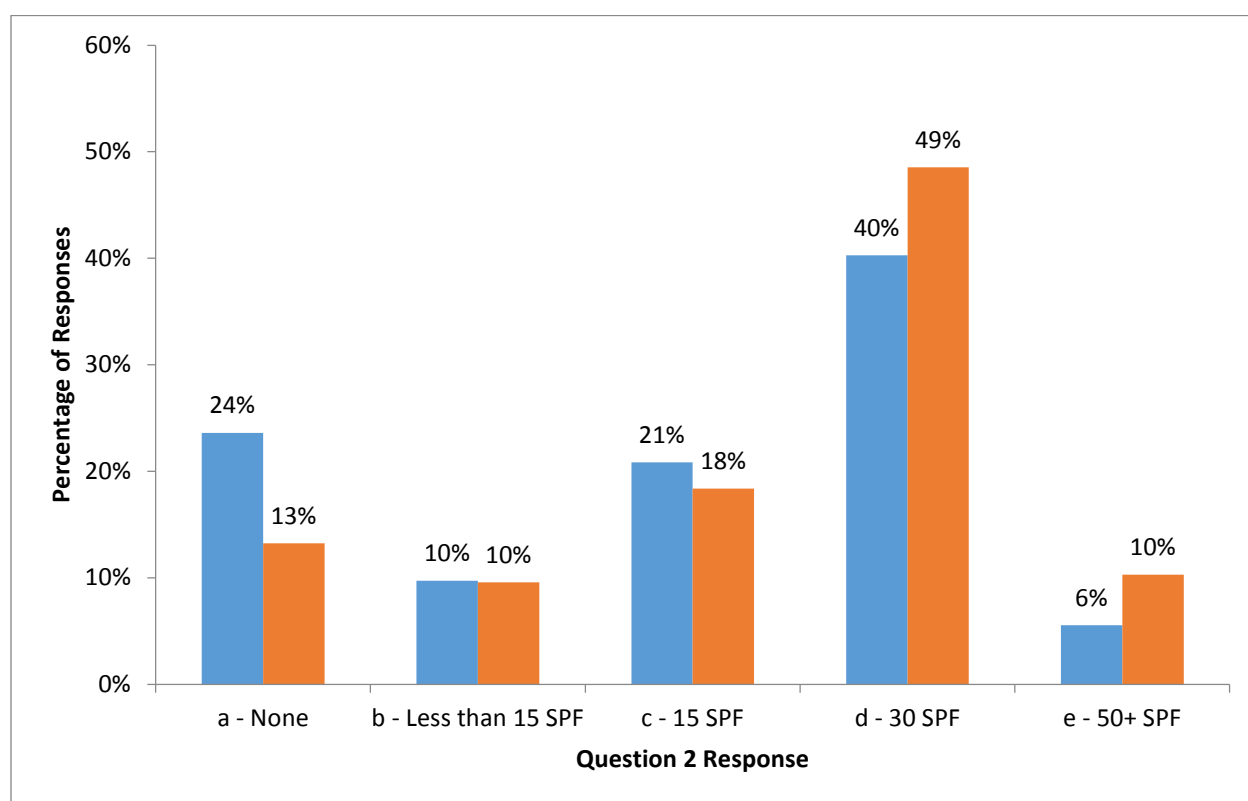


Figure 4: Question 2 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: do you wear sunscreen, and if so what level? Non-health Science Majors ■; Health Science Majors ■.

Question 3 aimed to determine when students applied sunscreen: what activities do you wear sunscreen for? Options included common outdoor activities, including always when outdoors, swimming/beach, working, and whenever it is remembered. Sixty-five percent of non-

health science students and 58% of health-science students wear sunscreen when going to the beach or swimming activities (Figure 5). Ten percent of non-health science students and 11% of health science students reported to wear sunscreen with all outdoor activities.

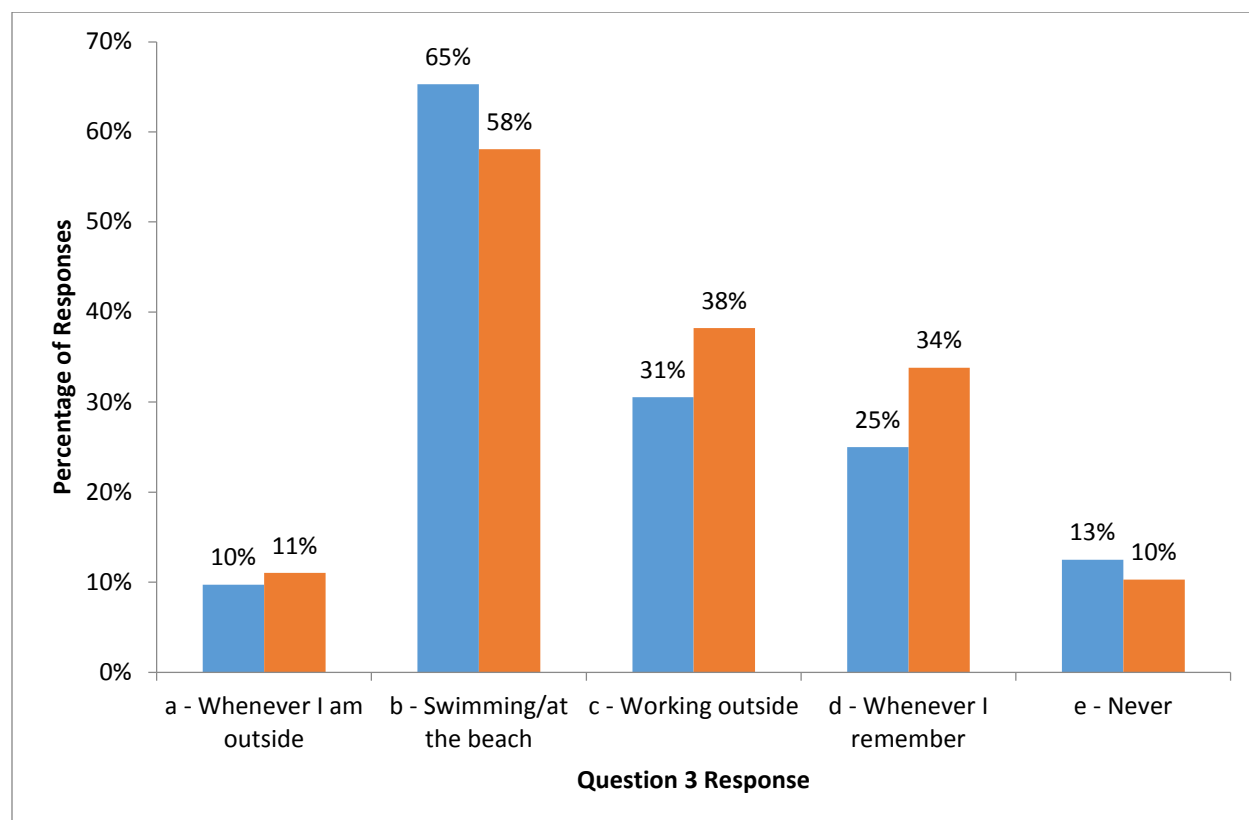


Figure 5: Question 3 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: what activities do you wear sunscreen for? Non-health Science Majors ■; Health Science Majors ■.

Question 4 aimed to determine what motivates students to wear sunscreen. Options included avoiding skin cancer, easily burning, not liking a tanned appearance, and aging prevention. Fifty-one percent of non-health science students and 61% of health-science students wear sunscreen to avoid skin cancer (Figure 6). Many students also wear sunscreen because of a tendency to get sunburned (38% of non-health science students and 30% of health-science students). Only 2% of health-science students and no non-health science students reported using sunscreen because they dislike a tanned appearance.

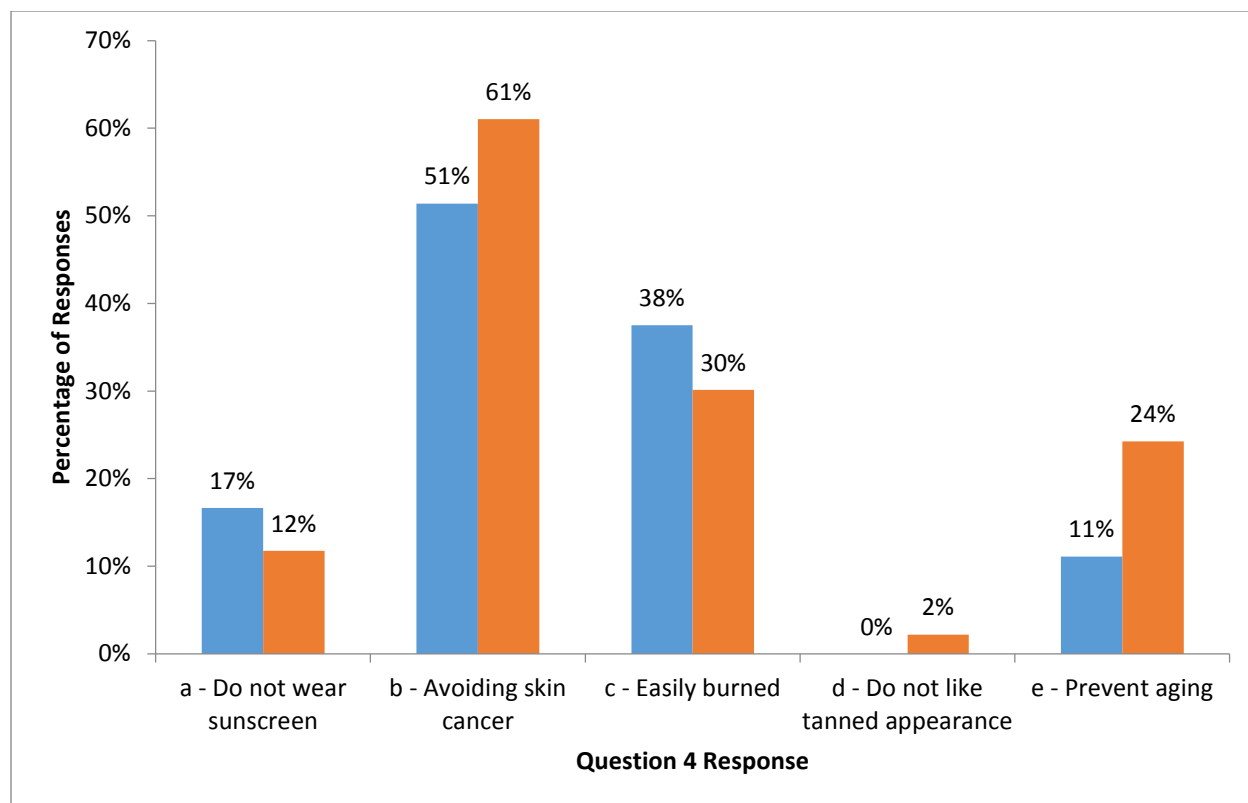


Figure 6: Question 4 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: if you wear sunscreen, what motivates you to wear sunscreen? Non-health Science Majors ■; Health Science Majors ■.

The purpose of question 5 was to determine why students do not wear sunscreen: if you don't wear sunscreen, why? Options included common complaints from adversaries of sunscreen: it does not work, wanting a tanned appearance, greasy feel or irritating to skin, and being too expensive. The most common response behind not using sunscreen was due to liking a tanned appearance (Figure 7). Cost and ineffectiveness of sunscreen collected the lowest responses of both groups. Fifty-six percent of students in both groups reported wearing sunscreen, and therefore, did not report a reason for disliking sunscreen.

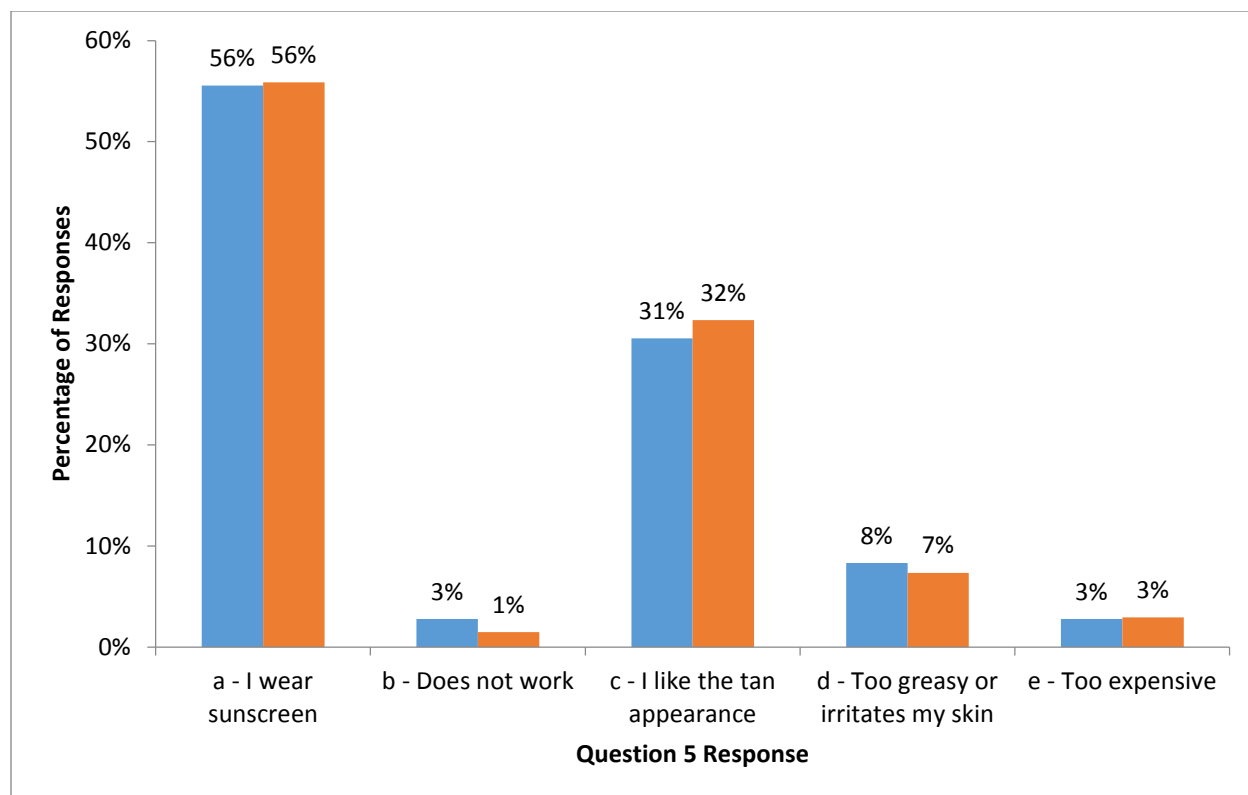


Figure 7: Question 5 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: if you don’t wear sunscreen, why? Non-health Science Majors ■; Health Science Majors ■.

The purpose of question 6 was to determine how much sunscreen students apply: when applying sunscreen, how much do you apply to cover your entire body? The majority of students in each group responded that they apply what they think is adequate (Figure 8). Only 14% of non-health science students and 12% of health science students reported applying the FDA approved amount (1 ounce) of sunscreen to their entire body. Four percent of students in each group reported to apply half of this recommended amount, half an ounce. Ten percent of non-health science students and 8% of health science students reported to apply double the recommended amount, 2 ounces.

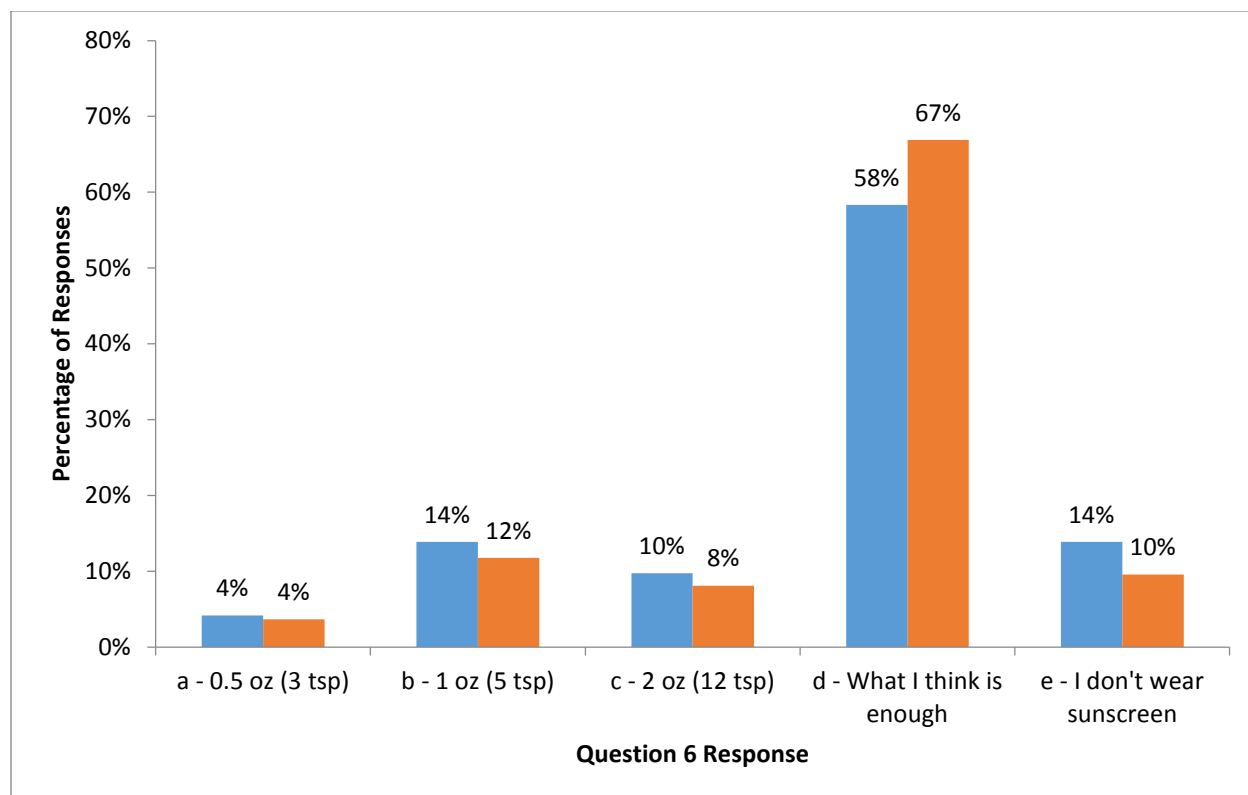


Figure 8: Question 6 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: when applying sunscreen, how much do you apply to cover your entire body? Non-health Science Majors ■; Health Science Majors ■.

The purpose of question 7 was to determine what sources students are obtaining information on sun protective behaviors: how have you been educated on sun protective behaviors and sunscreen use? Over half of the students in non-health science majors (67%) and health science majors (85%) reported learning about sunscreen through family and friends (Figure 9). The next most common education outlet reported was school, followed by doctor’s office, and finally skin cancer public service announcements.

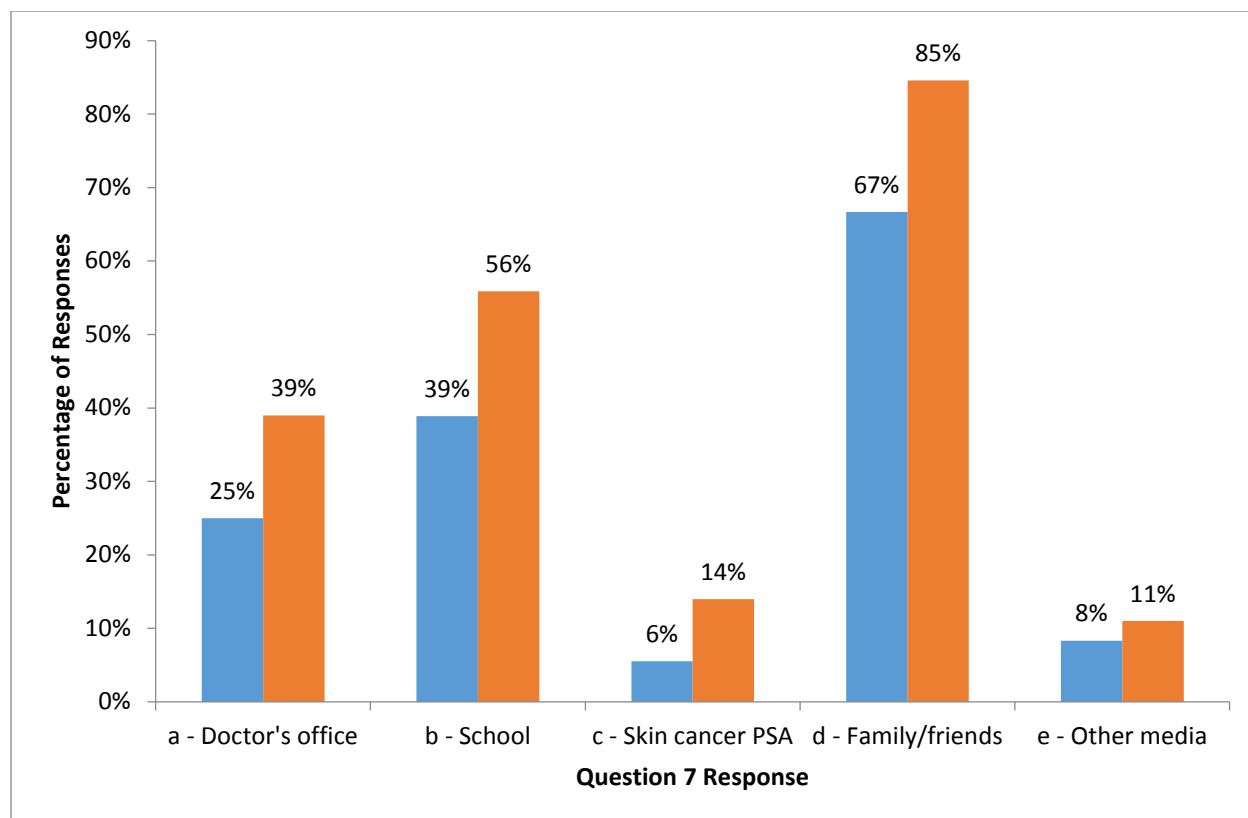


Figure 9: Question 7 responses from “Behavior Questions” section of the Bethel University undergraduate student survey: how have you been educated on sun protective behaviors and sunscreen use? Non-health Science Majors ■; Health Science Majors ■.

In seeking to accurately determine how many students do not wear sunscreen, we asked the question multiple times. In response to question 1, 22% of non-health science students and 15% of health science students reportedly do not wear sunscreen. In response to question 2, 24% of non-health science students and 13% of health science students reportedly do not wear sunscreen. In response to question 3, 13% of non-health science students and 10% of health science students reportedly do not wear sunscreen. In response to question 4, 17% of non-health science students and 12% of health science students reportedly do not wear sunscreen. In response to question 6, 14% of non-health science students and 10% of health science students reportedly do not wear sunscreen (Table 2). By averaging these results, we calculated 18% of non-health science students and 12% of health science students do not wear sunscreen.

Table 2: Percentage of students reporting to not wear sunscreen.

	<b>Health Science Majors</b>	<b>Non-health Science Majors</b>
Question 1	15%	22%
Question 2	13%	24%
Question 3	10%	13%
Question 4	12%	17%
Question 6	10%	14%
Average	12%	18%

## **Chapter 5: Discussion, Recommendation, and Conclusion**

### **Summary**

Our research project aimed to determine how educated the Bethel University undergraduate population is on using sunscreen as skin cancer prevention and what sun protective behaviors they utilize. Analysis of the “Knowledge Questions” section of our survey showed the 212 Bethel University undergraduate students are knowledgeable about certain aspects of sun protective behaviors, but not others. Contrary to our hypothesis, no statistical significance was found between the knowledge of students in the non-health science majors and health science majors. There was also no statistical significance between females of the two major groups, males of the two major groups, and all females versus all males. Finally, sun protective knowledge between females and males within the two separate major groups was not found to be statistically significant.

We found that students in both non-health science majors and health science majors need further education on: the meaning and significance of sunscreen SPF levels and wear time, the amount of sunscreen needed to adequately cover the human body, types of skin cancers and their prevalence, and the distinctions between UVA and UVB rays. However, students in both non-health science majors and health science majors were generally educated regarding: what time of the day and year sunscreen should be applied, the concept that repeat sunburns increases the

likelihood of getting skin cancer, and the concept that tanned skin does not protect against skin cancer. In regards to how further education is provided to students, it is important to note that most students reported obtaining their education on sun protective behaviors through friends and family. Compared to other sources listed in our survey (doctor's office, school, and PSAs), family and friends are likely the least reliable for accurate information.

Analysis of the "Behavior Questions" section of the survey revealed that approximately half of students of both health science and non-health science major groups apply sunscreen only five minutes before sun exposure. The American Academy of Dermatology recommends applying sunscreen at least 15 minutes before sun exposure, while the Center for Disease Control and Prevention advocates for 30 minutes before exposure (American Academy, 2015; Center for Disease, 2016a). Only about one quarter of the surveyed student population reported following the 30-minute recommendation. Over half of the students from both major groups reported wearing SPF 30 or higher (SPF 50+) sunscreen. With the American Academy of Dermatology recommending the use of SPF 30 or more, our results suggest that a little under half of this student population are not using sufficient sunscreen SPF (American Academy, 2015). This shows that there is a need for further education on how many minutes sunscreen should be applied before going outside and what level of SPF is advised.

We determined that avoiding skin cancer had the highest motivational influences behind students choosing to wear sunscreen, followed by in decreasing order: being easily burned, aging prevention, and avoiding a tanned appearance. It is interesting to note the correlation between this response and approximately one-third of the students reporting "liking a tanned appearance" for the number one reason not to apply sunscreen. Through repetitive questioning in our survey, we determined that approximately 12% of health science majors and 18% of non-health science



majors reported to not wear sunscreen on a regular basis. However, it is likely that more students wear sunscreen only intermittently based on our findings from Behavior Question #5: If you don't wear sunscreen, why?

### **Limitations**

The study had several limitations, with the main limitation being centered around the population. The study included only Bethel University undergraduate students between the ages of 18 through 25. The anticipatory majors of the students limited the population and the study to those with health science majors (e.g. biology) and those with non-health science majors (e.g. business). Further limitations also include subject dishonesty or subject disinterest in the topic, which might have affected the way the students answered the survey and thus interfered with the results.

Other limitations include response rate. Even though we acquired 212 surveys with both health science and non-health science majors, a larger number of surveys might have showed a statistical significant difference between the two majors. A limiting factor in obtaining a larger number of subjects was the availability and willingness of professors, in the needed major groups, to allow researchers to survey their classes/students. Due to the unavailability of the business department, most of the non-health science major students had to be obtained from the marketing department. Lastly, the study was limited by the results. The study did not show any statistical significance between the health majors and non-health majors and their overall knowledge on sunscreen factors.

### **Further Research**

Further research needs to be implemented to achieve a better understanding of what factors affect people's sun protective behaviors. By exploring the following future research

topics, we can develop a broader understanding on why people do and do not use sun protective behaviors. A further research topic to explore would be if location within the United States affects people's attitude on application of sunscreen, compliance of sunscreen use, and timing of usage. According to the Center for Disease Control and Prevention, in 2012, Minnesota had the fourth highest incidence rate of cutaneous melanoma by state with 28.3 per 100,000 people. The three states with higher incidence of melanoma of the skin were Utah, Vermont, and Delaware (Center for Disease, 2016b). A potential future research topic would be to see if sunscreen habits are different in a state that has a longer summer season (e.g. Florida or Hawaii) and if that contributes to a lower incidence of melanoma. It should be investigated to determine if the difference is due to attitudes on sun-protective behaviors, genetics, or a combination of both.

Another topic to explore would be if personal experience with skin cancer impacts attitudes towards the application of sunscreen, compliance of sunscreen use, and timing of usage. Our research was focused on college age students and included an age range of 18-25 years. According to the melanoma foundation, the average age of diagnosis is 52 years old. Although melanoma is the second most common cancer in people age 25-29, it is not at a great prevalence at this age group. The age range of this study was younger than those who are usually affected by skin cancer. It would be beneficial to explore the sun protective behaviors of those with an actual or anticipated skin cancer diagnosis.

With the majority of the students identifying themselves as Caucasians on our survey, it is clear that Bethel University lacks an ethnically diverse campus. Further research could be done to see if there are differences between the sun protective behaviors of various ethnic groups. People with darker skin tones are less likely to get sunburned as the higher concentration of melanin provides some sun protection. It may be valuable to determine if sun

protective behaviors differentiate between ethnic groups and what their motivational factors are. This information could allow public services announcements to be tailored towards certain ethnicities. In some Asian cultures, a lighter complexion is considered more attractive. This is a stark contrast compared to western cultures, such as the Bethel University student population, in which a tanned appearance is considered more attractive. Further research could be done to see if different perspectives on what is considered attractive plays an impact on people's sun protective behaviors or lack thereof.

### **Conclusion**

The research question investigated in this study was to see how educated is the Bethel University undergraduate population on using sunscreen as skin cancer prevention and investigate their sun protective behaviors. Overall, students answered approximately 50% of the "Knowledge Questions" component of the survey correctly. Students from both health science and non-health science major groups were generally educated regarding: what time of the day and year sunscreen should be applied, the concept that repeat sunburns increases the likelihood of getting skin cancer, and the concept that tanned skin does not protect against skin cancer. Analyzing the data gathered from the "Behavior Questions" component of the survey, we determined that avoiding skin cancer had the highest motivational influences behind students choosing to wear sunscreen. However, many students are still now following sunscreen recommendations by the American Academy of Dermatology and the Center for Disease Control and Prevention.

Through data analysis, we determined that there was no statistical significance between the sun protective knowledge and behaviors of students in non-science majors and science majors at Bethel University. This was consistent with previous studies done in this topic

with different populations and regions of the country and world. Even though our study results correlate with other studies done, the sample population was limited, so further studies could be done to expand on the topic. Further research could also look at sun protective behaviors of different age groups in the area and contrasted climate areas like between Minnesota and Hawaii. Future studies could also include a greater variety of ethnicities or majors of study at Bethel University. Although the results were not statistically significantly, we hope our results will contribute to future research in order to raise awareness for healthy sun protective behaviors and to decrease the skin cancer prevalence in our society.

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**Appendix A**

Permission to conduct survey



### Permission letter

Hello Dr. [insert name],

Our names are Sarah Beddow, Karien Wilson, and Chelsea Domeier. We are a part of the Bethel's 2016 Physician Assistant class. We received your name from a fellow faculty member as a professor who might be willing to help us with our Master's Thesis Project. We were wondering if you would allow us distribute a 5 minute survey to your classes in early May 2015. Our thesis project is about the attitude and knowledge of college students on sun protective behaviors including sunscreen use. We are looking classes that includes pre-medicine/science majors or business/marketing majors.

Please let us know if this will work for you and if you have any questions.

Thanks so much,

Sarah Beddow, Karien Wilson, and Chelsea Domeier  
Students of Bethel's 2016 Physician Assistant Program

**Appendix B**  
Informed Consent

## **Informed Consent**

You are invited to participate in a Bethel University research project assessing the undergraduate's level of understanding of skin cancer risk factors, skin cancer prevention, and the efficiency of sunscreen use. The study is being conducted by Sarah Beddow, Chelsea Domeier, and Karien Wilson of Bethel University's Physician Assistant Program. The results of this study will contribute to a better understanding on knowledge that the general young adult population possess regarding skin cancer and their behavior regarding sunscreen usage.

Your participation in this study involves completing a survey. The survey is comprised of demographic information, true or false knowledge based questions, and multiple choice behavioral questions, which will take a maximum of 10 minutes. During the study, paper copies of survey results will be kept in a binder at the Bethel University PA School campus. At the conclusion of this study, all unidentified survey data and statistically analyzed data results will be compiled on a flash drive and stored with the Bethel University PA Research Coordinator for security purposes. Your identity will not be compromised and we will not ask for your name. In no way will you be associated with the responses you provide. Your participation is anonymous.

Also, your participation is completely voluntary. You may choose not to answer any question or to withdraw from any portion of the study at any time. If you choose to not participate in the survey, simply leave your survey blank.

If you have any questions about the study itself, please-contact the researchers at Bethel University at [kaw76442@bethel.edu](mailto:kaw76442@bethel.edu), [sab32647@bethel.edu](mailto:sab32647@bethel.edu), or [chd39254@bethel.edu](mailto:chd39254@bethel.edu). You may also contact the researcher's chair, Cindy Goetz, MPAS, PA-C at Bethel University PA program at [c-goetz@bethel.edu](mailto:c-goetz@bethel.edu). This research protocol has been reviewed and approved, and if you have any questions on the approval process, please contact Wallace Boeve, EDd, PA-C at Bethel University PA program at [w-boeve@bethel.edu](mailto:w-boeve@bethel.edu).

X

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Student's Name

**Appendix C**  
Survey Tool

## Sun Protective Behavior and Knowledge Survey

### Demographic Questions

1. Age: \_\_\_\_\_

2. Sex

Male

Female

3. Race/Ethnicity

Caucasian

American Indian/Alaska Native

African American

Pacific Islander

Hispanic/Latino

Other: \_\_\_\_\_

Asian

4. Tendency to Tan

Deep Tan

No Tan

Moderate Tan

Burns Easily

Mild Tan

5. Major: \_\_\_\_\_ Year of Graduation: \_\_\_\_\_

Pre Health Emphasis

6. Family History of Skin Cancer

No

Yes

Self

Siblings

Parents

Other

Grandparents

### Knowledge (True/False)

1.  The sun is the strongest between 10:00 am to 04:00 pm.
2.  A sunscreen with a SPF of 30 means a person can stay in the sun 30 times longer without burning than he or she could if not wearing sunscreen.
3.  You can get a sunburn in a snowy environment.
4.  If you are not usually exposed to the sun, being severely sunburned two or three times during your life will probably not increase your chances of skin disease

5. \_\_\_ Having a tan protects my skin from the sun.
6. \_\_\_ 12 teaspoons (2 oz.) is the adequate amount needed for an average adult to cover their entire body with sunscreen
7. \_\_\_ Melanoma is the most common form of skin cancer
8. \_\_\_ Which portion of UV radiation do you think is more effective at causing a sunburn (UVB, UVA, Both, I don't know)

### **Behavior Questions**

1. Before going out in sun on a sunny day, when do you apply sunscreen?
  - a. 5 min before going out
  - b. 30 min before going out
  - c. 45 min before going out
  - d. It doesn't matter as long as I put it on
  - e. I don't wear sunscreen
2. Do you wear sunscreen. What level?
  - a. None
  - b. Less than 15 SPF
  - c. 15 SPF
  - d. 30 SPF
  - e. 50+ SPF
3. What activities do you wear sunscreen for (circle all those that apply)
  - a. Whenever I am outside
  - b. Swimming/At the beach
  - c. Working outside for a long period of time
  - d. Whenever I remember
  - e. Never
4. If you wear sunscreen, what motivates you to wear sunscreen?
  - a. I don't wear sunscreen
  - b. I do not want to get skin cancer
  - c. I burn easily.
  - d. I do not like the tan appearance.
  - e. Prevent aging
5. If you don't wear sunscreen, why?
  - a. I wear sunscreen
  - b. Sunscreen does not work
  - c. I like the tan appearance
  - d. It is too greasy or it irritants my skin
  - e. Sunscreen is too expensive

6. When applying sunscreen, how much do you apply to cover your entire body?
- 0.5 oz. (3 teaspoons)
  - 1 oz. (5 teaspoons)
  - 2 oz. (12 teaspoons)
  - I apply what I think is enough
  - I don't wear sunscreen
7. How have you been educated on sun protective behaviors and sunscreen use? Circle all that applies
- At the doctor's office
  - In school
  - Skin Cancer Public Service Announcements
  - Family/Friends
  - Other media: please list

**Appendix D**

Bethel University IRB Approval Form



Miss Beddow, Miss Wilson, & Miss Domeier;

With the permission of Bethel's IRB and as the PA Program Director, I write this letter to you in approval of Level 3 Bethel IRB of your project entitled: "The Knowledge and Attitude of Bethel's Undergraduate Population on Sun Protective Behaviors." This approval is good for one year from today's date for collecting the data. Additionally, prior to data collection, at least two professors who you will be working with must review your final survey to give their agreement that the survey itself is appropriate for their students to complete. This review must be completed and on file with my office. Please let me know if you have any questions.

Sincerely;

Wallace Boeve, EdD, PA-C  
Program Director  
Physician Assistant Program  
Bethel University  
[w-boeve@bethel.edu](mailto:w-boeve@bethel.edu)  
[651 308-1398](tel:6513081398) cell  
[651 635-1013](tel:6516351013) office  
[651 635-8039](tel:6516358039) fax  
<http://gs.bethel.edu/academics/masters/physician-assistant>