THE EFFECTS OF SKIN CANCER PREVENTION EDUCATION AND SUNSCREEN AVAILABILITY ON SUNSCREEN USE AMONG OUTDOOR HIGH SCHOOL ATHLETES

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Title of Study: THE EFFECTS OF SKIN CANCER PREVENTION EDUCATION AND SUNSCREEN AVAILABILITY ON SUNSCREEN USE AMONG OUTDOOR HIGH SCHOOL ATHLETES

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Abstract: The aim of this study was to determine the effects of an educational intervention on knowledge, behavior, and attitudes of outdoor high school athletes regarding skin cancer. An educational intervention was performed on knowledge and behaviors in athletes participating in high school soccer, tennis, cross country, and track and field (N=50). The effect of educational intervention on knowledge about sun exposure and skin cancer before and after was measured by paired samples t-test showed statistical significance in scores (($t(48) = 6.261$, $p < .001$). The effect of educational intervention on willingness to apply sunscreen was also measured during this study. The rates of willingness to use sunscreen if made available increased from 32.7% pre-intervention to 90% post-intervention. Outdoor high school athletes are at higher risk for skin cancer due to sun exposure and lack of sun-protective behaviors. Skin cancer education can improve knowledge, behaviors, and attitudes in that at-risk population.

Keywords: outdoor high school athletes, skin cancer, sun-protective behaviors, educational intervention

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CHAPTER I

INTRODUCTION

The American Cancer Society (ACS) estimates 5.4 million new cases of nonmelanoma cancers among 3.3 million people and 87,110 cases of melanoma in 2021. One in five Americans will develop skin cancer during a lifetime and each year there are more new cases of skin cancer than the combined incidence of cancers of the female breast, lung, and colorectal. The rate of melanoma, the deadliest form of skin cancer, has been steadily increasing for the past thirty years; researchers project the rate increase to continue (Bandi, Cokkinides, Weinstock, & Ward, 2010). Melanoma is the most common form of cancer in young adults aged 25 to 29 and it is the second most common form of cancer in adolescents and young adults ages 15 to 29 (Diao & Lee, 2014). A combination of non-modifiable and modifiable factors causes most cases of skin cancer, including hereditary, personal, and behavioral factors. Genetic factors are not controllable and can play an important role in skin cancer development (Anspaugh & Ezell, 2013).

The following personal characteristics increase the risk of skin cancer: having a naturally fair skin tone, light-colored eyes, blonde or red hair, a large number of moles and skin that burns, freckles, reddens, or becomes painful after too much time in the sun. Although genetics and individual characteristics have a great influence on skin cancer risk, nearly all skin cancers are also related to ultraviolet (UV) exposure from the sun or tanning beds.

Sun damage to the skin occurs over time with chronic, intermittent, and intense exposures. Based on previous research, broad-spectrum sunscreen is preventive for all forms of skin cancer and decreases the incidence of melanoma by up to 50% (Green, Williams, Logan, & Strutton, 2011). The Centers for Disease Control and Prevention (CDC), the American Academy of Dermatology (AAD), along with other health organizations, recommend easy options for protection from UV radiation and prevention of skin cancer. These steps include seeking shade during the midday hours when the sun's UV rays are the strongest (between 10 a.m. and 4 p.m.), wearing sun-protective clothing, such as a long-sleeved shirt, a wide-brimmed hat, and sunglasses, applying and reapplying a broad-spectrum, water-resistant sunscreen with a Sun Protection Factor (SPF) of 15 or more to all exposed skin, and avoiding indoor tanning.

Statement of the Problem

Despite health campaigns to raise public awareness of ultraviolet radiation, sun-protective practices still fall behind. A plausible explanation is the lack of behavioral change in populations at risk (Diao & Lee, 2014). It is estimated that 90% of all skin cancer deaths could be prevented if people properly controlled their exposure to the sun's ultraviolet radiation. Exposure to UV is the most preventable risk factor for all types of skin cancer, including melanoma. However, according to research published in the Journal of the American Academy of Dermatology, the majority of Americans are not regularly using sunscreen to protect themselves from the sun's harmful UV rays (AAD, 2015). Researchers from the CDC examined the results of a 2013 survey that asked participants how often they use sunscreen when outside in the sun for more than an hour. Only 14.3% of men and 29.9% of women reported that they regularly use sunscreen on both their face and other exposed skin.

Outdoor athletes participating in interscholastic and collegiate sports represent an important group at risk for skin cancer because they are routinely exposed to high levels of ultraviolet radiation. According to the National Collegiate Athletic Association (NCAA), in 2020 there were nearly 490,000 collegiate student-athletes and 8 million high school students participating in athletics in the United States. Many outdoor high school and collegiate athletes are at increased risk for skin cancer due to extended periods of time spent outside, with on average four hours a day and 10 months per year of sun exposure; collegiate athletes average 1,000 hours of unprotected sun exposure every year (Bagatti et al., 2016).

Previous research indicates however that this population does not use sunscreen daily and that sunscreen availability represents the main barrier to use among high school and collegiate athletes. According to the Centers for Disease Control and Prevention (2014), approximately 65% of young adults ages 18 to 29 suffer sunburn each year. The problem is the vast knowledge deficit of the athlete population regarding sun safety practices, and subsequently, the rising incidence of melanoma in young adults. High school and collegiate athletes have limited knowledge of their risk for melanoma, sun-protective behaviors, and harm from ultraviolet radiation. Many athletes do not limit their sun exposure and report low levels of sun-protective behaviors (Hobbs, Nahar, Ford, Bass, & Brodell, 2014). In a study assessing knowledge related to melanoma risk, only 20% of collegiate athletes understood the risk of prolonged, unprotected exposure such as sunburn or skin cancer (Bagatti et al., 2016). Another study revealed that 85% of athletes do not apply sunscreen before practice or games (Hobbs et al., 2014). Application of sunscreen in addition to other sun safety behaviors may result in a positive behavior change for athletic teams.

Given the public health burden of skin cancer in white populations, an increase in sun-protective behavior is needed. Inadequate and infrequent education from healthcare providers, coaches, and athletic trainers directly result in poor sun-protective behaviors. Without frequent education and promotion of sun safety behaviors, high school and collegiate athletes will continue to suffer irreversible skin damage, including premature aging and skin cancer. Focus on education is essential to ensuring athletes remain safe and protected. The study evaluated the attitudes, knowledge, and sun-protective behaviors of outdoor high school athletes towards sun exposure, sunscreen application, and skin cancer risks.

Purpose of the Study

The purpose of the study was to contribute to the reduction in the incidences of skin cancer in the United States by assessing the existing knowledge and behaviors regarding skin cancer and sun-protective behaviors in high school athletes who participated in an educational intervention. For this study, the primary objective was to improve the knowledge, attitudes, and behaviors regarding sun safety in the high school athlete population involved in outdoor sports, using effective educational intervention strategies. A short-term objective was to increase athletes' frequency of sunscreen application after learning more about the risks of skin cancer; a long-term objective was to reduce the risk of skin cancer in the high school outdoor sports athlete population. Implications of this study may extend to other high schools and collegiate programs.

Research Questions and Hypotheses

The following research questions were addressed during this study:

1. RQ1**:** What are the outcome expectations (beliefs) regarding sun-protective behaviors among outdoor high school athletes who are at high risk for ultraviolet radiation exposure?
2. RQ2: What is the level of self-efficacy regarding sun-protective behaviors among outdoor high school athletes who are at high risk for ultraviolet radiation exposure?
3. RQ3: What is the effect of educational intervention on knowledge about sun exposure and skin cancer among outdoor high school athletes?
    a. *Null Hypothesis:* There will be no significant difference in the knowledge of sun exposure and risks for skin cancer among outdoor high school athletes before and after the educational intervention.
    b. *Alternative Hypothesis:* There will be a significant difference in the knowledge of sun exposure and risks for skin cancer among outdoor high school athletes before and after the educational intervention.
4. RQ4: What is the effect of educational intervention on willingness to apply sunscreen if it is made readily available among outdoor high school athletes?
    a. *Null Hypothesis:* There will be no significant difference in the willingness to apply sunscreen if made readily available among outdoor high school athletes before and after the educational intervention.
    b. *Alternative Hypothesis:* There will be a significant difference in the willingness to apply sunscreen if made readily available among outdoor high school athletes before and after the educational intervention.

Theoretical Framework

Theories are the pillar of every well-planned intervention. According to Kerlinger (1986), "a theory is a set of interrelated concepts, definitions, and propositions that present a systematic view of events or situations by specifying relations among variables, in order to explain and predict events or situations" (as cited in Glantz, Rimer, & Viswanath, 2008, p. 26). Social Cognitive Theory (SCT), developed by Bandura in 1986, was the theoretical framework utilized in this study. Social Cognitive Theory states that learning is an interaction between a person and his or her environment, cognitive processes, and behavior, which is referred to as reciprocal determinism (Bandura, 1986). A basic premise of SCT is that people learn not only through their own experiences but also by observing the actions of others and the results of those actions. Although different sources discuss the components in different ways, there are several major constructs associated with this theory that are grouped into five categories: 1) psychological determinants of behavior, 2) observational learning, 3) environmental determinants of behavior, 4) self-regulation, and 5) moral disengagement. The SCT is very complex and includes many key constructs. Behavioral capability, expectations, expectancies, self-control, emotional coping responses, reciprocal determinism, and self-efficacy are a few of the constructs of the SCT (Glanz et al., 2008). For this study, the constructs including reciprocal determinism, observational learning, outcome expectations, self-efficacy, and facilitation were emphasized for analysis of attitudes, knowledge, and sun-protective behaviors among outdoor high school athletes. These athletes were in the environment surrounded by teammates, coaches, athletic trainers, athletic directors, and administrative staff, therefore, it was important to understand that individual behavior change is almost always rooted in one or more environmental levels and that

the methods for individual change need to be supplemented with methods for change at those environmental levels.

Reciprocal Determinism

The first construct, reciprocal determinism, means that behavior and the environment are reciprocal systems and that the influence is in both directions. That is, the environment in which high school athletes train, study, and live, may enable, hinder, or maintain their sun-protective behaviors, but athletes, in return, can also actively create and change their environment as well. The athletes' environments can assist in understanding and explaining athletes' attitudes toward their personal behaviors as well as observing teammates and coaches' sun-protective behaviors. Policies that shape the social or physical environment are often seen as the key to implementing sustainable health promotion programs into a social system. Sun-protective environmental and institutional policies that can help athletes to practice sun protection may include increasing the availability of sunscreen and protective apparel, adding sun-protective features to the sport physical environment, including shading, and implementing certain clothing guidelines, restrictions on outdoor activities during peak UV exposure hours.

Observational Learning

Observational learning is referred to as modeling in various literature, stating that people learn about what to expect through the experience with others. The sun safety habits athletes acquire during their high school and collegiate careers have a good chance of remaining with them throughout their lives. Sun protection and avoidance of ultraviolet exposure usually refer to specific behaviors by an individual, such as staying in the shade, limiting sun exposure during the midday hours when ultraviolet radiation is most intense, not using tanning beds, applying,

and reapplying sunscreen. Theories of health behavior at the interpersonal level assume that individuals exist in an environment where other people's actions, opinions, attitudes, thoughts, and support affect their own feelings, attitudes, behaviors. For high school athletes, such significant individuals can include family members, teammates, coaches, athletic directors, athletic trainers, team physicians, and other entities (i.e. teachers, classmates, and friends) that can be influential for them. Modeling is a useful method for attitude and behavior change and can be applied with high school student-athletes with the help of coaches and athletic trainers. Modeling is a strong method but only when certain parameters are met, for instance, in the reinforcement of the modeled behavior. People do not just behave in the desired manner because a model shows that behavior; they follow the model when the model is reinforced for that behavior and when they expect to be reinforced in a similar way (Bartholomew, Parcel, Kok, Gottlieb, & Fernandez, 2011). A study by Wysong, Gladstone, Kim, Lingala, and Copeland (2012) emphasized the importance of role modeling and the influences coaches and athletic department staff have on the attitudes, behaviors, and perceptions of collegiate athletes. High school athletes represent a large group of individuals with unique risk factors for skin cancer. These athletes are young people who can be affected by behavioral and verbal cues from the people around them, such as teachers, administrative staff, athletic trainers, and specifically coaching staff.

Outcome Expectations

Despite health campaigns to raise public awareness of ultraviolet radiation, sun-protective practices still fall behind. A plausible explanation is the lack of behavioral change in the populations at risk (Diao & Lee, 2014). Outcome expectations are beliefs about the

likelihood and value of the consequences of behavioral choices. Outcome expectations were used to identify the factors that relate to understanding the attitudes regarding sun exposure and skin cancer and sun-protective behaviors among athletes. The outcome expectations helped to guide the process of trying to identify and understand what affects athletes' attitudes and their sun-protective behaviors.

Self-Efficacy

Self-efficacy is defined as the conviction that one can successfully execute the behavior required to produce the outcomes (Glantz, Rimer, & Viswanath, 2008). Belief in one's ability to apply sunscreen effectively would have demonstrated confidence in performing a positive health action. Self-efficacy of athletes will become very important in understanding whether athletes will be able and will feel confident that they can change or improve sun-protective behaviors.

Facilitation

The facilitation construct of the SCT involves providing tools, resources, or environmental changes that make new behaviors easier to perform. Considering the culture of the target population is very important to choose proper mechanisms to achieve attention to skin cancer prevention. The language used in the health messages or in the visual aids needs to be accepted and understood by this age group. High school athletes need the knowledge, tools, and incentives to modify their sun-protective behavior.

Definition of Theoretical Concepts

The following constitute the theoretical definitions of Social Cognitive Theory constructs (Glanz et al., 2008):

- Reciprocal Determinism: Environmental factors influence individuals and groups, but individuals and groups can also influence their environments and regulate their own behavior.
- Observational Learning: Learning to perform new behaviors by exposure to interpersonal or media displays of them, particularly through peer modeling.
- Outcome Expectations: Beliefs about the likelihood and value of the consequences of behavioral choices.
- Self-efficacy: Beliefs about the personal ability to perform behaviors that bring desired outcomes.
- Facilitation: Providing tools, resources, or environmental changes that make new behaviors easier to perform.

Operational Definitions

The following definitions are provided to ensure uniformity and understanding of these terms throughout the study.

- Actinic keratoses: A precancerous, crusty, scaly growth caused by damage from exposure to ultraviolet (UV) radiation.
- Basal Cell Carcinoma (BCC): Abnormal, uncontrolled growths or lesions that arise in the skin's basal cells, which line the deepest layer of the epidermis (the outermost layer of the skin).
- Collegiate athlete: A participant in an organized competitive sport sponsored by the educational institution in which he or she is enrolled.

- Melanoma: A highly malignant tumor that starts in melanocytes of normal skin or moles and metastasizes rapidly and widely.
- Non-melanoma skin cancer: Two of the three main types of skin cancer (basal cell carcinoma and squamous cell carcinoma).
- Outdoor high school athlete: A participant in an organized outdoor sport (e.g. football, tennis or track and field) sponsored by a high school (9-12 grade).
- Squamous Cell Carcinoma (SCC): An uncontrolled growth of abnormal cells arising in the squamous cells, which compose most of the skin's upper layers (the epidermis).
- Sunscreen: A broad spectrum cream, lotion, gel, wax stick, or spray formulation containing chemical ingredients that protect the skin by blocking damaging ultraviolet A and B radiation from the sun with a sun protective factor (SPF) of 15 or greater.
- Sun-protective behaviors: The behaviors that include using sunscreen, wearing protective clothing, seeking shade when going outside, and avoiding indoor tanning.

Assumptions and Limitations

The main limitation to this study was the use of a convenience sample of athletes selected from only one high school, therefore, caution should be exercised in extending the findings to other high schools, especially high schools located in other geographical regions. Another limitation was the reliance on self-report and lack of objective measures of behavior or use of sunscreen and other sun-protective behaviors among high school athletes. Participants were required to determine their own skin type based on the brief description of the type included in the survey. The survey was constructed specifically for this study, therefore, the questionnaire itself has not undergone rigorous reliability or validity testing. The survey was administered

during the late fall (primarily December) which may not truly reflect the patterns of seasonal sunscreen use by the participants. The main assumption of this study was that all participants answered all survey questions honestly and to the best of their abilities.

Chapter Summary

Skin cancer is a significant public health problem. The athletes, specifically those engaged in year-round outdoor sports, such as softball, baseball, football, soccer, tennis, golf, track and field, and cross country, are exposed to chronic and intense UV rays from a young age resulting in an increased risk for skin cancer. Examining risk behaviors, perceptions, attitudes, knowledge of skin cancer and associated sunscreen use in this high-risk population is of high importance to prevent skin cancer and promote long-term health. Coaches, athletic trainers, and athletic coordinators are well-positioned in high school athletic settings to interact with this population and provide important resources and education on skin cancer prevention behaviors and long-term wellness.

CHAPTER II

REVIEW OF LITERATURE

According to the World Health Organization ([WHO], 2017), the incidence of skin cancer has increased in the last three decades in the United States and globally. One in five Americans will develop skin cancer in the course of a lifetime and skin cancer cases outweigh all cases of cancers combined (ACS, 2021). Most skin cancers are preventable, but incidence rates continue to rise, leading the U.S. Surgeon General to deem skin cancer "a major public health problem (AAD, 2021)." The main predisposing factor in the development of all types of skin cancer is intermittent, excessive exposure to the ultraviolet radiation from the sun acquired throughout the lifetime while participating in outdoor activities. Among the young population at risk, outdoor athletes represent a target group for skin cancer prevention and the development of protective strategies. Key aspects in combating this public health epidemic among athletes are altering the beliefs, perceptions, and attitudes about the disease and improving sun-protective behavior, specifically sunscreen application practices.

For the purposes of clarity, the literature review is broken down and organized into the following conceptual areas: a) overview of cancer as a disease, b) etiology of skin cancer, c) risk factors for skin cancer, including ultraviolet radiation, d) skin cancer prevention and education,

e) vulnerable populations at risk, and f) skin cancer risk for athletes, g) sunscreen use by athletes and barriers to its use.

Cancer as a Public Health Issue

According to the World Health Organization (2021), cancer is a leading cause of death worldwide, accounting for 8.8 million deaths in 2015 and the number of new cases is expected to rise by about 70% over the next two decades. By 2025 an estimated 2.1 million people in the United States will be diagnosed with cancer every year (National Cancer Institute [NCI], 2017). This is a 31% increase from 2012 that is due in part to the aging of the U.S. population and the greater use of cancer screening. The estimated number of annual cancer-related deaths is expected to increase even faster, by 37%, from 620,000 to 850,000 by 2025. The word cancer does not refer to one disease, but rather to a group of more than a hundred diseases, characterized by abnormal cell growth, that can affect any part of the body (Hale, 2015). Cancer is characterized by uncontrolled growth and the spread of abnormal cells (Anspaugh & Ezell, 2013). Cancer arises from the transformation of normal cells into tumor cells in a multistage process that generally progresses from a precancerous lesion to a malignant tumor.

These changes are the result of the interaction between a person's genetic factors and three categories of external agents, including: 1) physical carcinogens, such as ultraviolet and ionizing radiation, 2) chemical carcinogens, such as asbestos, components of tobacco smoke, aflatoxin, and arsenic, and 3) biological carcinogens, such as infections from certain viruses, bacteria, or parasites (WHO, 2017). This increase in the incidence of cancer cases makes a compelling case for improvements in cancer prevention and according to the American Cancer Society (2017) between 30 to 50% of cancers currently can be prevented.

Etiology of Skin Cancer

There are over a hundred different types of cancer and they all are classified according to the type of cell and the organ in which they originate. Skin cancer is the type of cancer that starts in the skin. The skin protects against heat, sunlight, injury, infection, helps control body temperature, and stores water and fat. Skin cancer begins in the epidermis (outer layer), which is made up of squamous cells, basal cells, and melanocytes. Skin cancer is the most common form of cancer in the United States with nearly five million people being treated for skin cancer each year, at a cost of $8.1 billion (Guy, Machlin, Ekwueme, & Yabroff, 2015*).* According to the American Cancer Society (2017), one in five Americans will develop skin cancer in the course of a lifetime and each year there are more new cases of skin cancer than the combined incidence of cancers of the female breast (252,710), prostate (161,360), lung (222,500) and colorectal (135,430). Skin cancer cases do not just outweigh these four main types of cancer; they outweigh all cases of cancers combined.

The three most common types of skin cancer, in order of incidence, are basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma. Basal cell cancer is the most common form of skin cancer and typically affects the head, neck, and trunk. Cutaneous BCC alone is thought to be more common than any other cancer, accounting for nearly three out of four skin cancers, and can be disfiguring, but is generally treatable (Lomas, Leonardi-Bee, & Bath-Hextall, 2012). BCCs are often associated with sunburns and intermittent sun exposure. It can appear as a small dome-shaped bump or papule with a pearly translucent surface or as a pimple-like lesion that will not heal completely (Wiggs, 2007). Treatment is important because BCC can grow wide and deep, destroying skin tissue and bone, and if left untreated, BCC can get

infected or cause disfigurement. The second most common skin cancer is squamous cell cancer, which has been linked to chronic sun exposure (Zanetti et al., 2001). It often presents clinically on the skin as a raised pink papule or plaque that is scaly, crusted, eroded, or ulcerated (Wiggs, 2007). SCCs are most prevalent on sun-exposed areas of the skin with the majority (approximately 60% of the cases located on the head and neck (Rudolf & Zelac, 2004). Although cutaneous SCC is less common than BCC, it is somewhat more aggressive and more inclined to spread and as a result can lead to death.

The incidence of squamous cell carcinoma has been on the rise with increases up to 200% over the past three decades in the United States (Karia, Han, & Schmults, 2013). About 20% of the 3.5 million known new non-melanoma skin cancers diagnosed in 2.2 million Americans each year are squamous cell carcinomas. Treatment is important because SCC can also grow deep, destroying tissue and even bone. In some cases, SCC spreads to lymph nodes and other parts of the body. Like BCC, SCC can get infected and cause disfigurement. Surgical removal of skin cancer is generally considered the best option for treatment. Mohs micrographic surgery is a specialized treatment performed for the removal of certain skin cancers located on the head, face, and neck. Other treatment options for cutaneous malignancies include cryotherapy, electrodessication and curettage, radiation therapy, and chemotherapy (Wiggs, 2007). Cases are underreported because non-melanoma skin cancers (NMSC) do not have to be recorded with the cancer registries (AAD, 2016). Melanoma is the most serious form of skin cancer because of its tendency to spread to other organs in the body. Cutaneous melanoma is a malignant cancer of the skin originating from melanocytes, the cells found throughout the lower part of the skin's epidermis, that are responsible for producing melanin, the pigment that gives

skin its natural color (Eisemann, Waldmann, Garbe, & Katalinic, 2014). Melanoma can start in a normally pigmented skin, but according to the American Academy of Dermatology (2015), an estimated 95% of cases of melanoma arise from an existing mole or birthmark.

Melanoma is readily detectable and usually curable if treated early, but it progresses faster than other types of skin cancer and can spread beyond the skin to affect numerous parts of the body, including the bones or brain. Once this occurs, melanoma becomes very difficult to treat and is incurable. Melanoma is less common than BCC and SCC but is the skin cancer that is responsible for the most deaths and is also the most common skin cancer for which incidence and mortality data are systematically tracked in the U.S. (Watson, Holman, & Maguire-Eisen, 2016). Rates of melanoma have increased over the past 30 years, especially in young white women and older white men (Teague, Mackenzie, & Rosenthal, 2013). According to the American Cancer Society (2017), there are 87,110 estimated new cases of melanoma (males = 52,170 and females = 34,940) with 9,730 of them are expected to result in death. Usually, delays in reporting melanoma cases to cancer registries are more common since they are usually diagnosed and treated in non-hospital settings such as physician offices (CDC, 2017).

For many patients, the diagnosis of BCC and SCC may come as a welcome relief since it is not a more serious diagnosis of melanoma, the deadliest form of skin cancer. However, according to the American Academy of Dermatology (2015), dermatologists are concerned that patients are not taking a non-melanoma skin cancer diagnosis as seriously as they should and point out that there are common misconceptions among the public that these types of skin cancer do not spread and do not require surgical treatment. In reality, BCC and SCC are the two most common forms of skin cancer and pose a significant health threat if left untreated.

The quality of life (QOL) of a person dealing with skin cancer can be impacted significantly by surgery, chemotherapy, and radiation therapy. The cases of NMSC often involve an area of the body that is visible to the self and others, with approximately 80% occurring on the face, with the highest rate of tumor recurrence (Roberts, Czajkowska, Radiotis, & Korner, 2012). While many people may know that skin cancer can kill them, few individuals realize how disfiguring it can be. While the cure rate is high, many of the patients may lose their nose, an eye, or ear if the invasive skin cancer is not detected and treated early. Surgical removal of the affected skin is the most effective treatment for squamous cell carcinoma and melanoma and involves removing the entire affected area along with a border of normal-appearing skin. The surgery can be traumatic, the recovery long, and the results devastating. Having a face disfigured can destroy a person's self-esteem and can lead to severe depression, causing a loss of employment or social interactions. It is a particular concern for younger patients for whom visible disfigurement from tumor excision may threaten self-esteem and self-confidence (Kneier, 2003).

Clinical experiences indicate that patients experience significant stress, anxiety, and emotional strain, especially during the surgical treatment. The article by Hewitt, Rowland, and Rosemary (2003) indicated that psychological problems among cancer survivors are common and may include fear of recurrence and death, anxiety and depression, feelings of alienation or isolation, problems with interpersonal relationships, and economic hardships related to the cost of care, job loss, and employment and insurance discrimination. The experience of cancer can also lead to the development of post-traumatic stress disorder (PTSD), including such risk factors as past experience of stressful life events, history of psychological disorders, high level of

distress prior to cancer diagnosis, coping through avoidance, poor social support and worse physical functioning (Gregurek, Bras, Dordevic, Ratkovic, & Brakovic, 2010). Numerous scientific studies tried to explain possible connections between psychological factors, especially depression, and the development and progression of cancer but often with very different results and contradictory conclusions. There is strong evidence of cancer-depression association, with depression prevalence from 20 to 50% with significant tumors. One-third of patients with cancer will experience distress, which requires evaluation and treatment, and the most common psychiatric disorders are depression, anxiety disorders, posttraumatic stress disorder, and adjustment disorders (Gregurek at al., 2010). An estimated 16 to 25% of newly diagnosed patients with cancer experience symptoms of depression. Sixty to seventy percent of cases are in the head and neck region and 80% of those cases are located on the face (Radiotis, Roberts, Czajkowska, Khanna, & Korner, 2014).

Despite the wide prevalence of skin cancer in our nation, the research devoted to psychological and psychosocial issues post-treatment is still lacking. The NMSC is the most common cancer worldwide, yet only a few studies have investigated the psychosocial implications of the disease. In 2013, Roberts and colleagues found that 19% of skin cancer patients experience significant levels of psychological distress. Concern for the associated threats to function and well-being of cancer survivors urged researchers to look into issues related to QOL following cancer treatment. The study by Radiotis et al. (2014), found 31% of patients with NMSC reported a moderate-to-large impairment in QOL domains such as affect, leisure, daily activities, and physical symptoms related to the diagnosis. In general, people might experience

certain negative post-surgery consequences, such as absenteeism from work and school, loss of income, and low self-esteem.

Risk Factors for Skin Cancer

Most cases of skin cancer are caused by a combination of non-modifiable and modifiable factors. Genetic factors are not controllable and can play an important role in skin cancer development (Anspaugh & Ezell, 2013). The following individual characteristics increase the risk of skin cancer: having a naturally fair skin tone, light-colored eyes, blonde or red hair, a large number of moles and skin that burns, freckles, reddens, or becomes painful after too much time in the sun. Tendency to sunburn with Fitzpatrick skin phototype I and II (white skin, does not tan or tans with difficulty, and burns easily) is also associated with increased risk, whereas melanoma occurs much less frequently in people with type V and VI skin (brown or black skin, tans easily, and usually does not or never burns) (Goldsmith et al., 2012).

People who have a close relative, parent, sibling, or child, with a specific type of skin cancer (especially melanoma) may be at greater risk of developing the disease than the general population (Chen et al., 2014). The rate of people getting or dying from melanoma of the skin varies by race and ethnicity. In a 2013 report, among men, white men had the highest rate of getting melanoma of the skin, followed by American Indian/Alaska Native, Hispanic, Asian/Pacific Islander, and Black men. Among women, white women had the highest rate of getting melanoma of the skin, followed by Hispanic, American Indian/Alaska Native, Asian/Pacific Islander, and Black women (CDC, 2017). It is a popular misconception that only fair-skinned people need to be concerned about overexposure to the sun. Darker skin has more protective melanin pigment, and the incidence of skin cancer is lower in dark-skinned people.

However, skin cancers do occur with this group and unfortunately, they are often detected at a later, more dangerous stage, and have poorer survival outcomes. One study showed that African Americans and Hispanics diagnosed with cutaneous melanoma are more likely to present with more advanced stages of disease at diagnosis and have higher rates of mortality than their nonminority counterparts (Chikoti, Wesley, & Jackson, 2013). Differences in prognosis and survival rates may also be related to socioeconomic factors, which may include insurance or transportation disparities that delay diagnosis and treatment (Harvey, Patel, Sandhu, Wallington, & Hinds, 2014).

Although genetics have a great influence on skin cancer risk, nearly all skin cancers are also related to ultraviolet (UV) exposure. A few years ago, the United States Environmental Protection Agency (USEPA), in cooperation with the National Weather Service (NWS), adapted the Ultraviolet Index as an initial step in a national program of public education about the dangers of sun exposure. According to NWS (2017), The *UV Index* is a next day forecast of the amount of skin-damaging UV radiation expected to reach the earth's surface at the time when the sun is highest in the sky, ranging from 0 (at night time) to 15 or 16 (in the tropics at high elevations under clear skies). UV exposure is the most common modifiable risk factor for skin cancer. Ultraviolet damage occurs in the skin after chronic or intense exposure to the harmful rays of the sun, known as UV radiation (UVR). Ultraviolet radiation produces mutations in deoxyribonucleic acid (DNA) affecting the tumor-suppressor gene P53 which allows for abnormal cell growth and uncontrolled cellular proliferation (Alam & Ratner, 2001). Ultraviolet exposure stimulates melanocytes to produce melanin, which can appear as tanned skin and indicates damage to the skin, skin cells, and DNA. There are three types of UV radiation: UVA,

UVB, and UVC. Whereas UVC rays (wavelengths of 100-280 nm) are absorbed by the atmospheric ozone, most radiation in the UVA range (315-400 nm) and about 10% of the UVB rays (280-315 nm) reach the Earth's surface. UVA rays that penetrate deep into the skin are primarily responsible for premature skin aging. UVB creates a tan, but overexposure to UVB rays causes sunburn. Sunburn, the best-known acute effect of excessive UV radiation exposure, indicates cell death (Gilechrest, Eller, Geller, & Yaar, 1999). Data from the 2010 National Health Interview Survey (NHIS) demonstrated that about 37% of women and 39% reported having experienced a sunburn in the past year, with 51% of them being adults under the age of 25 (NCI, 2017).

Both UVA and UVB are of major importance to human health. Small amounts of UV are essential for the production of vitamin D in people, yet overexposure may result in acute and chronic health effects on the skin, eye, and immune system (WHO, 2017). However, over the longer term, UV radiation induces degenerative changes in cells of the skin, fibrous tissue, and blood vessels leading to premature skin aging, uneven facial pigmentation, skin thinning, and actinic keratosis (a precancerous skin condition) (AAD, 2017; WHO, 2017). Exposure to ultraviolet radiation is a known risk factor for skin cancer and photoaging (wrinkles, uneven skin pigment, decreased elasticity, dryness, and roughness) (Gloster & Brodland, 1996). All forms of skin cancer are linked directly to ultraviolet light exposure, both UVA and UVB. According to the Skin Cancer Foundation (2017), more than 90% of the visible changes commonly attributed to skin aging are caused by the sun and about 90% of nonmelanoma skin cancers are associated with exposure to ultraviolet radiation from the sun. Traditionally scientists thought exposure to the B range of ultraviolet light, the wavelength of light responsible for sunburn poses the greatest

danger, but recent research indicated that the longer-wavelength ultraviolet A rays, which penetrate deeper into the skin, also play a major role in skin cancers (Hale, 2015). Various studies confirmed that chronic cumulative exposure, including occupational outdoor exposure, has been associated more commonly with BCC and SCC skin cancer, while melanoma is generally associated with intermittent exposure and a history of sunburn (Milon, Bulliard, Vuilleumier, Danuser, & Vernez, 2014; Gordon et al., 2015). The meta-analysis of 57 studies published before September 2002 by Gandini et al. (2005) demonstrated that intermittent sun exposure and sunburn history are shown to play considerable roles as risk factors for melanoma. Another study by Fears and colleagues (2002) studied the association between melanoma risk and average annual UV flux along with the usual outdoor exposure in men and women. A 10% increase in the average annual UV flux was associated with a 19% increase in individual odds for melanoma for men and 16% for women. In men, a 10% increase in hours outdoors was associated with a 2.8% increase in odds. Even in women who could develop a deep tan, a 10% increase in hours outdoors was associated with a 5.8% increase in odds. The results showed that the association between melanoma risk and average annual UVB flux was strong and consistent for men and for women (Fears et al., 2002). UV radiation varies dramatically both daily and seasonally, as well as by location (latitude and altitude). Individuals living in locations closer to the equator or at higher altitudes have been considered to be at the greatest risk for melanoma (Watson, Holman, and Maguire-Eisen, 2016). Another study found that melanoma risk did correlate with average annual UV exposure and residential history by residential history by country (Tatalovich, Wilson, Mack, Yan, & Cockburn, 2006).

The incidence of skin cancer has risen significantly over the past three decades, in part due to increased exposure to ultraviolet rays from the sun lamps at the tanning salons. Indoor tanning that involves using a tanning bed, booth, or sunlamp to get tan, exposes users to intense UV radiation. The UV exposure from tanning devices is usually significantly more intense than the UV exposure one would receive when outdoors, especially the levels of UVA (Gerber, Mathys, Moser, Bressoud, & Braun-Fahrlander, 2002). One study found that tanning devices expose users to an average of four to thirteen times the amount of UVA present in the noonday summer sun in Washington, DC (Hornung, Magee, Lee, Hansen, & Hsieh, 2003). According to a recent analysis of data on more than 400,000 people, more than one-third of all Americans, and nearly six out of ten U.S. university students, have used indoor tanning (Hale, 2015). According to the Skin Cancer Foundation ([SCF], 2017), more than 419,000 cases of skin cancer in the United States each year are linked to indoor tanning and more people develop skin cancer because of tanning than develop lung cancer because of smoking.

The International Agency for Research on Cancer, a World Health Organization affiliate, includes UV radiation and tanning beds (along with cigarettes) in Group 1: the group ranked as the most dangerous cancer-causing entities/substances (AAD, 2016). Another contributor to the rising incidence of skin cancer is excessive recreational sunbathing and overexposure to the sunlight during outdoor activities. The report entitled "Global burden of disease from solar ultraviolet radiation" published by the World Health Organization provided detailed estimates of UV-associated disease burden worldwide and estimated that annually around 1.5 mill DALYs (disability-adjusted life years) are lost through excessive UV exposure (Lucas, McMichael, Smith, & Armstrong, 2006). Experts believe that four out of five cases of skin cancer could be

prevented, as UV damage is mostly avoidable. In 1992, after reviewing all the evidence for the carcinogenicity of solar and ultraviolet radiation, an expert working group of the International Agency for Research on Cancer concluded that there was sufficient evidence in humans for the carcinogenicity of solar radiation and its causes of cutaneous malignant melanoma and non-melanocytic skin cancer (Armstrong & Kricker, 2001). All the epidemiological evidence that has accumulated since then has strengthened this conclusion.

Skin Cancer Prevention, Early Detection, and Education

Most skin cancers are preventable, but incidence rates continue to rise, leading the US Surgeon General to deem skin cancer "a major public health problem (AAD, 2017)." The Healthy People 2020 Guidelines aim to decrease the melanoma mortality rate in the United States from 2.7 deaths per 100,000 persons occurred in 2007 to 2.4 deaths per 100,000 population during the next 10 years (Healthy People, 2017). The initiative also seeks to increase the proportion of people using primary and secondary skin cancer prevention strategies. Primary prevention strategies are the steps taken to keep the malignancy from developing through the use of sun-protective measures. Secondary prevention efforts focus on activities to detect skin cancers early in asymptomatic persons and include skin evaluations by a dermatologist and skin self-examination (Mahon, 2003). The Centers for Disease Control and Prevention (2017), along with other health organizations, recommends easy options for protection from UV radiation, such as: 1) seeking shade during the midday hours when the sun's UV rays are the strongest (between 10 am and 4 pm), 2) wearing sun-protective clothing, such as a long-sleeved shirt, a wide-brimmed hat, and sunglasses, 3) applying and reapplying a broad-spectrum, water-resistant

sunscreen with a Sun Protection Factor (SPF) of 15 or more to all exposed skin, and 4) avoiding indoor tanning.

Besides other risk factors, including genetics and immunity, UV radiation has been established as the most important risk factor for both melanoma and nonmelanoma skin cancer. The most effective way to reduce the risk for skin cancer is to limit UV exposure, whether from the sun or from UV lights in tanning salons, but when it is not possible the sun-protective behaviors become the top tool for the prevention of skin cancer. Sun-protective behaviors are most needed when UV intensity is greatest, which occurs during the summertime and between 10 a.m. and 4 p.m. as approximately 60% of the total ultraviolet radiation is received during these hours. However, UV rays can reach a person on cloudy and hazy days, as well as bright and sunny days. UV rays can also reflect off surfaces like water, cement, sand, and snow. For some regions of the United States, such as the southeast and southwest, UV intensity is high year-round. UV rays from sunlight are the greatest during the late spring and early summer in North America (CDC, 2017). Based on the evidence, engaging in sun-protective behaviors while spending time outside can reduce an individual's exposure to UV radiation and sunburn. Avoiding sunburns and intermittent high-intensity sun exposure, especially in children, teens, and young adults reduces the chances of getting melanoma skin cancer. Although any amount of UV exposure can affect skin cancer risk, entirely avoiding UV from the sun is neither realistic nor advisable as spending time outside is shown to improve mental health, decrease vitamin D deficiency, and increase physical activity (Grinde & Patil, 2009; Thompson et al., 2011). To help maximize a person’s sun protection, multiple sun-protective behaviors should be practiced. Seeking shade can reduce the risk of sunburn, thus, one of the goals of the Surgeon General’s

Call to Action to Prevent Skin Cancer is to increase the availability of shade in outdoor recreation, education, and workplace environments (NCI, 2017). The relatively simple installation of a shade cloth reduces sun exposure by 60% (Emmons & Golditz, 2001).

Additional behaviors such as wearing sunglasses and sun-protective clothing, including long-sleeve shirts, long pants, and wide-brim hats, can help prevent excessive exposure to UV rays. Clothing provides the ideal barrier from the sun. A brim size of three inches can lead to a 70% reduction of UV rays exposure to the head and neck (Marks, 1996) and specialized sunglasses can reduce UV rays exposure to the eye by 80% (Mahon, 2003). In contrast to sunscreen, clothing is relatively cheap and does not rub off. Loose-fitting clothing and a wide-brimmed hat are recommended essentials for sun protection. However, photodamage can still occur, as the garment's design, the type and structure of the fabric, its color and tightness, and whether it is wet or dry determine its effectiveness in protecting against UV radiation. In general, synthetic materials provide better protection against ultraviolet than cotton materials. Densely woven material provides a reflective barrier, while darker materials also provide more protection. Over the past few years, the concept of a so-called Ultraviolet Protection Factor (UPF) has been introduced, and in some countries, manufacturers include the UPF with their garment labeling. The UPF is a measure of the protection against UV radiation provided by an item of clothing and is the equivalent of the sun protection factor for sunscreens. The higher the UPF value, the less UV radiation reaches the skin and the better the protection against sunburn and other harmful effects. Unfortunately, an international standard for the concept of the UPF has not been developed yet (WHO, 2017).

The American Cancer Society, the Centers for Disease Control and Prevention, the Skin Cancer Foundation, the World Health Organization, and the American Academy of Dermatology (2017) are only a few of the many health organizations that endorse the use of a broad-spectrum sunscreen as a protective product in the prevention of skin cancer. Sunscreens may contain physical or chemical barriers against the sun's rays. While physical barriers reflect or scatter the UV rays, chemical barriers act by absorbing the UV radiation before it hits the skin. In 2011, the U.S. Food and Drug Administration (USDA) updated regulations on sunscreen labeling to help consumers select and properly use sunscreens. The newly established regulations stated that all sunscreens should be "broad spectrum" products providing protective coverage from both UVA and UVB rays and also a sunscreen can no longer claim to be waterproof or sweat-proof. The common SPF label on the tube stands for sun protection factor, a measure of how much UVB the sunscreen can block. Sunscreens are rated for their UVR absorption under strict laboratory conditions. The numbers range from two and upwards to 100 (WHO, 2017). An SPF 15 sunscreen will absorb 92% of UV, an SPF 30 will absorb 96.7% of UV, and SPF 40 will absorb 97.5% of UV (Farmer & Naylor, 1996). The effectiveness of a particular sunscreen agent is affected by an individual's body site of application, degree of normal skin color, the thickness of the epidermis, time of day, time of year, cloud cover, ozone levels, reflection, and UVR scatter. Because most people typically apply less sunscreen than it is used in laboratories to establish the SPF number, actual SPF protection afforded is often 20 to 50% of the number on the label (Mayer, 2000). Approximately one ounce of sunscreen is needed to cover the entire body (AAD, 2017). According to the National Cancer Institute (2017), to ensure the ultimate protection against harmful UV rays, sunscreen needs to be broad-spectrum, contain an SPF of 15 or higher,

applied thickly and evenly to all exposed parts of a body, such as ears, nose, forehead, and neck, with an appropriate amount (approximately 35 ml of sunscreen must be applied to the total body surface of an adult), applied about 15 minutes before going outside, and be reapplied every two hours, especially after swimming or other sporting activities. Furthermore, according to a few different studies, if used properly, regular sunscreen use can reduce the risk for skin cancer (Green, Williams, Logan, & Strutton, 2011; van der Pols, Williams, Pandeya, Logan, & Green, 2006) and prevent or delay photoaging of the skin (Hughes, Williams, Baker, & Green, 2013). Sunscreens are effective in preventing many of the immunologic effects of UV exposure. Sunscreens can prevent sunburn, premature photoaging, as well as some skin cancers (Naylor & Farmer, 1997). A randomized controlled trial of 1383 participants in southeast Australia confirmed that sunscreen helps to prevent skin lesions, specifically cutaneous squamous-cell carcinoma and that topical barrier between solar ultraviolet light and the epidermis does prevent skin cancer (Hill, 1999; Green et al., 1999). Sunscreen alone does not provide complete protection from the harmful effects of the sun and should be used in combination with other sun-protective measures.

Skin cancer secondary prevention strategies are often defined as screening by a dermatologist and skin self-surveillance (Mahon, 2003). A thorough examination by a trained clinician can be accomplished in an average of seven minutes. Since the diagnosis of skin cancer is high when screening is performed by a trained clinician, the AAD has promoted various free skin cancer education and screening programs in the United States since 1985. Although dermatologists may have the most expertise in recognizing various forms of cancer, their practice is often limited to persons at high risk for developing melanoma. As a result, skin self-

examination can be an important and necessary tool to decrease the morbidity and mortality associated with all skin cancers. Everyone should know their own pattern of moles, blemishes, freckles, and other marks on the skin so they can notice changes during monthly self-exams. Key warning signs of non-melanoma skin cancers are new growth, a spot that is getting larger, or a visible sore that does not heal within three months (ACS, 2017). The skin self-examination, at this time, the best way to detect skin cancer early is to recognize changes in skin growths. Skin cancer can often occur in an existing mole or skin lesion, thus, it is important for every person to have an annual total-body skin screening and to perform self-skin exams on a monthly basis to monitor existing moles and freckles. A new or unusual lesion or a progressive change in the skin, such as a new growth, a sore that does not heal, or a change in a mole, is the most common sign of skin cancer. Melanoma usually starts as a small, mole-like growth that increases in size and changes color. While checking the whole body including the scalp, back, nails, and bottom of feet (with help of a hand mirror), a person needs to use the ABCDEs of Skin Cancer. A simple ABCDE rule outlines the warning signals of the most common type of melanoma: A is for asymmetry (mole has asymmetrical or irregular shape); B is for border irregularity (ragged, blurred, or jagged edges); C is for uneven color (pigmentation is not uniform); D is for diameter greater than 6 millimeters (the size of a pencil eraser); and E is for evolving mole (Goldsmith et al., 2012).

Educational interventions play an important role in decreasing the incidence of skin cancer in various vulnerable populations. The results of the randomized controlled trial indicated that a 2-year, multicomponent sun safety intervention that targeted 2662 letter carriers from 70 U.S. postal stations in Southern California was successful in increasing and sustaining regular

occupational use of sunscreen and wide-brim hats through the provision of the hat, accessible sunscreen, reminders, and six educational sessions (Mayer et al., 2007).

Educational programs aim to reduce sun exposure while competing in outdoor sports during their competitive seasons. Robinson and colleagues (2004) looked at the issue of preventive counseling by health care providers to determine whether communication dealing with sun protection is associated with skin-cancer-related prevention practices, detection self-efficacy, and knowledge. The data for the study was obtained from secondary analysis of two surveys of 1,469 randomly sampled farmers and soccer participants from southeast and coastal Georgia. The participants who received counseling on skin protection were more likely to wear sunscreen, receive clinical skin exams, and feel confident that they could identify unhealthy changes in their skin (Robinson et al., 2004). The findings suggest that counseling by health care providers can positively influence skin-cancer-related prevention practices, detection self-efficacy, and knowledge.

The Community Preventative Services Task Force ([Task Force], 2016), an independent, nonfederal, unpaid panel of public health and prevention experts provided evidence-based findings and recommendations about community preventative services, programs, and policies to improve health. Educational interventions generally provide information about sun safety and the effects of UV radiation. Messages delivered in lectures or through small media can be reinforced by modeling or role-playing (for children). Sun-protective environmental and policy changes include increasing the availability of sun-protective items (sunscreen or protective clothing), adding sun-protective features to the physical environment (shade structures), and implementing sun protection policies (clothing guidelines, restrictions on outdoor activities during peak

sunlight hours). The Task Force found sufficient evidence to recommend such intervention approaches in several community settings, specifically childcare centers, primary and middle schools, outdoor occupational settings, and outdoor recreational and tourism settings. At the time of the review, the Task Force found insufficient evidence to issue a recommendation regarding the effectiveness of such intervention strategies in high schools and colleges. Increasing sun-protective behaviors among high school and college students can be viewed as community-wide intervention, such interventions seek to increase sun-safety behaviors within a community by targeting a large part of the population in a defined area. The Task Force found sufficient evidence to recommend multi-component community-wide interventions to prevent skin cancer. Multi-component community-wide interventions use a combination of at least two or more strategies (individual directed strategies, mass media campaigns, and/ or environmental/policy approaches) across at least two or more settings within a defined geographic area (city, state province, country) in a coordinated effort to influence sun-safety behaviors. Since 2012, the U.S. Preventative Services Task Force (USPSTF) has recommended counseling children, adolescents, and young adults aged 10 to 24 years of age who have fair skin about minimizing their exposure to UV radiation to reduce the risk for skin cancer. The USPSTF found moderate-level evidence of a moderate net benefit of counseling among this population, with minimal harm.

Vulnerable Populations at Risk

Various studies examined different populations that are experiencing high exposure to sunlight due to their professional activities and can be vulnerable to the development of different types of skin cancer. Actinic keratosis and SCC are related to cumulative sun exposure and have been associated with people who have outdoor occupations. Two studies clearly demonstrated

that outdoor workers, such as post office carriers and farmers, are at increased risk of basal and squamous carcinomas (Mayer et al., 2007; Smith-Kroner & Brumbly, 2015). Outdoor workers are traditionally thought to be at increased risk of BCC and SCC, but not for melanoma, a pooled analysis combining 15 studies showed that outdoor workers in UV-intense areas were at increased risk of melanoma, specifically of the head and neck (Whiteman et al., 2006; Chang et al., 2009). Unfortunately, many skin cancer and various occupations are often limited by a lack of information regarding other vital factors, such as protective gear used, socioeconomic factors, and recreational exposure outside of work.

Evidence suggests that the best way to reduce the incidence of skin cancer is to reduce ultraviolet radiation exposure. Despite the evidence, many people remain unprotected from the harmful rays. Since the prevalence of skin cancer is directly related to sun-protective behavior among specific populations it is important to analyze sun-protective behavior rates. National surveys supported by the CDC indicate that U.S. youth and adults are being exposed to ultraviolet radiation and can do more to protect themselves. According to the CDC, in 2010 only 31% reported applying sunscreen with an SPF of 15 or higher, 40% reported wearing sun-protective clothing and 37% reported seeking shade. Only 60% of young adults aged 18 to 24 used one or more sun protective methods (using sunscreen, wearing sun-protective clothing, or seeking shade), while 72% of those 25 years of age and older reported using one or more methods.

The incidence of basal cell and squamous cell cancers is increasing among men and women under age 40. Melanoma has become the most common cancer among young adults between ages 25 and 29 and the second most common cancer among young adults 15- to 24-

year-olds (Hales, 2015). The younger population tends to expose themselves to UV rays, whether through natural tanning or using tanning beds, more often than older adults. The study by Stanton, Moffatt, and Clavarino (2005) found that people ages 18 to 39 years were less likely to use sun protection than people 40 years of age or older. Some of the reasons identified by the participants were they were "lazy" and they "like a tan." These attitudes might be influenced by the fact that some young people in their 20s or 30s may feel invincible and believe that serious illnesses only happen to older people and as a result ignore sun safety guidelines. Contrary to popular belief, 80% of a person's lifetime sun exposure is not acquired before age 18; only about 23% of lifetime exposure occurs by age 18 and about 47% by age 40 (SCF, 2017).

Several studies have shown that in general many people do not apply sufficient amounts of sunscreen and therefore do not achieve the specified SPF. In 2013, the study by Holman et al. (2014) assessed patterns of sunscreen use on the face and other exposed skin among U.S. adults. The results revealed that only a few adults regularly used sunscreen on the face (men: 18.1%, women: 42.6%), other exposed skin (men: 19.9%, women: 34.4%), or both the face and other exposed skin (men: 14.3%, women: 29.9%). One study indicated that the use of sunscreen was more common among women than among men (Berndt et al., 2011). Such differences are probably attributed to women being more concerned with the aging effects of UVA rays and their impact on their appearance rather than their contribution to developing skin cancer. The study by Linos et al. (2011) revealed that although using sunscreen is the most common sun protective behavior (30%) among U.S. adults, frequent sunscreen use was not associated with fewer sunburns. However, the odds of multiple sunburns were significantly lower in individuals who frequently avoided the sun by seeking shade or wearing long sleeves (Linos et al., 2011).

According to National Health Interview Survey data, approximately one-third of adults "usually" or "always" use sunscreen when outdoors in the sun for one hour or more (NCI, 2012). The epidemiological data suggest that implementing sun protection will have the greatest impact if achieved as early as possible in life with possible positive impact later in life, especially in those who had high childhood exposure to solar radiation (Armstrong & Kricker, 2001).

Skin cancer risk behaviors are very prevalent among the younger population and as a result, they are experiencing high levels of UV radiation through exposure to sunlight during their outdoor and recreational activities. Among high school students, when they were outside for more than an hour on a sunny day, 14.4% of girls and 7.3% of boys reported they routinely used sunscreen with an SPF of 15 or higher. More than 13% of high school students said they had used an indoor tanning device one or more times in the past year. Indoor tanning device use was higher among female students (21%) than male students (6%). According to the CDC (2010), about one-third of U.S. teens aged 14 to 17 years had a sunburn during the past year. About half of non-Hispanic White teens, 22% of Hispanic teens, 18% of non-Hispanic Asian teens, and 7% of non-Hispanic Black teens had sunburn during the past year. More than one-third of the United States population reported a sunburn in the previous year, with rates higher among men and the non-Hispanic white population. Results closely corresponded with the previous data from the 2013 Youth Risk Behavior Survey, which indicated that only about 10% of U.S. high school students used sunscreen with an SPF of 15 or higher always or most of the time when outside for more than one hour on a sunny day. Another survey also detected a decrease in the prevalence of routine sunscreen use among high school students over time, dropping from 13.3% in 1999 to 10.1% in 2013 (Kann et al., 2014). Despite the risk of skin

cancer associated with sun exposure, in 2009, a total of 73.5% of high school students never or rarely wore sunscreen with an SPF of ≥15 when outside for >1 hour on a sunny day, as compared with 65.2% in 1999 (Jones, Saraiya, Miyymoto, & Berkowitz, 2012).

The analysis of the national surveys and case studies from 2007 to 2009 by Buller et al. (2011) revealed that just fewer than one in ten high school students routinely used sunscreen with an SPF of 15 or higher. Prevalence of routine sunscreen use decreased over the past, from 13.3% to 9.3% from 1999 to 2009. The reasons for reduced sunscreen use are unknown but increased media attention to potential benefits of vitamin D, sociocultural influences on tanning, and appearance reasons may have had some effect (Jones et al., 2012).

During earlier years, parents are primarily responsible for sun exposure, but during adolescence and as young adults individuals become increasingly responsible for their own sun exposure behaviors. It is of concern, therefore, that sun-protective behaviors deteriorate during the teenage years with high sunburn rates, poor protective clothing use, and poor compliance with the application of sunscreen (Grunfeld, 2004).

Skin Cancer Risk for Athletes

Few studies examined the relationship between the rise in the incidence of skin cancers and increasingly popular outdoor activities and recreational exposure. Basal cell carcinoma and malignant melanoma depend on high-dose of intermittent sun exposure and sunburns which can occur during recreational activities (Zanetti et al., 2001). Furthermore, a few studies indicate that athletes participating in outdoor sports are at risk for numerous dermatological concerns, including sunburns, basal cell carcinoma, squamous cell carcinoma, and melanoma. Sunburns, which correlate with skin cancer risk, occur commonly among athletes. Forty-eight percent of

226 skiers and snowboarders in the South Island of New Zealand recalled having suffered at least one sunburn while skiing or snowboarding (Price, Ness, Leary, & Kennedy, 2006). Sixty-nine percent of field hockey, surfers, soccer, and tennis players acknowledged sunburns during the previous sporting season. Surfing elicited the greatest prevalence of sunburns (93% in males and 84% in females) despite having the highest reported use and reapplication of sunscreen. The prolonged UV exposure and minimal clothing are worn during competition likely explain this finding (Lawler et al., 2007). One study of cyclists found that UV exposure during races exceeded international exposure limits by more than 30 times (Moehrle, Heinrich, Schmid, & Garbe, 2000). One of the most recent studies by Fernandez-Morano et al. (2016) found that among 102 skaters 56.8% reported having suffered at least one sunburn event the previous summer and 91.6% said they practiced outdoor sports more than 90 days per year. The study by Dozier, Wagner, Black, and Terracina (1997) found that the incidence of precancerous lesions and BCC was significantly greater in 49 Texas Gulf Coast surfers than in a self-selected population of similar age participating in a skin cancer screening program, with 41% having actinic keratoses and 16% had BCC. One case-control study demonstrated a risk increase in BCC in outdoor athletes (Rosso, Joris, & Zanetti, 1999) and a significant association between BCC and water sports, such as swimming, surfing, boating, and sailing (Rosso at al., 1996).

In certain sports with intense UV exposure, competition rules may hinder athletes from sun-protective behavior. For instance, in beach volleyball, the medical health certificate has to state that an athlete is able to play in beach volleyball competitions, which can last up to three hours of exposure to intense sunlight. Under such sun-intensive conditions, however, the official rules of the International Volleyball Federation do prescribe tiny sports tops and bottoms that

barely cover any skin (Moehrle, 2008). The study by Watson, Geller, Tucker, Guy, and Weinstock (2016) emphasized that melanomas are most commonly diagnosed on the trunk and lower extremity among females and on the trunk and upper extremity among males. These areas of the body typically remained uncovered by most traditional athletic attire. The study by Ambros-Rudolf et al. (2006) examined 210 marathon runners with matching age and sex control group looking for risk factors for malignant melanoma. The data showed that marathon runners had an increased amount of atypical melanocytic nevi (moles) and solar lentigines (lesions) than the control group. A few years ago, athletes participating in the Hawaii Ironman Triathlon, who spent on average between eight to nine hours outside, were not allowed to apply sunscreen on the upper arms and thighs to mark competition numbers onto the skin (Moehrle, 2001). The importance of sun protection for triathletes, who are among the likely candidates to get skin cancer, is being brought to light with help of spokespersons, such as IRONMAN and IRONMAN 70.3 world champion Leanda Cave who was diagnosed with skin cancer in 2013 (Skin Strong & IRONMAN, 2013).

Many other factors also predispose athletes to ultraviolet radiation and sun damage. During moderate and intense practices and workouts as a result due to physical exertion and environmental factors, athletes have a tendency to sweat. Sweating contributes to UV radiation-related skin damage by increasing the photosensitivity of the skin, thereby increasing the sunburn risk (Moehrle, 2008). The environment in which certain athletes practice and compete also contributes to the exposure risk. For example, athletes who train at high altitudes, such as skiers, experience increased levels of UV radiation (Moehrle, 2008). A study between various natural surfaces found a UV radiation reflection of 50 to 60% off the snow as compared to 10% off sand,

and 2 to 3% off the grass (Chadysiene & Girgzdys, 2008). One study highlighted this dual effect on UV radiation exposure by showing that skiers at noon, in Vail, Colorado, USA experienced nearly the same UVB intensity as those standing at sea level in Orlando, Florida, USA, at the same time (Rigel D., Rigel E., & Rigel A., 1999).

Long-term exposure to the sun is the biggest risk factor for all types of cancer. Outdoor athletes represent an important group at risk for skin cancer because they are routinely exposed to high levels of ultraviolet radiation. The two main groups of young adults that represent the target groups for skin cancer prevention and the development of protective strategies are collegiate and high school athletes. According to the NCAA student-athletes and the teams on which they compete continue to rise. For the tenth consecutive year, data from the NCAA Sports Sponsorship and Participation Rates Report shows a marked increase in athletics opportunities in sports for which the NCAA sponsors championships, with more than 460,000 student-athletes competing in 24 sports on more than 18,000 teams every year (NCAA, 2017).

Each year along with more than 460,000 collegiate athletes, there are nearly eight million students currently participating in high school athletics in the United States, with more than half of them experiencing large levels of UV radiation during lengthy outdoor practices and multiple-day tournaments (Dubas & Adams, 2012; NCAA, 2017). According to the National Federation of State High School Association (NFHS), in 2018-19 there were 7,937,491 participants in high school sports, with 1,093,621 athletes participating in outdoor track and field, 853,182 in soccer, 488,640 in cross-country, and 348,750 in tennis. Medical experts consider these athletes high-risk due to frequent, prolonged exposure to ultraviolet radiation. In addition, the athletic population's knowledge of risk is minimal (Bagatti, Englert, & Cline, 2016).

Numerous factors potentially place athletes at high risk for developing both melanoma and non-melanoma skin cancers: outdoor sports rarely practiced in the shade and excessive sun exposure. Collegiate and high school athletes spend numerous hours outdoors and for many of them, this regimen begins at an early age. Many practices and competitions tend to take place outside during the peak hours of UV radiation, specifically between 10 a.m. and 4 p.m. (Adams, 2006). One study of 290 NCAA collegiate athletes in 13 different sports found a mean outdoor training duration of four hours per day and 10 months per year equating to approximately 1,000 hours of sun exposure annually (Wysong, Gladstone, Kim, Lingala, & Copeland, 2012). This increased exposure to UV radiation results in sunburns; these severe sunburns in childhood and adolescence play a prominent role in melanoma development (Bruce & Brodland, 2000). The study by Armstrong and Kricker (2001) demonstrated that there was persuasive evidence that skin cancer risk increased with increasing average annual hours of bright sunlight. High temperatures during the practice and competition in the fall and spring seasons contribute to the hours of sun exposure the student-athletes are experiencing.

The study by Hobbs et al. (2014) assessed current skin cancer knowledge, attitudes, and behaviors among 343 athletes attending a Southern University in the United States. The survey results demonstrated that the majority of the athletes do not limit their sun exposure and reported low levels of sun-protective behaviors. In addition, athletes lacked knowledge about skin cancer and sun protection. Eighty-three percent of the athletes stated that tanning beds improve one's overall health. The race was significantly associated with skin cancer knowledge, whereas gender was found to be significantly associated with knowledge, attitudes, and behaviors towards skin cancer (Hobbs et al., 2014). A belief that tanned skin looks healthier and more attractive

when compared with untanned skin is one of the important factors contributing to different behaviors and attitudes of collegiate athletes regarding sun protection. The rise in the incidence of skin cancers over the past decades is strongly related to increasingly popular outdoor activities and the use of tanning beds. Even when college students perceive the seriousness of skin cancer, especially young women, describe suntanned skin as attractive, healthy, and athletic-looking and view the benefits of getting a suntan as outweighing the risks of skin cancer or premature aging (Hales, 2015). The influence of social norms and environment is an important determinant of many behaviors and can be found in many change objectives. Many young people consider intensive sunbathing to be normal as the tan is cosmetically desirable and has established itself as a symbol of attractiveness and good health. The results of the study by Stacia (2000) confirmed that a higher frequency of tanning behavior was related to more concern about one's appearance and the belief that having a tan improves one's appearance. The perceptions of tan did not seem to shift much in the last decade as the earlier study found that the participants indicated that a medium tan is perceived as healthiest and most attractive, and “no tan” is perceived as both least healthy and attractive. Generally, darker tans were judged relatively healthier and more attractive (Broadstock, Borland, & Gason, 1992).

Sunscreen Use as Sun-Protective Behavior by Athletes

Although avoidance of sun exposure is the most effective tool, it is not practical for those in outdoor athletics. Usually, tennis matches, baseball, softball, soccer games, and track meets take place during peak sun hours (between 10 am and 4 pm) without any protective shade available. Athletes may not be able to avoid sun exposure between the recommended time frames, have access to shaded areas, or wear additional protective clothing during practices and

competition. Sunscreens are effective in preventing many effects of UV exposure, such as photo-aging, cell mutations, and skin cancer (Wiggs, 2007). Therefore, increased use of sunscreen may be a practical goal for skin cancer prevention in this population. Even with the simple solution of sunscreen application, numerous studies revealed that sunscreen use among athletes in the United States and other countries remains low.

The researchers in Buenos Aires, Argentina noted that only 29 of 554 (5.2%) adolescent athletes (11–18 years), used sunscreen on a routine basis while playing sports (Laffargue, Merediz, Bujan, & Pierini, 2011). Additionally, according to the results of the study by Berndt et al. (2011), Australian soccer, surfing, tennis, and field hockey athletes used sunscreen inadequately 50% of the time and not at all 30% of the time. Sunscreen use was highest among the surfers and lowest among field hockey players. Dobbinson, Doyle, and Effendi (2005) observed sun-protective behaviors among cricket players and coaches during two consecutive weeks in mid-February of 2000, the peak of the Australian summer. Results indicated that there was limited use of shade by both players and coaches and only three percent of the participants used sunglasses. However, the average total body cover was high (approximately 90% for players and 80% for coaches). Since it is impractical to think that people can avoid sun exposure completely, the importance of protecting skin with the help of sunscreen becomes even more evident. A survey by Buller et al. (2012) of 4,837 adult skiers and snowboarders indicated that only 4.4% wore sunscreen of SPF 15 or higher, applied it up to 30 min before sun exposure, and reapplied after two hours. Ambros-Rudolf and colleagues (2006) also found that most marathon runners wore gear that only partially covered exposed body sites with only 56.2% reported regular use of sunscreen during training and competing.

Sunscreen use in college athletes involved in sports with high sun exposure has been limited (Hamant & Adams, 2006). The cross-sectional survey by Cohen, Tsai, and Puffer (2006) assessed various measures of sun-protective behavior, sun exposure, attitudes, and knowledge in 1,006 collegiate and high-school athletes in Southern California found that overall rates of sun-protective behavior are low. Results indicated that young athletes also reported high levels of ultraviolet radiation exposure, and high rates of sunburns, despite knowing the risks of sun exposure, and infrequent sun-protective behaviors, regardless of the level of athletic participation. The authors found no statistically significant differences between high school athletes and controls in their use of sun protection behaviors, even though athletes have significantly higher amounts of sun exposure than non-athletes (16.1 vs 10.1 hours/week). Compared to the control group, university athletes were more inclined to believe that sunscreen impairs performance (12.4 vs. 3.4%), and both groups identified "forgetting" to use sunscreen as the main barrier. Females in the high-burn group (skin Type I/II) were more likely than males to reapply sunscreen but were also more likely than their male counterparts to seek a tanned appearance (Cohen et al., 2006). Similar findings to Cohen et al. (2006) were observed by Berndt et al. (2011) in 237 athletes, ages 18 to 30, competing in soccer, surfing, hockey, and tennis, who were surveyed about their use of sunscreen on their last day of completion on a sunny day. Results found that 29.5% of these young adults reported not using sunscreen, while 47.3% reported inadequate use (failure to apply sunscreen 30 minutes prior to sun exposure, reapplying every two hours) that day.

The study by Hamant and Adams (2005) examined 186 male and female Midwestern college athletes who participated in four soccer and cross-country teams to determine sunscreen

use. The results revealed that 85% of them reported no sunscreen use over the previous seven days of practice. Additionally, there were no significant differences in sunscreen use between gender and sport or among ages, class level, and college/university. There was a significant difference among the mean sunscreen use in relation to self-reported skin type. Fair-skinned athletes more often wore sunscreen as compared to peers with a darker complexion. To expand on the results, Hamant and Adams (2006) conducted a follow-up study to evaluate the degree of sunscreen use among those athletes. The results revealed that eight percent of male and four percent of female athletes reported regular use of sunscreen (at least three of the previous seven days). Only 5% of soccer and 11% of cross-country athletes reported regular use. Fifty percent of the total comments were related to inconvenience and accessibility issues ("did not have it," "forgot it" or "it was too expensive"). A few athletes cited reasons based on bad information, including thinking that they did not need it because the weather was cloudy, or it was afternoon. Some said they had already burned during the summer so they did not need it; they had a base tan and did not need it; or they thought that it was good to be burned because it helped their acne. The findings of this study reveal a failure to practice adequate primary prevention of ultraviolet damage among the majority of athletes surveyed (Hamant & Adams, 2006). In another survey study by Ellis, Mohr, Indika, & Salkey (2012) of 274 collegiate athletes, with 70.07% of participants being females, only 11% reported consistent use of sunscreen (>75% of the time) and 60.95% reported rare use of sunscreen (<25% of the time).

The study by Wysong et al. (2012) investigated the relationship between athletic participation and sun-protective attitudes, knowledge, and behaviors among collegiate athletes. The results found that 96% of respondents believed sunscreen would help protect them from skin

cancer. Yet, 43% of the athletes surveyed reported never using sunscreen, 31% reported only using sunscreen 1-3 days per week, 18% reported using sunscreen four to six days per week, and 8% reported using sunscreen every day of the week. The participants trained outside for approximately 4 hours per day for 10 months per year. It is alarming statistics since one of the deadliest forms of cancer, melanoma, can be developed from single blistering sunburn. Despite high levels of sun exposure, nearly half of collegiate athletes don't use sunscreen.

A few main factors influencing sunscreen use include: living in a certain geographical area, female gender, number of sunburns in the past year, belief in the risk of skin cancer, knowing someone with skin cancer, and worry about wrinkles (Wysong at al., 2012). The answers by the athletes in the study by Wysong and colleagues demonstrated a list of several reasons for not using sunscreen. The most common was forgetting to use it (63%), followed by the inconvenience of use (41%), and "I like to be tan" (39%). Other reasons the athletes reported for not using sunscreen included: the belief that they don't burn (35%), the greasy feel of sunscreen (34%), and the time it takes for application (22%). Not surprisingly, sunburns were common among the participants. Nearly 84% reported experiencing at least one sunburn in the past year, with 28% reporting four or more and 10% reporting blistering sunburn. The study by Cohen et al. (2006) revealed similar results about attitudes, behaviors, and perceptions of the athletes. The participants listed several reasons for not using a sunscreen, such as forgetting to use it, followed by inconvenience, liking to be tan, feeling that sunscreen impairs their performance, believing that they don't burn, the feel of sunscreen, and time for application. Finally, 45% of 554 adolescent outdoor athletes stated that sun protection factor rating was not relevant to them, and 39% of 290 NCAA athletes liked to be tanned (Cohen et al., 2006).

Evidence shows that athletes have limited knowledge of their risk for melanoma, sun-protective behaviors, and harm from ultraviolet radiation. Many athletes do not limit their sun exposure and report low levels of sun-protective behaviors (Hobbs, Nahar, Ford, Bass, & Brodell, 2014). In the study assessing knowledge related to melanoma risk, only 20% of collegiate athletes understood the risk of prolonged, unprotected exposure such as sunburn or skin cancer (Bagatti et al., 2016). Another study revealed that 85% of athletes do not apply sunscreen before practice or games (Hobbs et al., 2014). Despite the simple solution of sunscreen application, studies have shown that sunscreen use in this at-risk population remains low. It could be related to many different perceptions and attitudes, including lack of knowledge regarding their risks for developing skin cancer, protective effects, along with perceptions of sunscreen interfering with their performance.

High school athletes have received little attention in skin cancer prevention research. There are few articles discussing physician-diagnosed skin and soft tissue infections in high school athletes but not specifically discussing the development and prevention of skin cancer. One study by Cohen, Tsai, and Puffer (2006) evaluated the use, knowledge, and perceptions of sun-protective behavior among 1006 students from two public high schools and one public university in the Los Angeles area. The results found that the use of sun-protective behaviors by the high school and university students in Southern California is low. Second, within these groups, athletes differed from their non-athlete peers in the use of various sun-protective behaviors, performing better in some areas and worse in others. Third, athletes had significantly higher amounts of sun exposure than nonathletes. Given the combination of low rates of sun-

protective behaviors, and high amounts of sun exposure, the results concluded that the athletes may be at increased risk for adverse effects from UV radiation.

Barriers Related to Sunscreen Use

The literature cites several barriers to skin cancer prevention strategies among athletes, including sports competition rules, the lack of sunscreen availability, and the lack of information about sun safety behaviors. Previous research notes that sunscreen availability represents the main barrier to use among athletes and suggests that it is possible to increase the application of sunscreen among athletes when they have easy access to sunscreen during practice and competition. Providing sunscreen to athletes on a regular basis, placing it in suitable locations, such as locker rooms or tennis bags, might significantly minimize, possibly eliminate, the environmental barrier between athletes and sun protection (Hamant & Adams, 2005). The study by Dubas and Adams (2012), found that the athletes for whom sunscreen was placed in the locker room and golf bags exhibited statistically greater use of sunscreen at the end of the study compared with the control group.

Another barrier to sunscreen use is the lack of role modeling. According to Wiggs (2007), coaches and administrators need to be informed of the dangers associated with practicing and competing during the midday hours. Coaches and athletic trainers need to continuously recognize the importance of protecting outdoor sports athletes from excessive sun exposure through repeated exposure and shifting focus methods. Coaches are the most important role models during the practices and tournaments and may positively influence their players by regularly practicing sun-protective behaviors. This can serve as a powerful motivator for athletes

to adopt new practices and behaviors related to skin cancer prevention (Wiggs, 2007). Targeting these barriers to sunscreen use in athletes is necessary in order to implement effective strategies.

Sun safety education programs prove effective in getting athletes to participate in prevention strategies (Jinna & Adams, 2013). Since skin cancer is on a rise it is important to decrease the chances of current high school athletes developing skin cancer by implementing educational programs in all athletic departments across the nation. Encouraging the application of sunscreen, making sunscreen available, in addition to other sun-protective behaviors may result in a positive behavior change for interscholastic programs competing outdoors. With nearly eight million students currently participating in high school athletics, it is important to continue identifying the characteristics and barriers to sunscreen use.

CHAPTER III

METHODOLOGY

The purpose of the study was to evaluate the attitudes, knowledge, and sun-protective behaviors of high school athletes, who participate in outdoor sports, towards sun exposure, sunscreen application, and skin cancer risks. The study was also designed to analyze the effect of educational intervention on athletes' knowledge through the series of questions asked prior to and after the educational intervention. This chapter will discuss the population and sample used for the study, the survey instrument, and the process of the materials and survey distribution. For this study, the primary objective was to improve the knowledge, attitudes, and behaviors regarding sun safety in the high school outdoor athlete population using the effective educational intervention. A short-term objective was to increase athletes' frequency of sunscreen application due to obtained knowledge regarding the risks of sun exposure during sporting events and practices, and therefore, potentially reduce the risk of skin cancer in the high school outdoor athlete population.

Population and Sample

The population of interest comprises public high school athletes who participate in outdoor interscholastic athletic programs, rendering them at high risk for ultraviolet

radiation exposure. Inclusion criteria for the study's participants included active involvement on a high school athletic team, at least 14 years of age, ability to speak and understand English, and availability to participate in the educational intervention, and to complete the pre-and post-test survey. The final sample consisted of 50 female and male athletes, ranging in age from 14 to 18 years old on different interscholastic athletic teams met criteria at a four-year public high school in the suburb of a major metropolitan city in Texas. The nonrandom convenience sample included 19 male and 30 female participants, and one participant did not select a gender, from the soccer (17), track and field (1), cross-country (18), and tennis (14) programs. According to the 2018-19 High School Athletics Participation Survey (www.NFHS.org), sports of track and field (1,093,621), soccer (853,182), cross-country (488,640), and tennis (348,750) are included in the ten most popular boys and girls programs in the United States. These numbers indicate that outdoor high school athletes constitute a large group of athletes that are at risk for developing skin damage and skin cancer. All these teams met criteria for inclusion in the study due to their long periods of high exposure to ultraviolet radiation. These teams practice and compete outside during the peak sun hours from 10 a.m. and 4 p. m., and they have athletic seasons during late summer, early fall, and spring, when the average UV index may vary from 2.5 (with an average temperature of 51 degrees) in January to UV index of 9.9 (average temperature 95 degrees) in August. Sun-protective behaviors are most needed when UV intensity is greatest, which occurs during the summertime and between 10 a.m. and 4 p.m. However, for some regions of the United States, such as the southeast and southwest, UV intensity is high year-round (National Cancer Institute, 2017). Athletes practicing outdoor sports receive considerable UV doses because of

training and competition schedules with high sun exposure and as a result, are at higher risk for developing skin cancer (Matthias, 2008).

While these high school student-athletes are considered high risk due to their increased exposure to ultraviolet radiation, there are other genetic factors that can also contribute to being high risk, including having a naturally fair skin tone, light-colored eyes, blonde or red hair, and/or a large number of moles and skin that burns, freckles, reddens, or becomes painful after too much time in the sun. While the majority of participants had high-risk factors such as fair skin complexion (90%) and/or light eye color such as blue, gray, green, or hazel (70%), a small proportion indicated having more than a few freckles (14%). According to the CDC (2017), among men, white men had the highest rate of getting melanoma of the skin, followed by American Indian/Alaska Native, Hispanic, Asian/Pacific Islander, and Black men. Among women, white women had the highest rate of getting melanoma of the skin, followed by Hispanic, American Indian/Alaska Native, Asian/Pacific Islander, and Black women. Most participants in this study indicated a race of White/Caucasian (78%), indicating a high-risk category for developing skin cancers.

Procedures

An exploratory research design was used to evaluate the outcome expectations and self-efficacy of sun-protective behaviors of high school athletes regarding skin cancer. A pretest/posttest design was used to evaluate changes in knowledge of sun-protective behaviors, sun exposure, and risks for sun cancer, along with changes in willingness to utilize sunscreen, both before and after an educational intervention. The data were collected through the distribution of the Skin Cancer and Sun Protection in

High School Athletes Survey among all male and female athletes. Initially, data collection would have occurred in two phases: a pre-test issued before the face-to-face educational intervention and a final post-test administered four weeks after the intervention. However, due to complications with the Covid-19 pandemic, face-to-face interactions were limited and data collection happened through the distribution of the online survey in one phase.

Initially, the permission for participation was obtained through the high school district superintendent's assistant, high school principal, and the athletic coordinators. An email with an explanation of the study, the Parent Permission Form, and a copy of the survey was sent to the track and field, soccer, and cross country, and tennis head coaches in the middle of November 2020. Parents of the participants were given an option to opt-out from the participation in the study by signing a Parent Permission Form that was distributed three weeks prior to the study by the head coaches. Only one parent chose to opt her child out of the study, who was removed from the list of participants. All participants received an invitation to participate in the study through school emails on December 1. The emails with the reminders to complete the survey were sent out on December 7 and 14, with the survey closing on December 16, 2020.

The survey was created on Qualtrics, including a first page explaining the voluntary and anonymous nature of the survey. To ensure anonymity, each athlete used his or her student identification number. After completion of the survey, the participants had an opportunity to receive incentives for participating in the study: sign up for a free sample of travel size Banana Boat® Sport Performance® Broad Spectrum Sunscreen Lotion with Powerstay Technology SPF 30 sunscreen or/and sign up to win one of the six

Amazon gift cards. The winners for the Amazon gift cards were randomly selected and notified via email provided in the separate survey by the end of December 2020. The manufacturer of those samples did not provide any of the products nor offer any financial support. There were no conflicts of interest that warranted disclosure, and there was no financial assistance or gain from any person or corporation. The researcher was not paid to distribute, endorse, or display any of the products. The Institutional Review Board at Oklahoma State University and the high school administration approved the study prior to data collection involving any participants.

Survey Instrument

The Skin Cancer and Sun Protection in High School Athletes Survey consisted of 65 questions organized into ten sections: 1) General Information, 2) Health Information and Genetic Disposition, 3) Sun-protective Behaviors, 4) Self-efficacy and Sun-protective Behaviors, 5) Outcome Expectations and Sun-protective Behaviors, 6) Pre-test of Knowledge of Skin Cancer, 7) Lesson: Rays Awareness, 8) Post-test of Knowledge of Skin Cancer, 9) Sunscreen Availability, and 10) Survey Incentives. These questions were used to collect demographic information, levels of current sun-protective behaviors, outcome expectations for sun-protective behaviors, and self-efficacy measurements for sun-protective behaviors. The items of the survey were based on Social Cognitive Theory and specific to demographics, behaviors, knowledge, attitudes, environmental influences, and current practices of the targeted population. Some questions were written by the researcher to assess specific information regarding the athletic activity, sunscreen preference, exposure protection, and sources of information. Other items were generated by using questions based on previously published sun exposure survey instruments.

Attitudes and knowledge questions included some items from the "Suntelligence" Survey, created by the American Academy of Dermatology in 2010, to determine their knowledge, attitudes, and behaviors toward tanning, sun protection, and skin cancer detection among 7,000 adults nationwide. The survey used in this study also included questions about participants' skin color and their skin's reaction to the sun based on a scale created by Thomas Fitzpatrick (Skin Cancer Organization, 2017). The Fitzpatrick skin phototyping scale includes six different skin types and colors and provides a numerical classification based on the reaction of unexposed skin to UVA (tanning) and UVB (burning) radiation exposure. Fitzpatrick's Type I phototype is defined as very fair skin that burns easily and never tans; Type II is white skin that usually burns, tans with difficulty; Type III is fair skin that sometimes burns and tans gradually; Type IV is light brown skin that rarely burns, tans easily; Type V is dark brown skin that very rarely burns, tans easily; and Type VI is very dark brown skin that never burns and tans very easily.

Thus, the survey was a compilation of different questions based on the study's theoretical framework, some generated by the researcher and others from previous surveys and established measurement scales. Survey questions varied in format, including multiple-choice questions, five-point Likert-type scale questions, and true/false questions. The multiple-choice and Likert-type scale questions all included an "other" option, allowing participants to provide short answers, enhancing response validity. For the sun-protective behavior section, the questions included multiple-choice questions about the type of sunscreen preferred, frequency of use, availability of shade, the reasons for not using sunscreen, and others. The items for self-efficacy and sun-protective behavior and

outcome expectations and sun-protective behavior were scored from 1 to 5, indicating not at all confident, not so confident, somewhat confident, very confident, and extremely confident for higher self-efficacy, respectively. The 10 True/False questions were used to test for pre-intervention and post-intervention knowledge of sun exposure and risks for skin cancer, with "1" given if the student-athlete had the correct answer, if not, "0" was marked for the item.

Educational Intervention

The educational intervention was a part of the survey and was designed to provide information about sun safety and the effects of UV radiation. The educational intervention selected for this study was a lesson titled: *Rays Awareness – Preventing Skin Cancer*. The lesson can be obtained for free use upon completion of the registration with the Skin Cancer Foundation (Skin Cancer Foundation, 2017). All lesson materials were obtained through the Skin Cancer Foundation website in spring 2017. The lesson was aligned with the Centers for Disease Control and Prevention National Health Education Standards (NHES) for grades 6-12. *The Rays Awareness* lesson has been medically reviewed by Jessica J. Krant, M.D., M.P.H., Founder of Art of Dermatology on Fifth Avenue in Manhattan, and Assistant Clinical Professor of Dermatology at SUNY Downstate Medical Center, NYC. The lesson was transformed from the PowerPoint format to Qualtrics survey and covered the following information: 1) key facts and statistics about prevalence and incidence of skin cancer), 2) definitions of two different types of ultraviolet rays, 3) definitions of different types of skin cancer, including basal cell carcinoma, squamous cell carcinoma, and melanoma, 4) risk factors for developing skin cancer, 5) harmful effects of ultraviolet radiation including wrinkles and premature

aging, 6) prevention methods such as appropriate use of sunscreen, sunglasses, protective clothing, and shade, and 7) skin self-examination techniques and image identification using the ABCDE's of melanoma detection (asymmetry, borders, color, diameter, and evolving). Color images of the ABCDE's of melanoma detection are included in the handout as a part of the lesson provided by the Skin Cancer Foundation. The objectives of the educational intervention were to help student-athletes to: 1) understand ultraviolet radiation, including UVA and UVB rays, 2) explain how UV radiation affects their skin, 3) understand the effects of indoor and outdoor tanning, 4) understand the various forms of skin cancer, 5) understand how to detect skin cancer, and 6) protect themselves from UV radiation exposure. The lesson included 10 True or False interactive questions. These questions were used to measure the participants' knowledge about skin cancer and sun-protective behaviors before and after the educational intervention.

Data Analysis

The first two research questions were exploratory in nature, thus the analysis consisted of descriptive statistics and a summary of participant responses to the questions measuring outcome expectations and self-efficacy of sun-protective behaviors. The third research question examined the change in knowledge of sun exposure and skin cancer risks from before the educational intervention to after the educational intervention. Each participant answered the same questions twice, pre-and post-intervention, and they were graded for the number of questions they answered correctly each time. A paired samples t-test tested the null hypothesis that there was no change in scores from pre- to post-intervention. The fourth research question addressed the willingness of participants to utilize sunscreen if it was made readily available, examining the change in proportions

from pre-intervention to post-intervention. The pre-and post-intervention rates were compared using a Likelihood Ratio test, testing the null hypothesis that there was no change in the proportion of participants being willing to utilize sunscreen if it was made available.

A paired samples *t*-test requires that the differences obtained from pre-intervention to post-intervention be approximately normally distributed with no significant outliers. A histogram and boxplot were created to check for any issues with this assumption. The Likelihood Ratio test was used as an alternative to the chi-square test comparing proportions because the chi-square assumption that all cells have expected values of at least 5 was not met. All descriptive and inferential statistics were obtained using SPSS, Version 27. Statistical significance was based on a 5% alpha level.

CHAPTER IV

FINDINGS

Sample Description

Out of the 156 high-school student-athletes who were initially invited to participate in the study, 56 (35.9%) participants began the survey, six of which only partially completed the survey. Thus, the final sample size consisted of 50 student-athletes, yielding a 32.1% completion rate. Out of these 50 students, 30 (60%) were females, 19 (38%) were males, and one (2%) preferred not to select a gender. Most of the student-athletes identified as white (78%), followed by Hispanic or Latino (12%), and multiracial (10%). The age range of participants was 14 to 18 years old, with a mean of 15.5 years and a standard deviation of 1.1 years. A full summary of gender and race demographics can be found in Table 1 below.

Table 1

Personal Demographics for Student Participants

Demographic	***N***	**%**
Gender		
Female	30	60
Male	19	38
Preferred not to answer	1	2
Race/Ethnicity		
White	39	78
Hispanic/Latino	6	12
Multiracial	5	10

Note. $N = 50$ for each category. Participants were on average 15.5 years old ($SD = 1.1$).

Most of the participants were academically classified as sophomores (40%), followed by juniors (26%), freshmen (22%), and seniors (12%). The largest of the seven sports groups in the sample was represented by girls soccer players (28%), followed by girls cross country (20%), boys cross country (16%), boys tennis (16%), girls tennis (12%), boys soccer (6%), and girls track and field (2%). A summary of these academic and sports demographics can be found in Table 2 below.

Table 2

Academic and Sports Demographics for Participants

Demographic	***N***	**%**
Academic Classification		
Freshman	11	22
Sophomore	20	40
Junior	13	26
Senior	6	12
Sports Group		
Girls Soccer	14	28
Girls Cross Country	10	20
Boys Cross Country	8	16
Boys Tennis	8	16
Girls Tennis	6	12
Boys Soccer	3	6
Girls Track & Field	1	2

Note. $N = 50$ for each category.

Participants were also asked questions about attributes associated with higher levels of risk from sun exposure, including overall health, history of skin cancer from parents and self, and skin reaction to sun exposure. Most participants indicated having either very good or excellent health (64%), followed by good health (26%), and fair health (10%). Only one participant indicated having a history of skin cancer (described as a sunspot), and 56% indicated that nobody in their family had been diagnosed with skin

cancer. Regarding their skin's reaction after being in the sun for 30 minutes without sunscreen, most said they sometimes burn and tan gradually (38%), rarely burn and tan easily (46%), usually burn and tan with difficulty (10%), and tan easily without ever burning (6%). A summary of these risk factors can be found in Table 3 below.

Table 3

Summary of Participants' Genetic Attributes Associated with Sun Exposure Risks

Demographic	***N***	**%**
Overall Health		
Excellent	6	12
Very Good	26	52
Good	13	26
Fair	5	10
History of Skin Cancer (Self)		
Yes	0	0
No	49	98
Other – skin spot	1	2
History of Skin Cancer (Family)		
Yes	21	42
No	28	56
Preferred not to answer	1	2
Skin reaction to sun for 30 minutes without sunscreen		
Usually burns, tans with difficulty	5	10
Sometimes burns, tans gradually	19	38
Rarely burns, tans easily	16	46
Never burns, tans easily	3	6

Note. $N = 50$ for each category.

Most participants spent at least 10 months per year training outdoors (64%), while the rest spent between 7 and 9 months (22%) or 4 to 6 months (12%). During these

training months, most spent, on average, 2 to 4 hours per day outdoors (68%), while some spent less than 2 hours (28%), and a few spent 5 or more hours per day outdoors (4%). Just over half of participants indicated that there was available shade at their practice sites (54%), while the rest indicated no such availability (46%). Note that one participant wrote that shade was available during breaks, and this was added to the "yes" group for shade availability.

Table 4 below summarizes the shade availability for participants, organized by the number of hours per day they spent training outdoors. Out of those who spent 2 hours or less training outdoors, only 28.6% had shade available, while 61.8% of those who trained 2 to 4 hours had shade available, and 100% of those who trained 5 or more hours had shade available.

Table 4

Summary of Outdoor Training versus Available Shade

	Hours of Outdoor Training (per day)					
	Less than 2 hours		**2 - 4 hours**		**5 or more hours**	
Shade Available	***N***	**%**	***n***	**%**	***n***	**%**
Yes	4	8	21	42	2	4
No	10	20	13	26	0	0
Total	14	28	34	68	2	4

Note. $N = 50$.

Research Question One

The first research question of this study examined student athletes' outcome expectations by identifying and understanding their attitudes and beliefs regarding sun-protective behaviors.

RQ1**:** What are the outcome expectations (beliefs) regarding sun-protective behaviors among outdoor high school athletes who are at high risk for ultraviolet radiation exposure?

Each of the questions related to outcome expectations regarding sun-protective behaviors were answered on a scale from 1 to 5, with higher ratings indicating higher confidence in the statement provided (1=Not at all confident, 2=Not so confident, 3=Somewhat confident, 4=Very confident, 5=Extremely confident). The average rating was calculated across all participants for each of the statements, along with its standard deviation, minimum and maximum ratings. The statement "applying sunscreen regularly can prevent skin cancer," had the highest mean rating (M = 4.3, SD = .8), while the statement "sunscreen won't run into your eyes" had the lowest mean rating (M = 2.5, SD = 1.3). All statements except those regarding sunscreen making the wearer feel sticky and running into their eyes had a mean rating above 3, indicating at least some amount of confidence with the statement. Table 5 below summarizes the results from each of the outcome expectations for sun-protective behaviors.

Table 5

Responses to Statements Measuring Outcome Expectations for Sun-Protective Behaviors

Statement	Mean	SD	Min	Max
Sunscreen makes skin look healthier	3.7	.9	2	5
Sunscreen can prevent skin cancer	4.3	.8	1	5
Sunscreen reduces skin aging	3.9	1.1	1	5
Sunscreen won't make you sticky	2.8	1.3	1	5
Sunscreen won't run into your eyes	2.5	1.3	1	5
Would use sunscreen if available at your facility	2.9	1.3	1	5

Note. Each variable had $N = 49$ responses. One participant did not complete these questions.

Participants were also asked the main reason for not using sunscreen before practice, and results indicated that most simply forget to apply it (42%), don't like how it feels on their face (16%), prefer to be tan (14%), don't have it available to them or find it too expensive (12%), think it is too messy (2%), or indicated another reason for not using it (14%). For the participants who indicated another reason for not using sunscreen before practice, the following responses were written in as alternative reasons:

- "I don't burn easily"
- "I don't really care to take the time, and I don't want another thing to bring and apply"
- "I have never used sunscreen unless I'm swimming"
- "I use sunscreen on my face but not my body because I have sensitive skin"
- "It burns my eyes because my sweat brings it down into my eyes"

- “It makes my hands slippery”
- "It is dark when we run”

Research Question Two

The second research question of this study examined student athletes’ self-efficacy regarding their current and future sun-protective behaviors.

RQ2: What is the level of self-efficacy regarding sun-protective behaviors among outdoor high school athletes who are at risk for ultraviolet radiation exposure?

Current Practices. Participants were asked several questions regarding their self-efficacy of current sun-protective behaviors. A series of five questions asked participants the number of times in the past week they had taken part in or observed teammates and coaches engaging in sun-protective behavior. The majority of participants never used sunscreen on their face (72%), followed by those who used it on their face 1 to 3 days per week (14%), 7 days per week (10%), or 4 to 6 days per week (4%). Almost all participants never used sunscreen on their bodies (94%), while a few indicated using it on their bodies 1 to 3 days per week (6%). Most participants observed coaches (70%) and teammates (80%) never applying sunscreen before practice, while some observed them applying it 1 to 3 days per week (10% for coaches, 18% for teammates), 4 to 6 days per week (14% for coaches, 2% for teammates), or 7 days per week (6% for coaches, 0% for teammates). Finally, most participants wore some form of protective clothing or gear – such as a long-sleeved shirt, hat, or sunglasses – either 0 days per week (36%), 1 to 3 days per week (36%), 4 to 6 days per week (20%), or 7 days per week (8%). A summary of these practices is found in Table 6 below.

Table 6

Frequency of Sun-Protective Practices by Participants, Coaches, and Teammates

	Number of Days (per week)							
	0 days		1-3 days		4-6 days		7 days	
Practice	***N***	**%**	***N***	**%**	***n***	**%**	***n***	**%**
Use sunscreen on your face	36	72	7	14	2	4	5	10
Use sunscreen on your body	47	94	3	6	0	0	0	0
Observe coach apply sunscreen	35	70	5	10	7	14	3	6
Observe teammates apply sunscreen	40	80	9	18	1	2	0	0
Wear sun-protective clothing/gear	18	36	18	36	10	20	4	8

Note. $N = 50$.

Participants were also asked a variety of questions regarding the frequency of sun-protective practices in general, including seeking shade during practice, checking skin for signs of sun damage, tanning bed usage, and frequency of sunburns. Most participants rarely or never sought shade during practice (54%), while others sometimes did (28%), or often did (18%). Most never examined their own skin for changes to moles and other skin blemishes (44%), while others did so annually (22%), monthly (14%), weekly (8%), or daily (12%). Professional screenings for skin cancer by a healthcare provider were also not common, with most never having been screened before (32%), followed by screenings at least every 3 to 5 years (28%), at least every 2 to 3 years (14%), at least every year (10%), or at least every six months (6%). Note that five participants chose not to answer the question about professional screenings for skin cancer (10%). Almost all participants refrained from using a tanning bed (98%), while only one participant

indicated that he/she used a tanning bed 12 or more times in the last 12 months (2%). Most participants indicated that they had experienced a sunburn on the face or body 1 to 3 times within the last 12 months (50%), followed by 8 or more times (22%), 4 to 7 times (14%), or not at all (14%). A summary of these practices can be found in Table 7 below.

Table 7

Summary of Participants' Current Sun-Protective Practices

Variable	***N***	**%**
Sought Shade During Practice		
Never or rarely	27	54
Sometimes	14	28
Often	9	18
Performed Skin Screenings on Self		
Never	22	44
Annually	11	22
Monthly	7	14
Weekly	4	8
Daily	6	12
Sought Professional Skin Screenings		
At least every 6 months	3	6
At least every year	5	10
At least every 2 to 3 years	7	14
At least every 3 to 5 years	14	28
Other (written responses)	16	32
Preferred not to answer	5	10
Number of sunburns within the last 12 months		
0	25	50
1 to 3	7	14
4 to 7	11	22
8 or more	7	14

Note. $N = 50$ for each category.

Future Practices. Participants were asked a series of 12 questions regarding their self-efficacy of future sun-protective behaviors, each of which was answered on a scale from 1 to 5, with higher ratings indicating higher confidence in the statement provided (1=Not at all confident, 2=Not so confident, 3=Somewhat confident, 4=Very confident, 5=Extremely confident). The average rating was calculated across all participants for each of the statements, along with its standard deviation, minimum and maximum ratings. The statement "will apply sunscreen before practice if your coach will encourage you to apply sunscreen" had the highest rating ($M = 3.2$, $SD = 1.2$), followed by the statement "can select the right SPF based on your activity," which had the second-highest rating ($M = 3.0$, $SD = 1.4$). These were the only two statements of the 12 that had a mean at or above 3, indicating at least some confidence in the statement. The statement "will apply sunscreen before practice today" had the lowest mean rating ($M = 1.8$, $SD = 1.0$), followed closely by the statements: "will apply sunscreen even on a cloudy day," ($M = 1.8$, $SD = 1.3$); "will apply sunscreen before practice even if your coaches do not apply it," ($M = 1.9$, $SD = 1.2$); and "will apply sunscreen before practice even if your teammates do not apply it," ($M = 1.9$, $SD = 1.2$). Table 8 below summarizes the results from each of the self-efficacy for future sun-protective behaviors.

Table 8

Responses to Statements Measuring Self-Efficacy for Future Sun-Protective Behaviors

Statement	Mean	SD	Min	Max
I will apply sunscreen before practice today	1.8	1.0	1	5
I will apply sunscreen, even if teammates do not	1.9	1.2	1	5
I will apply sunscreen, even if coaches do not	1.9	1.2	1	5
I will use sun-protective clothing	2.1	1.1	1	5
I will apply sunscreen on a cloudy day	1.8	1.3	1	5
I will apply sunscreen if coaches encourage it	3.2	1.2	1	5
I will make time to apply sunscreen no matter how busy	1.9	1.2	1	5
I will seek shade on a sunny day at my facility	2.9	1.3	1	5
I can select the right type of sunscreen	3.0	1.4	1	5
I can select the right SPF based on my activity	2.9	1.4	1	5
I will apply sunscreen if available to me every day	2.8	1.3	1	5
I can recognize the signs of skin cancer on my body	2.6	1.4	1	5

Note. Each variable had $N = 49$ responses. One participant did not complete these questions.

Research Question Three

The third research question examined the change in knowledge about sun exposure and skin cancer from before the educational material was provided to after the participants were educated on these topics.

RQ3: What is the effect of educational intervention on knowledge about sun exposure and skin cancer among outdoor high school athletes?

Each of the participants answered a series of ten true/false questions about sun exposure and risks for skin cancer, followed by the educational intervention that provided information and facts about these topics. Immediately following the educational intervention, participants were asked to answer the same series of ten True/False questions to measure changes due to the educational intervention. The null hypothesis was that there was no significant difference in the knowledge of sun exposure and risks for skin cancer among outdoor high school athletes before and after educational intervention. Most participants answered the first six questions correctly in both the pre- and post-assessments, but there was a larger discrepancy in the number of correct responses from pre- to post-assessment with the last four questions. A summary of correct responses for each of the ten True/False statements is found in Table 9 below, indicating the number and percentage of respondents who answered each question correctly. It should be noted that only 49 of the 50 respondents completed the pre- and post-assessments.

Table 9

Summary of Correct Responses and Percentages of Pre- and Post-Assessment Questions

True/False Statement	Pre - Assessment		Post-Assessment	
	n	%	*n*	%
Skin cancer is rare	46	93.9	46	93.9
You can die from skin cancer	46	93.9	49	100
Skin cancer is a disease that affects only old people	49	100	49	100
People with dark skin can get skin cancer	49	100	47	95.9
Experiencing five or more sunburns can double your risks of developing skin cancer	43	87.8	49	100
Two forms of UV radiation, UVA and UVB, reach the earth and can cause skin cancer	48	98.0	49	100
Though a sunburn is a sign of sun damage, a tan is a sign of health	36	73.5	44	89.8
Sunshine clears up acne	27	55.1	49	100
"SPF" stands for Sun Protection Factor	44	89.8	49	100
Tanning beds are safer for you than sunlight	43	87.8	49	100

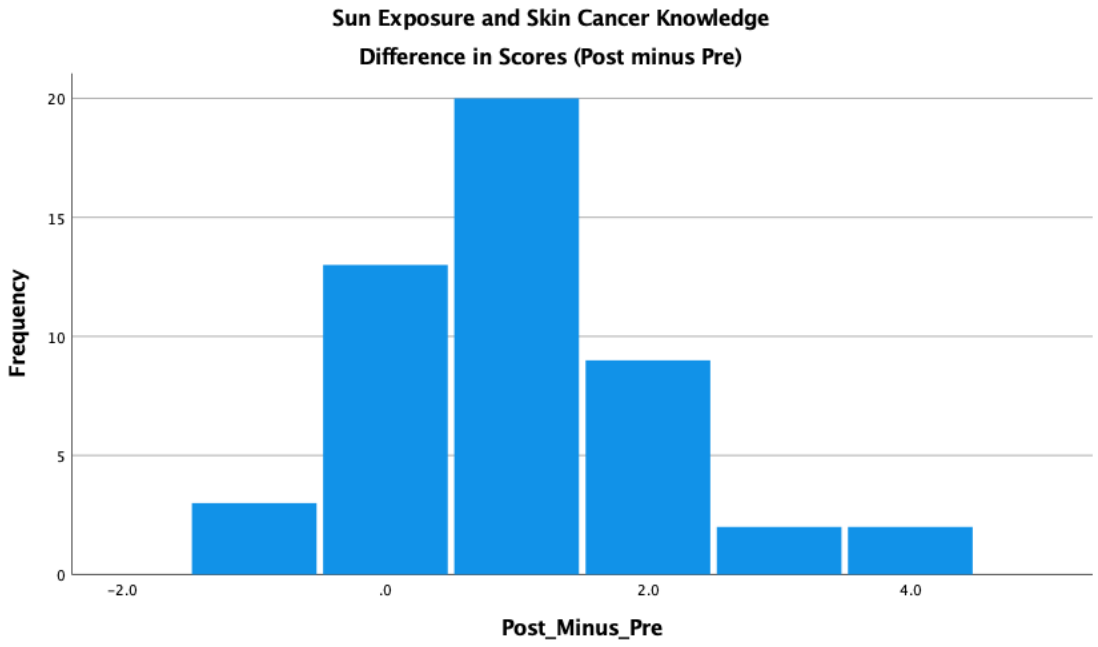
Note. Each question had $N = 49$ responses.

Assessment scores were calculated for each participant as a sum of correct responses, ranging from 0 to 10, with a 10 being a perfect score. Pre-intervention scores ($M = 8.8$, $SD = 1.1$) were lower than post-intervention scores ($M = 9.8$, $SD = .5$), with an 11.4% increase in scores from pre-intervention to post-intervention. The differences in

scores (post-intervention scores minus pre-intervention scores) were normally distributed (M = 1.0, SD = 1.1), as illustrated in the histogram in Figure 1 below.

Figure 1

Histogram of Differences in Scores for Sun Exposure and Risks for Skin Cancer



Note. The scores are calculated by subtracting post-intervention scores minus pre-intervention scores.

A paired samples *t*-test found the difference in scores (post-intervention scores minus pre-intervention scores) to be statistically significant ($t(48) = 6.261$, $p < .001$), with a large effect size (Cohen's d = 0.894). These results indicate that the intervention successfully increased knowledge of sun exposure and risks for cancer. Table 10 summarizes these findings.

Table 10

Summary of Paired Samples t*-test for Pre- and Post-Intervention Scores*

	M	***SD***	***M* Difference**	***t*(48)**	***p***	**Cohen's *d***
Pre-Intervention	8.8	1.1	1.00	6.261	<.001	0.894
Post-Intervention	9.8	.5				

Note. $N = 49$ responses. One participant did not complete these questions.

Research Question Four

The fourth research question examined whether the educational intervention had an effect on participants' willingness to apply sunscreen before practice if it were made readily available to them.

RQ4: What is the effect of educational intervention on willingness to apply sunscreen if it is made readily available among outdoor high school athletes?

Before the intervention, participants were asked about their confidence regarding two statements that were associated with applying sunscreen if made available. One statement fell under the series of questions measuring outcome expectations of sun-protective behavior, "You would use sunscreen before each practice if it was available in the locker room or athletic facility," and had a mean rating just below somewhat confident ($M = 2.9$, $SD = 1.3$). The other statement fell under the series of questions measuring self-efficacy for future practices, "Will apply sunscreen before practice if it was available to you every day," and had a similar mean rating ($M = 2.8$, $SD = 1.3$). Recall that both statements were measured on a scale of confidence from 1 to 5, with a 3 indicating "somewhat confident." The follow-up question regarding the willingness to use sunscreen if readily available was asked just after the series of 10 True/False

statements measuring knowledge post-intervention. This question asked, “if you were provided sunscreen to use during the practice or competition, would you choose to use it to protect yourself against UV rays?” The available responses to this question were yes, no, prefer not to answer, and other (with a write-in response option). Most participants answered this question with a “yes” (90%), 4 answers “no” (8%), and one wrote in “maybe” for the write-in response option (2%).

In order to statistically compare the pre-intervention to post-intervention response to a willingness to apply sunscreen if made readily available, responses for the related question under outcome expectations for sun-protective behavior was converted to a yes/no/maybe scale, where response ratings of 1 or 2 (1=Not at all confident, 2=Not so confident) were converted to a “no,” 3 (3=Somewhat confident) were converted to a “maybe,” and 4 or 5 (4=Very confident, 5=Extremely confident) were converted to a “yes.” Converted results from this question showed that the pre-intervention rates of willingness to use a sunscreen if made readily available were 38.8% indicating “no,” 28.5% indicating “maybe,” and 32.7% indicating “yes.” Research question three aimed to determine whether the proportion of those who were willing to use sunscreen if it were readily available changed from pre-intervention to post-intervention. The null hypothesis was that there would be no significant difference in the willingness to apply sunscreen if made readily available among high school athletes before and after the educational intervention. The proportion of students willing to use the sunscreen was defined by the percentage of the participants who answered “yes” to the converted question pre-intervention and “yes” to the follow-up post-intervention question. This proportion increased from 32.7% saying yes pre-intervention to 90% post-intervention, almost

tripling the rate after the educational intervention. A Likelihood Ratio Test found this difference to be statistically significant (p = .034), with medium effect size (ϕ = .424, V = .300). Table 11 below summarizes these findings.

Table 11

Summary of Pre- and Post-Intervention Intention Rate for Applying Sunscreen if it Was Made Available

	Pre-Intervention		**Post-Intervention**		**Likelihood Ratio Test**	**Effect Size**	
	N	**%**	***n***	**%**	***p***	***ϕ***	***V***
Yes	16	32.7	45	90	<.034*	.424	.300
Maybe	14	28.5	1	2	---	---	---
No	19	38.8	4	8	---	---	---

Note. Pre-Intervention N = 49, Post-Intervention N = 50. One participant did not answer the question post-intervention.

Chapter Summary

Results from this study indicated that students didn't demonstrate very high confidence in important areas of sun-protective behaviors. With regard to outcome expectations of sun-protective behaviors, most were confident that using sunscreen could help prevent skin cancer, but they were less confident that the use of sunscreen wouldn't have negative side effects such as running into their eyes and making their skin feel sticky. When asked why they don't regularly apply sunscreen before practice, most participants either cited forgetfulness or had a reason connected to a common myth or side effect that isn't accurate (such as it running into their eyes, making skin sticky, only

needed during swimming, etc.). With regard to self-efficacy, most participants never used sunscreen on their faces, rarely saw teammates and coaches applying sunscreen, didn't seek shade during practice, and rarely had a health professional inspect their bodies for moles or skin blemishes due to sun exposure. However, the educational intervention indicated a significant increase in knowledge about sun exposure and skin cancer, along with a higher intention rate for applying sunscreen before practice if it was made readily available. In summary, participants reflected common myths and misconceptions regarding sun-protective behaviors and effects of sun exposure, but these were easily corrected with a short educational intervention, and participants indicated a higher motivation to use sunscreen after learning the realities about these myths and misconceptions.

CHAPTER V

CONCLUSION

The study was conducted at a four-year public high school in a suburb of a major metropolitan city in Texas. The population of interest consisted of athletes participating in popular outdoor sports, rendering them at high risk for skin cancer. Athletes practicing outdoor sports receive considerable ultraviolet doses because of training and competition schedules with high sun exposure and as a result are at higher risk for developing skin cancer (Matthias, 2008). The final nonrandom convenience sample consisted of 50 male and female athletes from cross-country (18), soccer (17), tennis (14), and track and field (1) teams. The primary objective of the study was to examine the knowledge, attitudes, and behaviors regarding sun safety in the high school athlete population involved in outdoor sports. These were measured through outcome expectations (beliefs), self-efficacy, and general knowledge about sun-protective behaviors, sun exposure, and skin cancer. The study was also designed to analyze the effect of educational intervention on athletes' knowledge and sunscreen application prior to and after the educational intervention.

This chapter presents the major findings and conclusions derived in the conduct of the study which is to examine the effect of skin cancer educational intervention and

sunscreen use among outdoor high school athletes. It also discusses strengths, limitations and provides future recommendations that can be pursued by the coaching and administrative staff in high schools across the country. High school athletes have received little attention in skin cancer prevention research. This group of athletes is large in number, is at high risk, and is easily accessible, which makes them an important population to target for primary prevention of skin cancer. This study concluded that the knowledge and attitudes relating to skin cancer and sunscreen application among high school student-athletes who participated in a skin cancer educational intervention significantly increased. Therefore, providing support for the need of a school-based sun safety educational intervention. However, the study also revealed that many outdoor athletes have poor sun-protective behaviors as it relates to sun safety. As a result, these outdoor high school athletes would benefit from further interventions. Despite a few health campaigns to raise public awareness on ultraviolet radiation, skin cancer remains "a major health problem," while sun-protective practices still fall behind in the U.S. (AAD, 2017). According to the American Academy of Dermatology (2017), 90% of all skin cancer deaths could be prevented if people properly controlled their exposure to the sun's ultraviolet radiation. The Centers for Disease Control and Prevention (2017), recommends easy options for protection from UV radiation, such as 1) seeking shade during the midday hours when sun's UV rays are the strongest (between 10 am and 4 pm), 2) wearing sun-protective clothing, such as a long-sleeved shirt, a wide-brimmed hat, and sunglasses, 3) applying and reapplying a broad-spectrum, water-resistant sunscreen with a SPF factor 15 or more to all exposed skin, and 4) avoiding indoor tanning.

Major Findings

The study assessed current skin cancer knowledge, attitudes, and sun-protective behaviors among outdoor high school athletes and examined main barriers to primary prevention of sun damage and skin cancer. More specifically, the study examined the frequency of sunscreen use, teammates and coach modeling and encouragement for sun protection, and the impact of educational intervention on the athletes' knowledge of sun danger and willingness to use sunscreen. Among various populations at risk for developing skin cancer, the outdoor athletes represent a target group for skin cancer prevention due to the following factors: increased sun exposure during practice and competition, lack of sun-protective behaviors, and lack of educational intervention that increase knowledge about skin cancer development and identification of suspicious skin lesions. Melanoma is the most common form of cancer in young adults aged 25 to 29 and it is the second most common form of cancer in adolescents and young adults ages of 15 to 29 (Diao & Lee, 2014). Results from this study indicated that outdoor high school athletes didn't demonstrate very high confidence in important areas of sun-protective behaviors. While they took advantage of protective clothing and sunglasses, with 54% of them using at least one of these items at least once a week, they performed poorly with the use of sunscreen, with 94% of participants indicating not using sunscreen at all.

Outcome Expectations

The Social Cognitive Theory (SCT) served as the theoretical framework for this study, indicating that learning is an interaction between a person and his or her environment, cognitive processes, and behavior (Bandura, 1986). The SCT is very

complex and not all constructs were addressed by this research. One of the theory's constructs – outcome expectations, was addressed by looking at the outcome expectations regarding sun-protective behaviors among outdoor high school athletes who are at high risk for ultraviolet radiation exposure. Outcome expectations are beliefs about the likelihood and value of the consequences of behavioral choices. The outcome expectations helped to guide the process of trying to identify the factors that relate to understanding the attitudes regarding sun exposure and skin cancer and sun-protective behaviors among athletes. These questions in the survey asked students about how they expected sunscreen would look and feel, how it might interfere with performance and practice, and why they didn't apply sunscreen regularly. With regard to outcome expectations of sun-protective behaviors, most participants demonstrated a high level of confidence that applying sunscreen could help prevent skin cancer, yet they indicated many negative side effects that would prevent them from actually using it. The majority of participants cited forgetfulness as the main reason for not applying sunscreen before practice. Some other reasons identified by the participants were they were "lazy" and they "like a tan" or had a reason connected to a common myth or side effect that isn't accurate, such as it was running into their eyes, making skin sticky, and only needed during swimming. Twelve percent of participants indicated that the sunscreen was not available to them or was too expensive to purchase. These findings are consistent with other research in which barriers such as forgetfulness, inconvenience, impairment of performance were frequently cited as a reason why athletes failed to apply sunscreen (Cohen et al., 2006; Hamant & Adams, 2005). The participants in the study by Cohen and colleagues (2006) revealed several reasons for not using sunscreen, such as forgetting to

use it, followed by inconvenience, liking to be tan, and feeling that sunscreen impairs their performance. The young athletes' attitudes toward sunscreen use are very similar to the general young population. These attitudes might be influenced by the fact that some young people in their 20s or 30s may feel invincible and believe that serious illness only happens to older people and as a result ignore sun safety guidelines. Helping to identify and educate young athletes about the risks of the extensive sun exposure may facilitate the change in their attitudes and increase in the use of sun protection.

Self-Efficacy

The second research question addressed the outdoor high school athletes' level of self-efficacy regarding sun-protective behaviors. Self-efficacy is another important construct of the Social Cognitive Theory and was first defined by Albert Bandura in 1977 as people's beliefs in their capabilities to exercise control over their own functioning and over events that affect their lives. One's sense of self-efficacy can provide the foundation for motivation, well-being, and personal accomplishment. In this study, the self-efficacy was measured to examine student-athletes' confidence regarding whether they could change or improve their current and future sun-protective behaviors. With regard to self-efficacy of current behaviors, most participants never used sunscreen on their faces (72%) and bodies (94%); rarely saw teammates (80%) and coaches (70%) applying sunscreen; didn't seek shade during practice (54%); never examined their own skin for changes to moles and other skin blemishes (44%); and most rarely or never had a health professional inspect their bodies due to sun exposure. The study found that contrary to the previous research conducted with the university students by Hale (2015), the high school athletes demonstrated a strong self-efficacy when it came to the use of tanning

beds, with 98% of them not using them at all in the past year. However, it is unknown if these results reflected the current trend of declined use of the tanning beds by the younger population, or if it was simply due to the fact that many U.S. states require minors who are 16 or 17 to have a parent permission to use the tanning salons.

Participants' self-efficacy of future sun-protective behaviors was measured on the survey with a 5-point Likert scale (not at all confident, not so confident, somewhat confident, very confident, and extremely confident). The results showed that the statement "will apply sunscreen before practice if your coach will encourage you to apply sunscreen" had the highest confidence rating, followed by the statement "can select the right SPF based on your activity," which had the second-highest rating. The participants demonstrated a low level of self-efficacy when it came to believing that they "will apply sunscreen before practice today" or "will apply sunscreen before practice even if your coaches do not apply it." These results indicate a serious lack in self-efficacy with regard to applying sunscreen, an important sun-protective practice. While this low self-efficacy can lead to less desirable behavior outcomes, increasing students' belief in their ability to perform their sun-protective behaviors can lead to an increase in their sun-protective practices. Coaches are the most important role models during the practices and tournaments and may positively influence their players by regularly practicing sun-protective behaviors. Observing their coaches practice sun-protective behaviors, such as applying sunscreen, wearing sunglasses or long sleeve shirts, can serve as a powerful motivator for athletes to adopt new practices and behaviors related to skin cancer prevention (Wiggs, 2007). According to a couple of earlier studies from the late 1990s, coaches can effectively alter the sunscreen habits of their athletes by acting as positive

role models and promoting sun protection to youth and their parents (Parrott, Duggan, Cremo, Eckies, Jones, & Steiner, 1999). The Social Cognitive Theory construct of observational learning emphasizes learning new behaviors by exposure to interpersonal or media displays, particularly through peer modeling or in this case, modeling by the coaching staff. The participation of the coaching staff in education and setting examples are important components for the success of decreasing the rates of skin cancer and damage of the UV rays. Although role modeling by the coach is crucial in improving sun-protective behaviors of athletes, this study indicated insufficient modeling behavior by the coaching staff, with 70% of participants not observing sunscreen application by coaches and 80% not observing any sunscreen application by teammates. The statement "will apply sunscreen before practice if your coach will encourage you to apply sunscreen" had a high rating of confidence, confirming the need for continuous encouragement, modeling and education by the coaching staff.

Facilitation

Another important Social Cognitive Theory construct that helped to guide this study was the concept of facilitation. The facilitation construct of the SCT involves providing tools, resources, or environmental changes that make new behaviors easier to perform. Educational interventions play an important role in decreasing the incidence of skin cancer in various vulnerable populations, such as high school athletes who have a large exposure to the sun. High school athletes need the knowledge, tools, and incentives to modify their sun-protective behavior, so it is important to use language and visual aids that can be understood by this age group. According to Jinna and Adams (2013), sun safety education programs prove effective in getting athletes to participate in prevention

strategies. One important contribution of this study was to examine the need for and importance of educational intervention with high school athletes. This study looked at the effectiveness of the educational intervention on the knowledge about sun exposure and skin cancer among outdoor high school athletes, as well as the willingness to apply sunscreen if it was made readily available.

The educational intervention, entitled *Rays Awareness – Preventing Skin Cancer,* was designed to provide information about sun safety and the effects of UV radiation (Skin Cancer Foundation, 2017). Results found that a brief educational intervention improved behaviors, knowledge, and attitudes about skin cancer. After this brief educational intervention, participants were more likely to apply sunscreen and answer post-test questions more accurately, supporting the use of a targeted educational intervention for outdoor high school athletes in an effort to improve their knowledge, behaviors, and attitudes about skin cancer. Overall, the findings revealed an 11.4% increase in scores from pre-intervention to post-intervention, indicating that the intervention successfully increased knowledge of risks of skin cancer and sun exposure. Most participants answered the first six questions correctly in both the pre- and post-assessments, but there was a large discrepancy in the number of correct responses with the last four questions. Before learning about sun exposure and skin cancer, 26.5% of participants thought "a sunburn is a sign of sun damage, a tan is a sign of health," while only 10.2% thought that after the intervention. One of the biggest misconceptions that participants had was regarding if sunshine clears up acne, with only 27 participants answering that question correctly, and after the educational intervention all participants knew that that was not the case. Another significant improvement in knowledge was on

the question stating “tanning beds are safer for you than sunlight,” with 87.8% answering the questions correctly pre-intervention to 100% post intervention. These changes from pre-intervention to post-intervention indicated that students can easily fix their initial misconceptions when provided with correct information, at least in the short run after being provided with proper education.

The educational intervention was also tested to see if it had a significant impact on participants’ willingness to apply sunscreen if it were made readily available. The American Cancer Society, the Centers for Disease Control and Prevention, the World Health Organization are just a few of the health organizations that endorse the use of a broad-spectrum sunscreen as a protective product in the prevention of skin cancer. A previous study of 1,383 participants in southeast Australia confirmed that sunscreen helps to prevent skin lesions, specifically cutaneous squamous cell carcinoma, and that topical barrier between solar ultraviolet light and the epidermis does prevent skin cancer (Hill, 1999; Green et al., 1999). The results of this study indicated that the educational intervention had a positive impact on the participants’ outcome expectation and their self-efficacy regarding the sunscreen use. The proportion of participants who said they would use sunscreen before each practice if it was available in the locker room or athletic facility tripled from pre-intervention to post-intervention, increasing from 32.7% to 90%. This significant increase indicates that when these athletes are educated about the importance of sun-protective behaviors, they are more willing to take action to protect themselves when sunscreen is made readily available. Twelve percent of participants indicated that sunscreen was not available to them or was too expensive to purchase. These barriers to sunscreen use could be simply eliminated by making sunscreen readily

available at the facilities before practice or completion, such as installing sunscreen dispensers or making sure the locker rooms or athletic facilities are stocked with bottles of sunscreen. Overall, these results provide a strong incentive for schools to prioritize making sunscreen readily available before practices, along with educating athletes about the facts and importance of sunscreen usage.

Recommendations for Practice

Skin cancer is a significant public health problem. The athletes, specifically those engaged in year-round outdoor sports, such as softball, baseball, football, soccer, tennis, golf, track and field, and cross country, are exposed to chronic and intense UV rays from young age resulting in an increased risk for skin cancer. Examining risk behaviors, perceptions, attitudes, knowledge of skin cancer and associated sunscreen use in this high-risk population is of high importance to prevent skin cancer and promote long-term health. The student-athletes spend many hours in the environment surrounded by teammates, coaches, athletic trainers, and administrative staff, therefore, it is important to understand that individual behavior change is almost always rooted in one or more environmental levels and that the methods for individual change need to be supplemented with measures for change at those environmental levels. One way of measuring these networks of interactions is using the Social-Ecological Model (SEM) as a framework for a behavior change. According to the CDC (2021), the Social-Ecological Model considers the complex interplay between individual, interpersonal, community, and societal factors. The SEM can be used to understand the range of factors that put outdoor high school athletes at risk for skin cancer and to help to protect them from experiencing sun damage that can lead to skin cancer. The overlapping rings in the model illustrate how factors at

one level influence factors at another level. Besides helping to clarify these factors, the model also suggests that in order to prevent skin damage and skin cancer, it is necessary to act across multiple levels of the model at the same time. This approach is more likely to sustain prevention efforts over time and achieve population-level impact.

Theories of health behavior at the interpersonal level assume that individuals exist in an environment where other people's actions, opinions, attitudes, thoughts, and support affect their own feelings, attitudes, behaviors. At the SEM's interpersonal level, the relationships and social networks that a person takes part in also have great potential to impact behaviors. For high school athletes, such significant individuals can include family members, teammates, coaches, athletic directors, athletic trainers, team physicians, and other entities (i.e. teachers, classmates, and friends). Coaches, athletic trainers, and athletic coordinators are well-positioned in high school athletic settings to interact with this population and provide important resources and education on skin cancer prevention behaviors and long-term wellness. Observational learning is referred to as *modeling* in various literature, stating that people learn about what to expect through the experience with others. The sun safety habits athletes acquire during their school years have a good chance of remaining with them throughout their lives. Forty two percent of participants in the study indicated that one of the reasons why they do not use sunscreen before practice is that they simply forget to apply it, thus, a simple reminder and encouragement to use a sunscreen can make a difference. Seventy percent of participants did not observe coaches apply sunscreen, thus, coaches need to change their sun-protective behavior themselves and that's another reason why education of coaches is so important. Observing their coaches practice sun-protective behaviors, such as applying

sunscreen, wearing sunglasses or long sleeve shirts, can serve as a powerful motivator for athletes to adopt new practices and behaviors related to skin cancer prevention (Wiggs, 2007). With consistent encouragement from the coaches to use sunscreen, to stay in the shade when possible, and to wear sun-protective clothing, it is possible to improve sun-protective behaviors in outdoor high school athletes. Coaches can strongly encourage the use of sunscreen with a brief educational discussion at the beginning of each athletic season on the importance of skin cancer prevention. Additionally, coaches need to demonstrate the behavior of sunscreen application/reapplication themselves. Teammates can be key players in developing better sun-protective behaviors, by being peer and community educators. Creating a culture where players motivate each other to be better, to make better choices when it comes to their health and well-being, starts with the coaching staff. Parents need to be included in messages that are directed to adolescents and to become part of their education. Parents can also play an important role by modeling the sun-protective behaviors, such as wearing sun-protective clothing or staying in a shade.

Outdoor high school athletes need the knowledge, tools, and incentives to modify their sun-protective behaviors. There is a need for more support for developing various educational interventions specifically targeting high school athletes as it has been shown that the educational intervention had a positive impact on the participants' outcome expectation and their self-efficacy regarding the sunscreen use. The proportion of participants who said they would use sunscreen before each practice if it was available in the locker room or athletic facility tripled from pre-intervention to post-intervention, increasing from 32.7% to 90%, supporting the use of a targeted educational intervention

for outdoor high school athletes in an effort to improve their knowledge, behaviors, and attitudes about skin cancer. This significant increase indicates that when these athletes are educated about the importance of sun-protective behaviors, they are more willing to take action to protect themselves when sunscreen is made readily available. The results of this study revealed the effectiveness of education intervention and the need for improved primary prevention of sun damage in high school athletes participating in outdoor sports. As members of an organized group, high school athletes can be provided with more coordinated efforts that target at-risk teams through funding of various prevention programs that can be assimilated into daily routines. Any successfully implemented prevention program would potentially affect millions of athletes. The opportunity to target this large, easily accessible, high-risk population that is young enough to successfully adopt new behaviors should not be neglected.

The community level of the Social-Ecological Model focuses on the networks between organizations and institutions that make up the greater community. Increasing sun-protective behaviors among high schools can be viewed as community-wide intervention. Such interventions seek to increase sun-safety behaviors within a community by targeting a large part of the population in a defined area. Considering the culture of the target population is very important to choose proper mechanisms to achieve attention to skin cancer prevention. The language used in the health messages or in the visual aids needs to be accepted and understood by this age group. Also, the provision of the tools, resources, or environmental changes can make new behaviors easier to perform. There are a few success stories mentioned on the CDC website, but only a couple of them are targeting the outdoor athletes as the main target. Majority of changes mentioned by

the CDC, include adding free-standing sunscreen dispensers in the parks or public beaches. The one community-based approach related to the outdoor sports discussed installing shades at the dugouts or implementing health messages, such as “Be Sun Smart®” to ensure the young athletes see the sun-safe message every time they play. Another element of the community based approach to change of behavior involves evaluating current trends in the targeted population. Adolescents and young adults have high rates of social media usage. According to the study by Falzone and colleagues (2019), more than 70% of teens use social media, with Facebook (71%); Instagram (52%); Snapchat (41%); and Twitter (33%). Social media has the potential to be a cost-effective way to reach large numbers of young people and target messages at characteristics of specific audiences. More research is needed on how to best utilize these platforms to raise awareness of sun exposure prevention of skin cancer.

Organizations are instrumental in the development of health behaviors as they often enforce behavior-determining regulations or restrictions. Schools play significant role when it comes to communicating information about safe health practices and controlling the diffusion of knowledge. Sun-protective environmental and policy changes should include: increasing the availability of sun-protective items, such as sunscreen and protective clothing through providing funding, adding sun-protective features to the physical environment, such as shade structures, implementing sun protection policies, clothing guidelines, restrictions on outdoor activities during days with high heat and UV index. Recruiting local dermatologists and scheduling educational sessions for coaches and student-athletes at the beginning of season can be other measures implemented at the organizational level.

Additionally, the school districts need to educate coaches on sun-protective behaviors in order for them to advocate proper sun safety behaviors in their athletes. Previous research supports the importance of educating coaches first. In one randomized study, coaches with the training felt they had an easier time getting their athletes to wear sunscreen compared with those coaches without training (Parrott et al., 1999). Similarly, another study reported that the coaches who attended the training seminar promoted sun protection significantly more often than those who did not (Parrott & Duggan, 1999). Results from this study demonstrated the effectiveness of a short educational intervention on student athletes with the increase of correct responses and also willingness to use sunscreen, but implementation depends on the coaches and their support staff. To ensure well-informed coaches, sun safety education modeled after the American Academy of Dermatology's Play Sun Smart program should constitute part of the coaches' training. Once coaches are properly trained, they can incorporate educational sessions into their preseason meetings with their teams to help them understand the importance of sun-protective behaviors and dangers associated with sun exposure. School districts also need to educate coaches on sun-protective behaviors in order for them to advocate proper sun safety behaviors in their athletes and also to demonstrate those behaviors themselves on a daily basis. At the school level, the implementation of the educational programs should be encouraged by high school administrators, including principals, athletic directors, and athletic coordinators, and fully embraced by coaches in an effort to continually improve knowledge of skin cancer risks and decrease the chances for its development at this high-risk group.

Sunscreens are effective in preventing photoaging, cell mutations, and skin cancer (Wiggs, 2007); yet, literature suggests sunscreen use remains low. Part of the behavior change is ensuring that athletes are provided with the tools and resources that make new behaviors easier to perform. Participants in this study indicated that they would apply sunscreen if it was made available to them before practice (close to 33% before intervention, and 90% after intervention), thus, having sunscreen available at the athletic facilities for athletes to use is crucial. This significant increase indicates that when these athletes are educated about the importance of sun-protective behaviors, they are more willing to take action to protect themselves when sunscreen is made available at the athletic facility or locker room. Sunscreen is not cheap, thus, schools need to provide more funding to purchase sunscreen in bulk or install sunscreen dispensers in the high traffic areas, such as locker rooms and athletic facilities, to make it easily available for outdoor student-athletes.

Policies and laws that are initiated at local, national and global levels make up the broadest level of the Social-Ecological Model. These policies often have the potential to impact large numbers of people. There are no coordinated sun exposure awareness programs at this time that specifically target outdoor high school athletes. The majority of sun exposure in a person's lifetime happens before age 20, and children spend most of their time at school. High schools are ideal settings for practicing sun smart behaviors. There are only a few initiatives mentioned in the literature that focused on the high school students' sun safety. One of the recent programs that is worth mentioning and could be copied by the school districts in Texas is the Sun Smart Schools program by Nevada Cancer Coalition. According to the Nevada Cancer Coalition (2021), the goal of

Sun Smart Schools is to establish healthy sun safety habits in children and teens from a young age to prevent skin cancer during adolescence and adulthood. Just one blistering sunburn during childhood can double a person's risk of developing skin cancer later in life, so it's important to establish sun smart habits during childhood and adolescence. Nevada Senate Bill 159, which became law July 1, 2019, requires all public and private schools to implement sun safety policy and to allow students to possess and self-administer sunscreen in schools settings. SB 159 specifies that sunscreen must not be considered an over-the-counter medication. The majority of sun exposure in a person's lifetime happens before age 20, and as children spend most of their time at school, this is an ideal setting for practicing sun smart behaviors. The Sun Smart Schools launched its pilot program during the 2015-2016 school year in seven schools across Nevada and currently have 90 schools participating. In the 2020–2021 school year, nearly 200 teachers received program toolkits. Schools can also choose to receive free automatic sunscreen dispensers and a 1-year supply of sunscreen. Thousands of students received UV-activated bracelets, educational postcards, and bookmarks. Nevada Cancer Coalition staff and volunteers provided 64 in-person and online sun safety presentations to teachers and students during the 2019–2020 and 2020–2021 school years. Implementation of the similar program in Texas schools would be possible considering the Texas climate is similar to Nevada and students do spend hours in the sun either during school hours or after.

The administration can implement a policy requiring sunscreen use among all outdoor athletes and provide additional funding to purchase the sunscreen for the teams. Sun-protective environmental and policy changes include increasing the availability of

sun-protective items, such as sunscreen and protective clothing; adding sun-protective features to the physical environment, such as shade structures; and implementing sun protection policies, clothing guidelines, and restrictions on outdoor activities during days with high heat and UV index. The importance of these proposals should not be underestimated as thousands of young athletes stand to benefit.

Strengths and Limitations of Study

This study reinforces the need for schools and coaches to focus on the education of high school athletes about the dangers of sun exposure and importance of sunscreen application and availability. Despite a small sample size, findings can be generalized if the selection process is well-designed and the sample is representative of the study population. The intervention and data collection was time and cost-effective. Additionally, this study adds to the gap in research with this specific population. However, there are some limitations with the study's design. The use of a convenience sample of athletes selected from only one high school and from only four sports could limit the generalizability of the findings. Conducting this research with high schools in nearby school districts will help with generalizing the results to the larger population. In this study of high school athletes, the data was self-reported, which may have resulted in recall bias and socially desirable responses. Due to the recent COVID-19 pandemic, the format of the study had to be changed from having a face-to-face educational intervention to the electronic survey, which resulted in the smaller sample size and possibly less meaningful results. The COVID-19 face-to-face limitation could have reduced the positive impact of the educational messages about risk of sun exposure and skin cancer, in comparison to the education being delivered by the researcher directly. Additionally,

the survey was administered during late fall (late November-early December) which could not truly reflect the patterns of seasonal sunscreen use by the participants. Conducting study in spring, when temperatures and heat index are significantly higher, could have impacted the participants' willingness to apply sunscreen before practice if it were made readily available to them and led to higher confidence in the statement "will apply sunscreen before practice today." It is not certain that the timing of administration of the survey would have any effect on the change in knowledge about sun exposure and skin cancer.

Future Studies

Implications for further research include a larger, random sampling of participants in a more ethnically diverse study sample. Seventy-six percent of the sample that was used for this study was predominantly White/Caucasian, thus, conducting future studies using a larger and more diverse population focusing on the outcome expectations, attitudes, behaviors, and knowledge of skin cancer can help raise awareness of skin cancer in populations with darker skin. According to the American Academy of Dermatology (2014), people of all colors, including those with brown and black skin, get skin cancer. Many people do not realize that even if they do not experience a sunburn, they can still get skin cancer. When skin cancer develops in people of color, it's often in a late stage when diagnosed, which can be deadly when the person has melanoma, a type of skin cancer that can spread quickly. There is also a need for further research that will include data collection at 1-, 3- and 6-month intervals to determine knowledge retention and adaption of sun-protective behaviors, since with this study the knowledge was

evaluated right after providing the information about skin cancer and dangers of sun exposure.

One of the basic premises of the Cognitive Social Theory is that people learn not only through their own experiences but also by observing the actions of others and results of those actions. The previous studies have highlighted the profound effect of counseling by coaches in preventing eating disorders, binge drinking and steroid use (Goldberg et al., 2000; Weshsler et al, 2008). The coaching staff can reinforce sun protective behaviors and endorse a culture of self-care behaviors on the fields or courts such as encouraging the proper use of sunscreen. The results of this study demonstrated the importance of encouragement of athletes by the coaching staff to apply sunscreen. Forty-two percent of participants indicated that they simply forget to apply sunscreen before practice and they also indicated a high level of confidence that they would be applying sunscreen before practice if their coach encouraged them to apply it. Future research can focus on involving coaching staff in being good role models by applying sunscreen themselves before practice but also reminding student-athletes to apply it regularly before practice or competition. Future studies can also customize the messages to this specific population by pointing out the major myth or misconceptions about the effect of sun rays on their skin. One of the important messages to include in the future educational sessions is that sunshine does not have a healing effect on acne. According to Balkrishnan and colleagues (2006), acne is a common adolescent problem, affecting more than 85% of teenagers. Although some consider acne to be merely a cosmetic problem, it may have significant and enduring emotional and psychological effects. The presence of acne can negatively affect quality of life, self-esteem, and mood in adolescents. The findings of this study

identified the gap in knowledge regarding the effect of sun rays on acne. When asked if "sunshine clears up acne," almost half of the participants (55%) indicated they believe for it to be true prior to the pre-assessment. After the educational intervention, all participants were aware that sunshine has no therapeutic effect on acne. The difference in scores illustrated the importance of including information about the effect of the UV rays on acne, and also importance of applying sunscreen if anti-acne medications are prescribed as most topical treatments increase skin's sun sensitivity.

Conclusion

High school athletes have received little attention in skin cancer prevention research. This group of athletes is large in number, is at high risk, and is easily accessible, which makes them an important population to target for primary prevention of skin cancer. According to the National Federation of State High School Association (NFHS), in 2018-19 there were 7,937,491 participants in high school sports, with 1,093,621 athletes participating in outdoor track and field, 853,182 in soccer, 488,640 in cross-country, and 348,750 in tennis. These numbers indicate that outdoor high school athletes constitute a large group of athletes that are at risk for developing skin damage and skin cancer. Multiple organizations and studies indicated that the use of sunscreen decreases the amount of ultraviolet radiation to the skin and is recommended as a skin cancer prevention strategy, along with limiting sun exposure, using protective clothing, and avoiding tanning beds.

This study highlights the elevated sun exposure of outdoor high school athletes which puts them at higher risk for skin damage and skin cancer. Despite long hours in the sun and a strong belief that sunscreen can help prevent skin cancer, the vast majority of

athletes did not use sunscreen regularly. Since skin cancer rates are increasing, it is important to decrease the chances of current high school athletes developing skin cancer in the future by implementing educational programs in all athletic departments across the nation. Encouraging the application of sunscreen, making sunscreen available, and educating athletes and coaches on sun-protective behaviors may result in a positive behavior change for interscholastic programs competing outdoors. Coaches and staff could serve as role models and may positively influence their players by regularly practicing sun-protective behaviors that could serve as a powerful motivator for athletes to adopt new practices and behaviors related to skin cancer prevention. Parents and health professionals need to be included in messages that are directed to teens and to become part of their education. Increasing sun-protective behaviors among high school and college students can be viewed as a community-wide intervention, attempting to increase sun-safety behaviors within a community by targeting a large part of the population in a defined area. A multi-level educational approach that includes coaches, trainers, administrators, and parents may be useful in protecting this high-risk population of high school student-athletes.

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APPENDICES

APPENDIX A

Recruitment Email to Parents of Participants

Good afternoon!

My name is Mrs. Natalya Nikitina-Helvey and I am the Centennial High School's Head Tennis Coach and Health Science Teacher I am conducting a research study as a doctoral student at Oklahoma State University to learn more about sun-protective behavior and depth of knowledge about skin cancer among high school student-athletes, specifically, athletes that are participating in outdoors sports (soccer, tennis, cross country and track and field) that receive high exposure of sun rays throughout the year.

Your child's input on various aspects of sun-protective behaviors is very important, but participation is completely voluntary. All your child is required to do is complete the survey that will be emailed to her/him and she/he will eligible to enter the drawing to win one of the six $25 Amazon gift cards.

This study has been approved by Oklahoma State University Institutional Review Board (IRB), the BISD, and the CHS administration.

In this email, you will find the Parent Permission Form that provides more information about the study. **If you have no objections to your child participating in this study, you DO NOT need to do anything and do not need to complete this form.** If for any reason, you would like to opt your child out from participating in this study/taking this survey, please sign the Parent Permission Form and email it back to me by Thursday, November 19th.

You can find the Parent Permission Form at the following link or view it as an attachment.

https://drive.google.com/file/d/1rXUdFTrPkIhI98cD-AjYOhl-R48-ICY6/view?usp=sharing

APPENDIX B

Recruitment Email to Participants

Good afternoon!

You are invited to participate in a research study called *The Effects of Skin Cancer Prevention Education and Sunscreen Availability on Sunscreen Use among High School Athletes*. This study is being conducted by Natalya Nikitina-Helvey, CHES®, a Health Science Teacher/Head Tennis Coach at Burleson Centennial High School and Ph.D. student in the College of Education and Human Sciences at Oklahoma State University. The purpose of the study is to contribute to the reduction in the incidences of skin cancer in the United States in high-school student-athletes. Eligible participants will be individuals who are currently enrolled at Centennial High School and are student-athletes in outdoor sports.

Participation will entail completing an anonymous 15-20 minutes online survey consisting of multiple questions that will examine your skin cancer knowledge and sun-protective behaviors. The survey can be taken on your mobile device and all responses will be kept confidential.

At the end of the survey, all participants will be given the opportunity to enter their email address into a drawing for a chance to win one of SIX $25 Amazon gift cards (with the odds of winning are 1 in 4)! At least 80% of questions must be answered in order to qualify for the gift card drawing. You also will have a chance to enter your email address if you would like to receive a *complimentary, travel size sunscreen*. The option to receive a complimentary sunscreen or to be entered in the drawing is completely voluntary.

Email addresses, if provided, will only be kept for a maximum of two weeks following the end of the recruitment period for the online survey and cannot be connected to your survey responses.

Dear CHS athlete, your perspective is highly important and greatly valued and I hope you will help me with my study and complete this survey. If you are interested in participating, please follow the link below:

https://okstateches.az1.qualtrics.com/jfe/form/SV_aa70VYlgzCvKeAB

If you have any questions or concerns regarding this study, please contact Mrs. Natalya Nikitina-Helvey at natalya.nikitinahelv@bisdmail.net

Thank you for your time and assistance!

Mrs. Natalya Nikitina-Helvey
Health Science Teacher/Head Tennis Coach (Centennial High School)
Ph.D. Student (Oklahoma State University)

IRB Protocol Number: IRB-20-457

APPENDIX C

Oklahoma State University IRB Letter of Approval

Oklahoma State University Institutional Review Board

Date:	10/13/2020
Application Number:	IRB-20-457
Category:	College of Education and Human Sciences
Proposal Title:	The Effects of Skin Cancer Prevention Education and Sunscreen Availability on Sunscreen Use among High School Athletes
Exempt Categories:	New Category 1: Research conducted in commonly accepted education settings that involve normal education practices that are not likely to adversely impacts student opportunities to learn or the assessment of educators who provide instruction.
Principal Investigator:	Natalya Nikitina-Helvey
Faculty Advisor:	Dr. Julie Croff

Status Recommended by Reviewer(s): Approved

APPENDIX D

The Skin Cancer and Sun Protection in High School Athletes Survey

Participant Information Form

.

You are invited to participate in a research study about *Skin Cancer Prevention Strategies for High School Athletes* and evaluates the attitudes, knowledge of skin cancer, the use of sunscreen, and sun-protective behaviors by high-school athletes. This study is being conducted by Natalya Nikitina-Helvey, CHES®, a Health Science teacher at Burleson Centennial High School, and a Ph.D. student in the College of Education and Human Sciences at Oklahoma State University. Your participation will help me better understand sunscreen usage patterns and attitudes toward sunscreen use.

Your participation in this research is voluntary. There is no penalty for refusal to participate, and you are free to withdraw your assent and participation in this project at any time. In order to participate, you must be a current student-athlete at Centennial High School.

If you agree to be in this study, I would ask you to do the following things:

Complete an online survey which includes the pre-test, questions about sun-protective behaviors, outcome expectations, the lesson slides about different types of skin cancer, identification, and prevention from Skin Cancer Foundation, and the post-test. The survey will take about 25-30 minutes.

Compensation: Upon completion of the survey, with at least 80% of questions answered, you will be prompted to enter your email for the chance to win one of six

$25 Amazon gift cards (the odds of winning are about 1 in 4).

Confidentiality: The information you give in the study will be anonymous. This means that your name will not be collected or linked to the data in any way. All responses will be recorded confidentially and stored securely.

Contact and Questions: If you have questions about the research study itself, please contact the researcher at natalya.nikitinahelv@bisdmail.net or nikitin@okstate.edu. If you have any questions about your rights as a research volunteer, please contact the OSU IRB at (405) 744-3377 or irb@okstate.edu

By agreeing to participate you are indicating that: you are a current student-athlete at Burleson Centennial High School and you have read and understood the statements regarding your participation in this study.

If you agree to participate in this research, please click "I agree" to continue.

- ◯ I agree
- ◯ I disagree

General Information

. Type Your Participant Code (first 2 letters of last name + first 2 letters of first name + birth month + birth date; *Example*: smj1012)):

○ ID#

. What is your gender?

○ Male
○ Female
○ Prefer not to answer

. What is your age?

.

Which race/ethnicity best describes you? (Please choose only one)

☐ American Indian or Alaskan Native
☐ Asian/Pacific Islander
☐ Black/African American
☐ Hispanic
☐ White/Caucasian
☐ Other (Please specify)
☐ Prefer not to answer

. What is your current year in high school?

○ Freshman
○ Sophomore
○ Junior

- ◯ Senior
- ◯ Prefer not to answer

. Which of the following sports do you currently participate in at your high school?

- ◯ Girls Cross Country
- ◯ Boys Cross Country
- ◯ Girls Soccer
- ◯ Boys Soccer
- ◯ Girls Tennis
- ◯ Boys Tennis
- ◯ Girls Track and Field
- ◯ Boys Track and Field
- ◯ Other (Please specify)

- ◯ Prefer not to answer

Health Information & Genetic Disposition

. In general, how would you rate your overall health?

- ◯ Excellent
- ◯ Very Good
- ◯ Good

- ○ Fair
- ○ Poor
- ○ Prefer not to answer

.

Have you ever been diagnosed with skin cancer?

- ○ Yes
- ○ No
- ○ Other (please specify)
- ○ Prefer not to answer

.

Has anyone in your family been diagnosed with skin cancer?

- ○ Yes
- ○ No
- ○ Other (please specify)
- ○ Prefer not to answer

.

Your natural skin color (before sun exposure) is?

- ○ Ivory white (very fair)
- ○ Fair (white) or pale

- ◯ Fair to beige, with golden undertone
- ◯ Olive or light brown
- ◯ Dark brown
- ◯ Other (please specify)

- ◯ Prefer not to answer

.

Your eye color is?

- ◯ Light blue, light gray, or light green
- ◯ Blue, gray or green
- ◯ Hazel or light brown
- ◯ Dark brown
- ◯ Brownish black
- ◯ Prefer not to answer

.

Your natural hair color is?

- ◯ Red or light blonde
- ◯ Blonde
- ◯ Dark blonde or light brown
- ◯ Dark brown
- ◯ Black
- ◯ Prefer not to answer

.

How many freckles do you have on unexposed areas of your skin?

- ○ Many
- ○ Several
- ○ A few
- ○ Very few
- ○ None
- ○ Prefer not to answer

.

Which of the following best describes your skin's reaction to the sun (after being in the sun for 30 minutes with no sunscreen)?

- ○ Burns easily, never tans
- ○ Usually burns, tans with difficulty
- ○ Sometimes burns, tans gradually
- ○ Rarely burns, tans easily
- ○ Very rarely burns, tans easily
- ○ Never burns, tans very easily
- ○ Prefer not to answer

Sun-Protective Behaviors

. In the past week, how often did you:

	0 days/week	1-3 days/week	4-6 days/week	da
Use sunscreen on your face	○	○	○	
Use sunscreen on your body	○	○	○	
Wear any protective clothing or gear (long sleeve shirt, hat, or sunglasses)	○	○	○	
Observe your coach apply sunscreen before practice	○	○	○	
Observe your teammates apply sunscreen before practice	○	○	○	

.

How many months, on average, do you spend training outdoors?

- ○ Less than 4 months
- ○ 4-6 months
- ○ 7-9 months
- ○ 10-11 months
- ○ 12 months
- ○ Prefer not to answer

.

During the months you are training, how many hours per day, on average, do you spend outdoors?

- ◯ Less than 2 hours
- ◯ 2-3 hours
- ◯ 3-4 hours
- ◯ 5 or more
- ◯ Prefer not to answer

.

Which type of sunscreen do you use the most?

- ◯ Cream
- ◯ Gel
- ◯ Spray
- ◯ Wax stick
- ◯ Other (please specify)

- ◯ Prefer not to answer

.

At your practice site do you have a shade to provide you with protection from the sun?

- ◯ Yes
- ◯ No
- ◯ Other (please specify)

- ◯ Prefer not to answer

.

During practice, how often do you seek to stay in the shade?

- ○ Never
- ○ Rarely
- ○ Sometimes
- ○ Often
- ○ Always
- ○ Prefer not to answer

.

If you do not use sunscreen before practice, what is the main reason for your decision?

- ○ I do not like how it feels on my face
- ○ I forget to apply it
- ○ It is too expensive to purchase
- ○ I just like to be tan
- ○ It is not available
- ○ It is too messy
- ○ Other (please specify)

- ○ Prefer not to answer

.

Have you ever seen information flyers or fact sheets about sun protection and dangers of excessive sun at your school, athletic facilities, athletic training room, or locker rooms?

- ◯ Yes
- ◯ No
- ◯ Other (please specify)
- ◯ Prefer not to answer

.

How often do you examine your skin for changes to moles and other skin blemishes?

- ◯ Never
- ◯ Annually
- ◯ Monthly
- ◯ Weekly
- ◯ Daily
- ◯ Other (please specify)
- ◯ Prefer not to answer

.

How often do you get screened for skin cancer by a healthcare provider (primary doctor or dermatologist)?

- ◯ At least every six months
- ◯ At least every year
- ◯ At least every two to three years
- ◯ At least every three to five years
- ◯ Other (please specify)

- ◯ Prefer not to answer

.

In the last 12 months, how many times did you use a tanning bed?

- ◯ 0
- ◯ 1-3
- ◯ 4-7
- ◯ 8-11
- ◯ 12 or more
- ◯ Other (please specify)
- ◯ Prefer not to answer

.

In the last 12 months, how many times did you have a sunburn on a face or body?

- ◯ 0
- ◯ 1-3
- ◯ 4-7

- ◯ 8 or more
- ◯ Other (please specify)

- ◯ Prefer not to answer

Self-Efficacy and Sun-protective Behaviors

.

For each of the following statements about the self-efficacy and sun-protective behavior, please indicate *how confident are you that you:*

	1. Not at all confident	2. Not so confident	3. Somewhat confident	4 co
Will apply sunscreen before practice today?	◯	◯	◯	
Will apply sunscreen before practice even if your teammates do not apply it?	◯	◯	◯	
Will apply sunscreen before practice even if your coaches do not apply it?	◯	◯	◯	
Will use sun-protective clothing (hat, sunglasses, long sleeve shirt, etc.) during practice on a sunny day?	◯	◯	◯	
Will apply sunscreen even on a cloudy day?	◯	◯	◯	
Will apply sunscreen before practice if your coach will encourage you to	◯	◯	◯	

apply sunscreen?	1. Not at all confident	2. Not so confident	3. Somewhat confident	4 co
Will make time for sunscreen application no matter how busy you are?	○	○	○	
Will seek shade on a sunny day at your athletic facility?	○	○	○	
Can select the right sunscreen (gel, spray, cream, wax stick) for your sport?	○	○	○	
Can select the right SPF based on your activity?	○	○	○	
Will apply sunscreen before practice if it was available to you every day?	○	○	○	
Can recognize signs of skin cancer on your body?	○	○	○	

Outcome Expectations and Sun-protective Behavior

.

For each of the following statements about the outcome expectations and sun-protective behavior, please indicate *how confident are you that:*

	1. Not at all confident	2. Not so confident	3. Somewhat confident	4. Very confiden
Applying a sunscreen will make your skin look healthier	○	○	○	○

	1. Not at all confident	2. Not so confident	3. Somewhat confident	4. Very confiden
Applying sunscreen regularly can prevent skin cancer	○	○	○	○
Applying sunscreen regularly can prevent skin aging (wrinkles, sunspots)	○	○	○	○
Sunscreen before practice will not make your face and hands sticky	○	○	○	○
Sunscreen will not run into your eyes	○	○	○	○
You would use sunscreen before each practice if it was available in the locker room or athletic facility	○	○	○	○

Pre-test of Knowledge of Skin Cancer

. For each of the following ten statements about skin cancer, please indicate whether it is true or false:

 # 1: Skin cancer is rare.

○ True

○ False

.

Sorry, wrong answer! :(

Fact #1: 1 in 5 Americans will get skin cancer in their lifetime.

That's the correct answer! Well done! :)

Fact #1: 1 in 5 Americans will get skin cancer in their lifetime.

#2: You can die from skin cancer.

- ○ True
- ○ False

Sorry, wrong answer! :(

Fact #2: You can die from skin cancer if it spreads to your internal organs. Melanoma is the deadliest form of skin cancer. However, when caught early, about 99% of all melanomas are curable. That's why it is important to go to a dermatologist to catch skin cancer early- so it doesn't spread and become fatal.

That's the correct answer! Well done! :)

Fact #2: You can die from skin cancer if it spreads to your internal organs. Melanoma is the deadliest form of skin cancer. However, when caught early, about 99% of all melanomas are curable. That's why it is important to go to a dermatologist to catch skin cancer early- so it doesn't spread and become fatal.

. **#3: Skin cancer is a disease that affects only old people.**

- ○ True
- ○ False

.

Sorry, wrong answer! :(

Fact #3: Melanoma is the second most common form of cancer among 15-29-year-olds.

.

That's the correct answer! Well done! :)

Fact #3: Melanoma is the second most common form of cancer among 15-29-year-olds.

. **#4: People with dark skin can get skin cancer.**

○ True

○ False

.

Sorry, wrong answer! :(

Fact #4: No one is immune from the dangers of the sun. In fact, skin cancer is rarer but more *deadly* among darker-skinned people.

.

That's the correct answer! Well done! :)

Fact #4: No one is immune from the dangers of the sun. In fact, skin cancer is rarer but more *deadly* among darker-skinned people.

. #5: Experiencing five or more sunburns can double your risk of developing skin cancer.

○ True

○ False

.

Sorry, wrong answer! :(

Fact #5: Experiencing just one bad sunburn as a child or teen doubles your risk of getting melanoma. Five sunburns by *any* age also doubles your chances of developing melanoma.

.

That's the correct answer! Well done! :)

Fact #5: Experiencing just one bad sunburn as a child or teen doubles your risk of getting melanoma. Five sunburns by *any* age also doubles your chances of developing melanoma.

. **#6: Two forms of ultraviolet radiation - UVA and UVB- reach the earth and can cause skin cancer.**

- ○ True
- ○ False

.

Sorry, wrong answer! :(

Fact #6: *UVA* penetrates the skin even more deeply than UVB and damages the inner layer of skin. These rays play a major role in skin aging and wrinkling, as

well as skin cancer.
UVB is a shorter wave that damages the skin's top epidermal layers. UVB rays are chief causes of skin reddening and sunburn and play a key role in the development of skin cancer, as well as a role in skin aging.

That's the correct answer! Well done! :)

Fact #6: *UVA* penetrates the skin even more deeply than UVB and damages the inner layer of skin. These rays play a major role in skin aging and wrinkling, as well as skin cancer.
UVB is a shorter wave that damages the skin's top epidermal layers. UVB rays are chief causes of skin reddening and sunburn and play a key role in the development of skin cancer, as well as a role in skin aging.

. #7: Though a sunburn is a sign of sun damage, a tan is a sign of health.

- ○ True
- ○ False

Sorry, wrong answer! :(

Fact #7: Both sunburns and suntans are signs that your skin cells have been damaged by the sun. There is no such thing as a "healthy tan." Both suntans and burns can lead to skin cancer.

That's the correct answer! Well done! :)

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. #8: Sunshine clears up acne.

- ○ True
- ○ False

Sorry, wrong answer! :(

Fact #8: Sun exposure appears to help acne at first, but in the end, it can aggravate it and make it worse. If you use acne medication, be sure to apply sunscreen,

wear protective clothing, and seek the shade. Many acne medications make your skin more likely to burn in the sun, which makes you more susceptible to sun damage.

.

That's the correct answer! Well done! :)

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. #9: "SPF" stands for Sun Protection Factor.

- ○ True
- ○ False

.

Sorry, wrong answer! :(

Fact #9: SPF indicates how long it will take for UVB rays to redden skin when using a sunscreen, compared

to how long skin would take to redden without the product.
For instance, someone using a sunscreen with an SPF of 15 will take *15 times longer* to redden than they would without the sunscreen. An SPF 15 sunscreen screens approximately 93% of the sun's UVB rays; SPF 30 protects against 97%.

That's the correct answer! Well done! :)

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. #10: Tanning beds are safer for you than sunlight.

- ○ True
- ○ False

Sorry, wrong answer! :(

Fact #10: There is no such thing as a safe tan, especially in tanning beds. People using tanning beds may receive as much as *12 times* the annual dose of harmful UVA radiation compared to the dose they receive from sun exposure. Using a tanning bed increases your risk of melanoma by 74%.

That's the correct answer! Well done! :)

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Lesson: Rays Awareness - Preventing Skin Cancer

In this lesson, you will learn about ultraviolet (UV) radiation from the sun and tanning beds, how it affects your skin, and why protecting yourself is critical to preventing skin cancer. You will also learn about

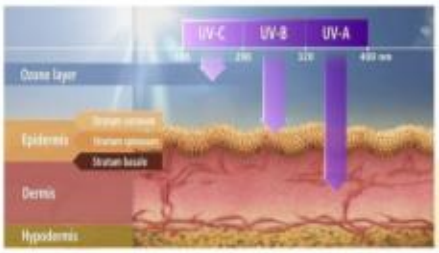
various forms of skin cancer, understand how to detect skin cancer, and protect from UV radiation exposure. Please read the information carefully on the next few slides.

Lesson: Skin Cancer

RAYS AWARENESS

OVERVIEW OF SKIN CANCER

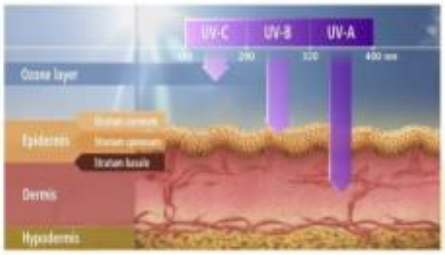
- Over 100 different types of cancer are classified according to the type of cell or organ in which they originate.
- **Skin cancer** begins in the outer layer of skin, which is made up of squamous cells, basal cells, and melanocytes.
- Skin cancer most often develops on areas of the skin exposed to the sun rays.
- The UV radiation produces mutations in a cell's DNA allowing for abnormal cell growth.



RAYS AWARENESS

OVERVIEW OF SKIN CANCER

- Three types of skin cancer include basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma.
- More than 3.5 million cases of BCC and SCC diagnosed in over 2 million people annually.
- If caught early, almost all are curable.



RAYS AWARENESS

FORMS OF SKIN CANCER

- **Basal Cell Carcinoma (BCC)** is the most common form of skin cancer.
- It can be a raised, translucent, pearly nodule, a scar-like area that is white, yellow or waxy, OR an open sore that bleeds, oozes or crusts and doesn't heal, OR a pink growth with a slightly elevated border and a crusted indentation in the center.
- It is usually caused by both cumulative and intermittent, intense sun exposure or tanning bath exposure.
- Commonly found on the head, neck, arms, and legs.

RAYS AWARENESS

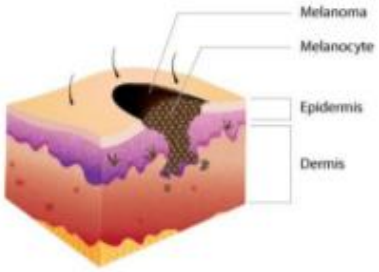
FORMS OF SKIN CANCER

- **Squamous Cell Carcinoma (SCC)** can be seen as scaly red patches, raised growths with a sore in the center, open sores that bleed and crust, OR wart-like growths that crust and may bleed.
- Long-term, cumulative sun exposure is the most common cause.
- Occurs often on the rim of the ear, face, neck, arms, chest, and back.
- A small percentage become deadly.

RAYS AWARENESS

FORMS OF SKIN CANCER

- **Melanoma** is the deadliest form of skin cancer.
- Develops in a mole or appears as a new dark spot on the skin.
- One American dying from melanoma every hour.
- Can **spread to other organs** in the body if not caught at the early stage.



RAYS AWARENESS

THE ABCDEs OF MELANOMA

- Moles, brown spots and growth on the skin are usually harmless - but not always.
- Anyone who has more than 100 moles or one or more unusual looking or atypical moles is at greater risk for melanoma.
- That's why it's so important to know your skin very well and to recognize any changes in the moles on your body.
- Look for the **ABCDE** signs of melanoma, and if you see one or more, make an appointment with a dermatologist immediately.

RAYS AWARENESS

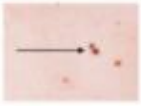
THE ABCDEs OF MELANOMA

The pictures below show normal moles and melanomas.

	Benign (Normal)	Malignant (Cancerous)	
Symmetrical			**ASYMMETRICAL** (the two sides do not match)
Border is even			**BORDER** is uneven

RAYS AWARENESS

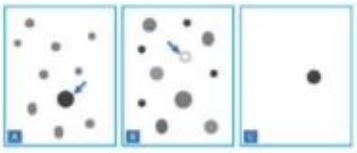
THE ABCDEs OF MELANOMA

	Benign (Normal)	Malignant (Cancerous)	
One Color			Two or more **COLORS**
Smaller than 1/4 inch			**DIAMETER** is larger than 1/4 inch
Ordinary mole			**EVOLVING** or changing in size, shape, color or another trait

RAYS AWARENESS

The Ugly Duckling Signs

- These three different scenarios depict "ugly duckling' moles that should prompt suspicion. Squares A, B, and C each represent a body area such as the back.



- In A, there is a dominant mole pattern with slight variation in size. The "ugly duckling" is clearly darker and larger than all other moles.
- In B, there are two main patterns, one of large moles and other of smaller, darker moles. The "ugly duckling" is small but lacks pigmentation/color.
- In C, there is only one lesion on the back. If this lesion is changing, causing a problem, or deemed unusual or atypical, see a dermatologist and have this "ugly duckling" examined.

- An approach combining the ABCDEs and "Ugly Duckling" technique should improve the chances of early detection of all types of melanoma and help save lives.

RAYS AWARENESS

SUN SMART STEPS

Seek shade Play is safe in the shade whenever possible and avoid midday sun. UV rays are especially strong between 10 AM and 4 PM.

Cover up Make your own shade with a wide-brimmed hat and long-sleeved shirts and long pants. Baseball caps and visors shade the face but leave the neck, lower face, and ears exposed. A broad-brimmed hat can help prevent cancer in those areas.

RAYS AWARENESS

SUN SMART STEPS

Wear sunglasses Protect your eyes with UV-blocking sunglasses. Look for a tag that says the lenses block 99% or more of UV radiation.

Learn not to burn! Just one blistering sunburn when you're a child or teen more than doubles your risk of developing melanoma later in life. Using sun protection every day may be the smartest thing you can do for yourself!

RAYS AWARENESS

SUN SMART STEPS

Use sunscreen every day UV rays are strongest during summer, but they can cause damage year-round. Use 2 tablespoons of a broad-spectrum (UVA/UVB) sunscreen with an SPF of 15 or higher every day—in every season—no matter what your skin color. For extended outdoor activity, use a water-resistant, broad-spectrum sunscreen with an SPF of 30 or higher. Be sure to reapply every 2 hours or after swimming or sweating.

Don't use tanning beds Indoor tanning poses an equally great or greater risk of causing skin cancer than sun exposure.

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Post-Test of Knowledge of Skin Cancer

. For each of the following statements about skin cancer, please indicate whether it is true or false:

	1.True	2. False
Skin cancer is rare	○	○
You can die from skin cancer	○	○
Skin cancer is a disease that affects only old people	○	○
People with dark skin can get skin cancer	○	○
Experiencing five or more sunburns can double your risk of developing skin cancer	○	○
Both forms of ultraviolet radiation, UVA and UVB, reach the earth and can cause skin cancer	○	○
Though a sunburn is a sign of sun damage, a tan is a sign of health	○	○

	1.True	2. False
Sunshine clears up acne	○	○
"SPF" stands for Sun Protection Factor	○	○
Tanning beds are safer for you than sunlight	○	○

Sunscreen Availability

. Considering what you have learned today, if you were provided a sunscreen to use during the practice or competition, would you choose to use it to protect yourself against UV rays?

- ○ Yes
- ○ No
- ○ Prefer not to answer
- ○ Other

Survey Incentives

. Do you wish to receive the incentive for completing this survey? If you answer "yes," you will be taken to a second survey so that you can enter your email address.
Incentives include: a chance to win one of six $25 Amazon gift cards and/or a travel size Banana Boat Sport Performance Sunscreen Lotion SPF 30.

- ◯ Yes
- ◯ No

. Thank you! You have reached the end of the survey!

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VITA

Natalya Nikitina-Helvey

Candidate for the Degree of

Doctor of Philosophy

Dissertation: THE EFFECTS OF SKIN CANCER PREVENTION EDUCATION AND SUNSCREEN AVAILABILITY ON SUNSCREEN USE AMONG OUTDOOR HIGH SCHOOL ATHLETES

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Biographical:

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Completed the requirements for the Doctor of Philosophy in Health and Human Performance at Oklahoma State University, Stillwater, Oklahoma in December 2021.

Completed the requirements for the Master of Education in General Education at University of Central Oklahoma, Edmond, Oklahoma in 2011.

Completed the requirements for the Bachelor of Business Administration in Business Management at Oklahoma Christian University, Edmond, Oklahoma in 2003.

Experience:

Health Science Teacher – Centennial High School, Burleson, TX	2017-present
Faculty/Sports & Exercise Science - Cameron University, Lawton, OK	2014-2017
Adjunct Faculty/Tennis Coach – U. of Central Oklahoma, Edmond, OK	2006-2014
Assoc. Head Tennis Coach – Wichita State University, Wichita, KS	2004-2006

Membership:

Texas Health Occupations Association (THOA)