Making an Impact on Skin Cancer Prevention and Strategies for Sun Safety:

DNP Project Report

Kristen Pope

Edson College of Nursing and Health Innovation Arizona State University

Author Note

The Institutional Review Board at Arizona State University approved this study. There were no conflicts of interest to disclose in this report.

Correspondence for this article should be directed to Kristen Pope. Email: kapope2@asu.edu

Abstract

Skin cancer is the most prevalent form of cancer diagnosed in America. No formal educational program for skin cancer prevention and sun safety previously existed at a Southwest University. As a result, a sun safety educational intervention sought to address this gap. For this co-ed young adult population, an education video outlining sun safety measures was developed and delivered. An evidence-based review of the literature supported the intervention design inclusive of pre-and post- descriptive surveys, distributed via Survey Monkey. Data collected included sun safety behaviors, intent for behavioral change, and attitudes towards sun safety. Twenty-eight students completed both the pre-and post-survey. Based on the findings, it is clear that students are more likely to adhere to sun-safe behaviors following this video-based education, potentially decreasing their risk of skin cancer development.

Making an Impact on Skin Cancer Prevention and Strategies for Sun Safety

Skin cancer is the most highly diagnosed cancer in the United States (CDC, 2019). It can be prevented through regimens, including daily sunscreen, avoiding risky behaviors such as tanning, and participating in annual skin exams. In individuals under the age of thirty, melanoma is the most common type of cancer (Brunssen et al., 2017). This type of skin cancer is the most aggressive and results in the most deaths related to skin cancer. Non-melanoma type skin cancers include basal cell and squamous cell carcinomas, which represent more than 98% of skin cancer cases in the United States and are in most cases preventable (USPSTF, 2018). A majority of exposure to ultraviolet radiation (UV) in a person's lifetime occurs during adolescents. Exposure to UV is the most significant modifiable risk factor for the occurrence of skin cancer.

Problem Statement

In a University located in Arizona, the fitness/wellness center provides programs and services that facilitate healthy lifestyles, wellness, provide community and other various recreational events. This agency strives to stimulate student success through a healthy mindset, sense of community, and overall wellness. There is a heavy emphasis on wellness content that every student is required to participate in at the start of their freshman year, including managing stress levels and self-care. However, there is no formal education regarding skin cancer prevention and sun safety measures at the university. The identified GAP is a program for all students promoting sun safety awareness. This GAP affects all students on campus exposed to the sun daily, engaging in various campus activities. Students lack knowledge regarding sun safety and skin cancer prevention.

Despite the preventable nature of skin cancer, there is a lack of adherence to preventative measures like seeking shade, wearing protective clothing, and sunscreen application (CDC,

2019). The topmost risk factor for skin cancer is exposure to ultraviolet radiation (Cancer Treatment Centers for America, 2019). Areas exposed to year-round sunlight or populations who spend most of their time partaking in outdoor activities are at an amplified risk (Cancer Treatment Centers for America, 2019). Frequent sunburns, even during childhood, can increase the risk of developing melanoma later in life (Cancer Treatment Centers for America, 2019). Several national initiatives such as Healthy People 2020, CDC, and the Arizona Department of Health Services support this issue. Arizona was one of the first states to teach sun safety education in schools through a program (Arizona Department of Health Services, 2020). The CDC recommends wearing sunscreen of SPF 15 or higher along with other safe sun practices such as protective clothing, finding shade, and wearing sunglasses that block UV (Center for Disease Control and Prevention, 2019). This data underlines the increasing need for preventative education and awareness in early adulthood to decrease skin cancer prevalence later in life. The project's purpose was to provide an intervention to address sun safety in a population of university students.

Background/Significance

College Students

The university is a melting pot consisting of a culturally diverse student population from all over the world. Living in Arizona means adapting to mostly sunny weather all year round. Arizona has more than 300 sunny days annually (Arizona Department of Health Services, 2020). For students, this means increased outdoor activities and events throughout campus. Popular activities include laying out by the pool, indoor tanning, attending pool parties, walking to class, and other events such as football games without adequate knowledge of the harmful UV damage. The UV index is a way of measuring the sun's intensity and can range from 1-11 (Arizona

Department of Health Services, 2020). A higher UV index requires more sun protection to decrease the risk of damage (Arizona Department of Health Services, 2020). A study showed that students who had a family member with skin cancer felt that they were at an increased risk for developing skin cancer in their lifetime; however, despite this fear, they still reported engaging in risky behaviors like sun-bathing (Basch et al., 2017). Popular beliefs and attitudes can significantly influence behaviors. In previous research, indoor tanning behaviors connect to self-worth, appearance, and body dysmorphia (Blashill & Traeger, 2013; Phillips et al., 2006 as cited in Bowers & Moyer, 2019). This indicates that appearance influences the behaviors of tanning. Another study revealed that a motivating factor for sun-seeking behavior like tanning was positive feelings associated with tanning, such as feeling attractive (Basch et al., 2017). For this reason, students are at an increased risk and vulnerability to skin cancer that could be prevented through effective education and promoting sun safety awareness.

Skin Cancer Prevention Program

The U.S. Preventative Services Task Force (USPSTF) recommends educating and counseling people ages 10-24 with fair skin to minimize UV exposure to reduce the risk of skin cancer (USPSTF, 2018). Empowerment through education is crucial to implementing change and sustaining an impact on the population's overall health. A study in a culturally diverse group of college students showed that students were willing to modify their sun protection behaviors after being given information regarding skin cancer risk (Cassel et al., 2018). Another study highlighted that medical students were more likely to use sun protection such as daily sunscreen and had changed their beliefs regarding tanning after receiving a formal education in their program about skin cancer and complete skin examinations (Smith et al., 2018). This evidence underlines the positive correlation between skin cancer prevention education and adherence to

increased sun safety measures. According to the Center for Disease Control and Prevention (CDC), students who practice sun safety measures such as daily sunscreen and avoid indoor tanning can significantly reduce their risk of being diagnosed with cancer (2019).

No Education Program

The leading behaviors associated with an increased risk of skin cancer are unprotected sun exposure and the use of tanning beds (Trad & Estaville, 2017). Young adults are resistant to modifying behaviors to decrease skin cancer risk despite overwhelming evidence that primary prevention methods are vital in preventing cancer (Trad & Estaville, 2017). According to a study, 80% of a sample of students reported having a tan as vital (Platforth et al., 2014 as cited in Trad & Estaville, 2017). Another study found that female college students valued the emotional benefits of tanning over decreasing their risk of preventing skin cancer (Yoo & Hur, 2014 as cited in Trad & Estaville, 2017). This implies that the act of tanning and being tan is perceived as normal without regard to adverse health outcomes associated with this behavior.

Research has shown that social media heavily influences attitudes towards tanning and often portrays tan individuals positively (Mahler et al., 2010, as cited in Willoughby & Myrick, 2019). Social media platforms such as Instagram and Facebook generate millions of users, most of whom are young adolescents. Social media is such a powerful platform among college students that all campus events at the university are promoted via these platforms. Students are encouraged to engage, post, and tag other students on these platforms to increase engagement and attendance at events. Students who help put on events at the university are responsible for posting and engaging in these platforms. A study examining the influence of social media on tanning found that the sample population viewed tanning as beneficial to appearance, mood, and approval by other peers (Myrick et al., 2017 as cited in Willoughby & Myrick, 2019). It is

apparent that the normalization and grandiose facade of tanning significantly impacts students' decision to engage in this activity.

Beliefs about tanning, however, are not the only influencing factors contributing to the problem. Key cogs in the lack of skin cancer awareness are attitudes towards sun protection. Studies have shown that minority populations like Hispanics and Blacks are less knowledgeable about skin cancer risk and do not often practice skin cancer prevention strategies (Calderon et al., 2019). These populations are influenced by the belief that due to their dark skin, they will not be affected by UV ray damage compared to those with fair skin.

Increase Intentions to Change Behaviors

The desired future state is for college students to be aware of skin cancer preventative measures. UV damage from the sun occurs in fifteen minutes from exposure (CDC, 2019). To tan, damage to the skin must occur (Arizona Department of Health Services, 2020). Even artificial UV light can cause the same amount of damage as UV from outside (Arizona Department of Health Services, 2020). Studies indicate a strong positive correlation between education and decreased risky behaviors. In a study designed to examine the link between emotions and sun protection practices, participants that felt they would experience negative emotions if they failed to use protection from the sun were more likely to use sunscreen in the future (Mahler, 2014). In the same study, participants that displayed adverse emotional reactions to photos of their underlying skin damage were strongly associated with higher probabilities of utilizing sun protection in the future (Mahler, 2014).

Internal Evidence/ Setting Generated Data

Currently, there is no formal skin cancer prevention program in place for college students attending the university. Students are influenced heavily by perceived normalizations and an

overall lack of awareness for sun safety practices across the culturally diverse student population. Potential barriers to education need to be addressed, and substantial successful interventions can positively impact current behaviors.

PICOT Question

This literature review has led to the PICOT question, “In College students, how does a sun safety and UV awareness program in comparison to no program impact sun safety awareness within 12 weeks”?

Search Strategy

An exhaustive search was performed in the electronic databases PubMed, EBSCO host, and Cumulative Index of Nursing and Allied Health Literature (CINAHL) to answer the PICOT question utilizing the most current evidence. These databases were chosen for medical application, foundation in research, peer review or academic journals, and applicability to PICOT question. All databases yielded a vast amount of valuable and reliable articles.

Inclusion Criteria, Exclusion Criteria, and Limitations

The inclusion criteria for selecting studies utilized were publishing dates ranging from 2015 to the present to keep the search results relevant and current. Articles published more than five years ago were excluded. Criteria for inclusion consisted of sun safety, adolescents, ultraviolet radiation exposure consequences, adolescents' behaviors towards sun safety, and knowledge and awareness. All settings and countries were included in the search; however, articles not in the English language were excluded; this is a limitation to the search process. Peer-reviewed articles and academic journals were the inclusion criteria for the search yield. Articles that were not peer-reviewed or academic journals were excluded from the search, such as expert opinion articles, to limit the search to include only articles with high evidence levels;

this was a limitation to the search process. Studies from multiple countries were included unless they were not published in the English language; this was a limitation to the search.

Keyword Selection

Keywords were carefully selected based on the PICOT question. The following keywords were employed in the initial search: skin cancer, prevention, and sun safety. This search yielded copious results that did not meet inclusion criteria and contained articles irrelevant to the PICOT question. For this reason, keywords were further refined in a second search to include ultraviolet radiation and college students. This refined search yielded a more relevant and valid selection of evidenced-based practice literature that could be used to answer the PICOT question.

PubMed

The initial search of PubMed utilizing the initial key terms of skin cancer, prevention, and sun safety and inclusion criteria yielded 334 results. A second search was performed using refined vital terms, which yield 139 results. The titles and abstracts of each of the 139 articles in the final search yield were investigated for relevance to the PICOT. Rapid critical appraisals were performed on all citations chosen for this review.

EBSCO

A database search of EBSCO host using key terms sun safety and college students yielded 21,022 results. The critical world ultraviolet radiation was then added, which yielded 1135 results. However, not all results met inclusion criteria, and therefore a third search was performed this time, including on randomized control trials. This search yielded 602 results. The inclusion criteria then further refined the search yield to 209 articles. The articles in the final search yield were scrutinized for applicability to the PICOT. Rapid critical appraisals were performed on all citations chosen for this review.

CINAHL

A database search of CINAHL with initial key terms and inclusion criteria yielded only two articles. Therefore, Boolean phrases were used to expand the search. Key terms college students, sun safety, and ultraviolet radiation yielded 324 results. Publication dates and applicability to PICOT question further narrowed the search yield to 115 articles. Articles that contained information unrelated to the PICOT question were eliminated through a thorough examination of the titles and abstracts in the final search yields. Rapid critical appraisals were performed on all citations chosen for this review.

Critical Appraisal and Synthesis

Ten studies were retained and critically appraised for this literature review using Melnyk and Fineout-Overholt's (2019) rapid critical appraisal tool. This tool measured the quality and strength of the evidence from each retained study. Four of the studies retained were a high level of evidence; RCTs (Appendix A). The remaining studies retained were qualitative, mixed-method studies, and non-randomized control trials (Appendix B).

Five of the ten articles listed their funding sources, and two articles recognized potential reporting bias (Appendix A). All but one of the studies, White et al. (2019), were conducted in the United States. Most studies were multiethnic, contributing to international sampling. The majority of the studies had an adequate sample size and mixed-gender demographics except for two studies that consisted of predominately female participants (Appendix A; Appendix B). Reliability and validity can be assumed for all ten retained studies due to statistically significant results, practical measurement tools, and detailed discussion of limitations. All articles were grounded in theory and utilized the guided application of frameworks and evidence-based models. The majority of studies reported means and standard deviations.

Noteworthy heterogeneity was observed in the sample demographics, variables of interest, measurements, and outcomes in all the retained studies. In the qualitative studies (Appendix B), variables of interest were survey questions to participants regarding current knowledge of sun safety and the probability of implementing decreased risky behaviors such as tanning before and after the education-based intervention. In the quantitative studies (Appendix A), attitudes and behavior intentions were standard dependent variables studied. Sun safety behaviors were a common theme throughout all retained studies.

All studies found significant evidence that attitudes and beliefs surround sun safety behaviors could be improved, and intents for risky behaviors decreased with adequate knowledge and education. It is reasonable to assume based on the high level of evidence that education and knowledge can influence perceived norms and intents to change behaviors.

Theory Application

Theories are patterns of ideas that allow the phenomenon to be viewed in an organized manner (Smith & Liehr, 2014). The Theory of Planned Behavior (TPB), developed by Icek Ajzen, proposes that attitude toward the behavior, subjective norm, and perceived behavioral control significantly influence behavioral intention (Ajzen, 1991 as cited in Asare, 2015). The Theory of Planned Behavior Diagram (Appendix D) is a visual representation of the three key constructs that comprise the theory. Behavioral intention is the first construct of the theory that implies the more robust the intention to engage in a behavior, the more likely a person will perform the behavior (Ajzen, 1991 as cited in Asare, 2015). The second construct is attitudes towards a behavior, which affirms whether a person has a positive or negative attitude toward a particular behavior influences behavioral intention (Ajzen, 1991 as cited in Asare, 2015). Subjective norm is the third construct indicating the pressure socially to perform or not to

perform a behavior (Ajzen, 1991 as cited in Asare, 2015). Another critical aspect of the theory is the perceived behavioral control element. This element states that a person has perceived available resources and opportunities significantly impact the likelihood of the behavioral outcome's success (Ajzen, 1991 as cited in Asare, 2015).

When applied to skin cancer prevention and sun safety, the TPB suggests that to successfully influence students at the university, there must be a perceived change in the norm, attitudes, and easily accessible opportunities for students to engage in positive behaviors. Early investigation of internal evidence suggests there is no formal skin cancer prevention program for college students attending the university. The utilization of the TPB can help guide the development of an effective intervention to address the PICOT.

Implementation Framework

The model selected to guide the application of the evidence synthesized is the Health Belief Model. The Health Belief Model (HBM) delineates six constructs that predict health behavior: benefits to action, self-efficacy, cues to action, a risk to susceptibility, and risk severity (Becker, 1974 as cited in Jones et al., 2015). According to the HBM, ideal behavioral change occurs if interventions target perceived barriers, benefits, self-efficacy, and threats (Becker, 1974 as cited in Jones et al., 2015). This model is appropriate and consistent with the TPB and further outlines how to achieve successful behavioral change (Appendix E). This model's utilization will guide the application of an intervention that inspires change and motivates students at the university to implement sun safety practices into their daily lives. Incorporating the constructs of this model into the proposed intervention will decrease resistance to change within the university and increase the likelihood of normalization of sun safety behaviors like the daily application of sunscreen.

Methods

Participants

Institutional Review Board (IRB) approval was obtained on 9/15/20. Participants were required to be 18 years of age and read English to participate in the study and alleviate any barriers to outcome measurement. Due to the voluntary nature of the study, the exact number of participants was unknown before implementation; however, the project exceeded the goal of 25 participants, with 46 participants in total participating. Consenting of participants was accomplished via survey monkey before and after the educational video presentation; Participation in the study was voluntary.

Design

The intervention consisted of a video presentation that outlines sun safety measures such as how to properly apply sunscreen and information on the consequences of engaging in risky behaviors like tanning. The video was delivered via the campus Instagram: @livewellasu during wellness Wednesday every Wednesday for six weeks. Wellness Wednesday is for students to engage with various wellness events hosted by Sun Devil Fitness Complex virtually in place of the in-person events that typically take place on campus. The video was promoted via social media several days before the video went live to encourage student participation. The entire project's budget cost totaled $325, a very reasonable amount considering everything is delivered online via you-tube video presentation and email of surveys. Digital publication and delivery saved on the cost of printing and brochures. The cost for equipment to create the video is the majority of the project cost. No funding was received for this project.

Procedure

Data was collected on knowledge of sun safety behaviors, intent for behavioral change, increased use of sunscreen and decreased tanning, and attitudes towards sun safety. Descriptive statistics were utilized to illustrate study participants' characteristics, such as demographic factors that could be influencing knowledge, attitudes, and behaviors towards sun safety. Likert-type scale items were used to measure participants' beliefs and attitudes towards sun safety and risky behaviors such as tanning. These questions addressed perceived norms towards tanning, perceived benefits to UV, and knowledge about UV damage. Behaviors and intents towards increasing sun safety measures and decreasing risky behaviors were also measured utilizing these scales. Participants responded to questions using a 1 (completely agree) scale to 5 (completely disagree). Established questions and measures from previous studies were modified and adjusted accordingly to address and evaluate questions such as "I believe I should practice sun-safe behaviors," "A good tan is worth the increased risk of skin cancer," and " How often do you use a sunscreen with an SPF of 15 or higher" (Hobbs, Nahar, Ford, Bass, & Brodell, 2014 as cited in Bowers & Moyer, 2019). These scales had Cronbach's alphas of .65 and .63, indicating reliability and validity (Bowers & Moyer, 2019).

Pre/post surveys were given to students before receiving any education and immediately post-implementation to measure outcomes via survey monkey. The survey was the same, both pre and post, with the intent of students being more likely to use sun-safe behavior following the intervention. Data analysis was conducted via Intellectus Statistics. Three separate descriptive data analyses were formulated to account for the multi-response questions.

Results

The study intended to explore if an educational program would increase sun-safe behavior like applying sunscreen and decreasing risky behaviors like tanning. There were a total

of 46 participants who watched the video and completed the survey. Only 28 participants, however, completed both the pre-and post-survey and were retained for the study. Participants' mean age was 19.57 with a standard deviation of 1.35 (age ranges 18-21). 82% of participants were female (n=23) with White (n=19) or Hispanic (n=6) ethnicity (Figure 2).

Frequencies were calculated for questions that assessed the perceived risk of tanning, such as “how likely are you to add additional protective measures such as a hat or sunglasses before watching the video” Before watching the video, 75% (n=19) of students were unlikely to add additional sun protection measures (Table 1). Following the intervention, 32% (n=9) of students were unlikely to add additional sun protection measures (Table 2). Before the video, 75% (n=21) students were not likely to decrease risky behaviors such as tanning (Table 1). Following the intervention, this number dropped to 43% (n=12) (Table 2). Before the video, 25 % (n=7) of students reported changing to an effective sunscreen (Table 1). Following the video, 71% (n=20) reported changing to a more effective sunscreen (Table 2).

Frequencies and percentages were calculated for perceived barriers to sun safety. 57% (n=16) of students reported no barriers to sun safety (Table 4). 29% of students (n=8) reported a lack of sun safety awareness as a barrier (Table 4). 14% (n=4) of students reported time constraints as a barrier to sun safety (Table 4). Percentages and frequencies were also calculated for questions assessing sun safety attitudes, such as "A nice tan improves one's appearance" (Table 3). 63% (n=18) of participants agreed or strongly sagreed with this assumption (Table 3).

Table 1

Frequency Table for Pre-Intervention Survey and Post-Intervention Survey Variables

	Pre-Survey		*Post Survey*	
Variable	*n*	*%*	*n*	*%*
How likely are you to participate in activities such as indoor tanning before the video?				
Unlikely	6	21.43	8	28.57
Very unlikely	14	50.00	16	57.14
Neither likely nor unlikely	3	10.71	1	3.57
Likely	3	10.71	1	3.57
Very likely	2	7.14	2	7.14
Add additional protection with hats sunglasses UPF clothing before the video				
yes	7	25.00	19	67.86
no	21	75.00	9	32.14
Change to a more effective formula of sunscreen before the video				
no	21	75.00	20	71.43
yes	7	25.00	8	28.57
Decrease risky behaviors such as tanning before the video				
no	27	96.43	16	57.14
yes	1	3.57	12	42.86
All of the above before video				
no	18	64.29	14	50.00
yes	10	35.71	14	50.00

Note. Due to rounding errors, percentages may not equal 100%.

Table 2

Frequency Table for Attitude Variables

Variable	*n*	*%*
How often do you use sunscreen with an SPF of 15 or higher while out in the sun?		
Often	4	14.29
Sometimes	12	42.86
Rarely	4	14.29
Always	5	17.86
Not applicable - I rarely go out in the sun	1	3.57
Never	2	7.14
I believe I should practice sun-safe behaviors		

Variable	*n*	*%*
Strongly agree	13	46.43
Agree	13	46.43
Neither agree nor disagree	1	3.57
Disagree	1	3.57
A nice tan improves one's appearance		
Strongly agree	6	21.43
Agree	12	42.86
Neither agree nor disagree	8	28.57
Disagree	2	7.14

Note. Due to rounding errors, percentages may not equal 100%.

Table 3

Frequency Table for Barrier Variables

Variable	*n*	*%*
Cost barrier		
yes	2	7.14
no	26	92.86
Lack of awareness of the importance of use barrier		
no	20	71.43
yes	8	28.57
Dislike feel or appearance of sunscreen barrier		
no	21	75.00
yes	7	25.00
Time constraint barrier		
no	24	85.71
yes	4	14.29
None of the above barriers		
no	16	57.14
yes	12	42.86

Note. Due to rounding errors, percentages may not equal 100%.

Figure 1
Pie Chart of Sex

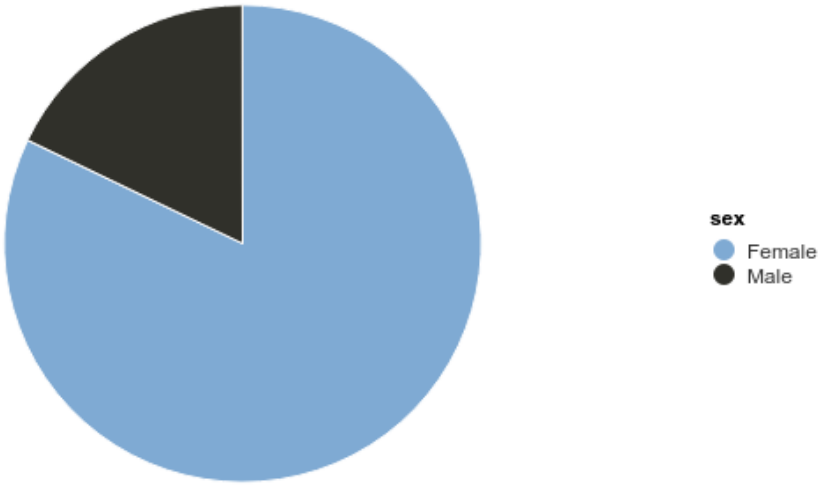
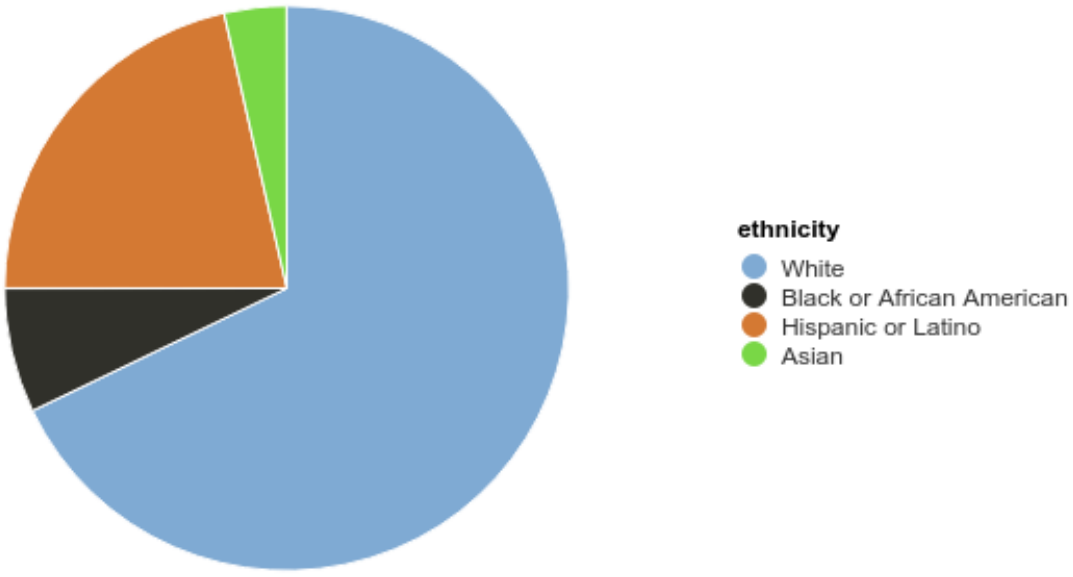


Figure 2
Pie Chart of Ethnicity



Discussion

Overall the project intends to portray the damage of UV on the skin and encourage protective measures to be the new norm while breaking down barriers that students perceive to interfere with safe practices. The results indicate intention for increased adherence to sun safety measures such as daily sunscreen and decreased likelihood of participating in risky behaviors such as tanning. The study also showed that students perceive risky behaviors such as tanning to improve one's appearance, thus contributing to the lack of awareness and knowledge surrounding sun safety. The convenience and accessibility of having the educational presentation available via you-tube ensure that this project can be carried out and encourages a more significant possibility of impacting other universities. To date, Arizona State University plans to continue to utilize this educational video for future skin cancer awareness activities. The guidance and foundation of the project in theory and evidence-based practice suggest a highly positive impact that the intervention can have on the targeted population and both a regional and national level. Limitations to the project include it only being accessible via the internet. This barrier, however, also contributed to the increased likelihood of sustainability of the project and continued outreach via social media platforms. Another limitation to the study was the lack of valid and reliable tools appropriate to the study. However, questions were developed utilizing references with face validity and approval from experts in the field. Based on the study results and recommendations from health initiatives like USPSTF, it is recommended that continued education be provided to college students and other populations to decrease the incidence of skin cancer. Prevention is critical for improved health outcomes such as these.

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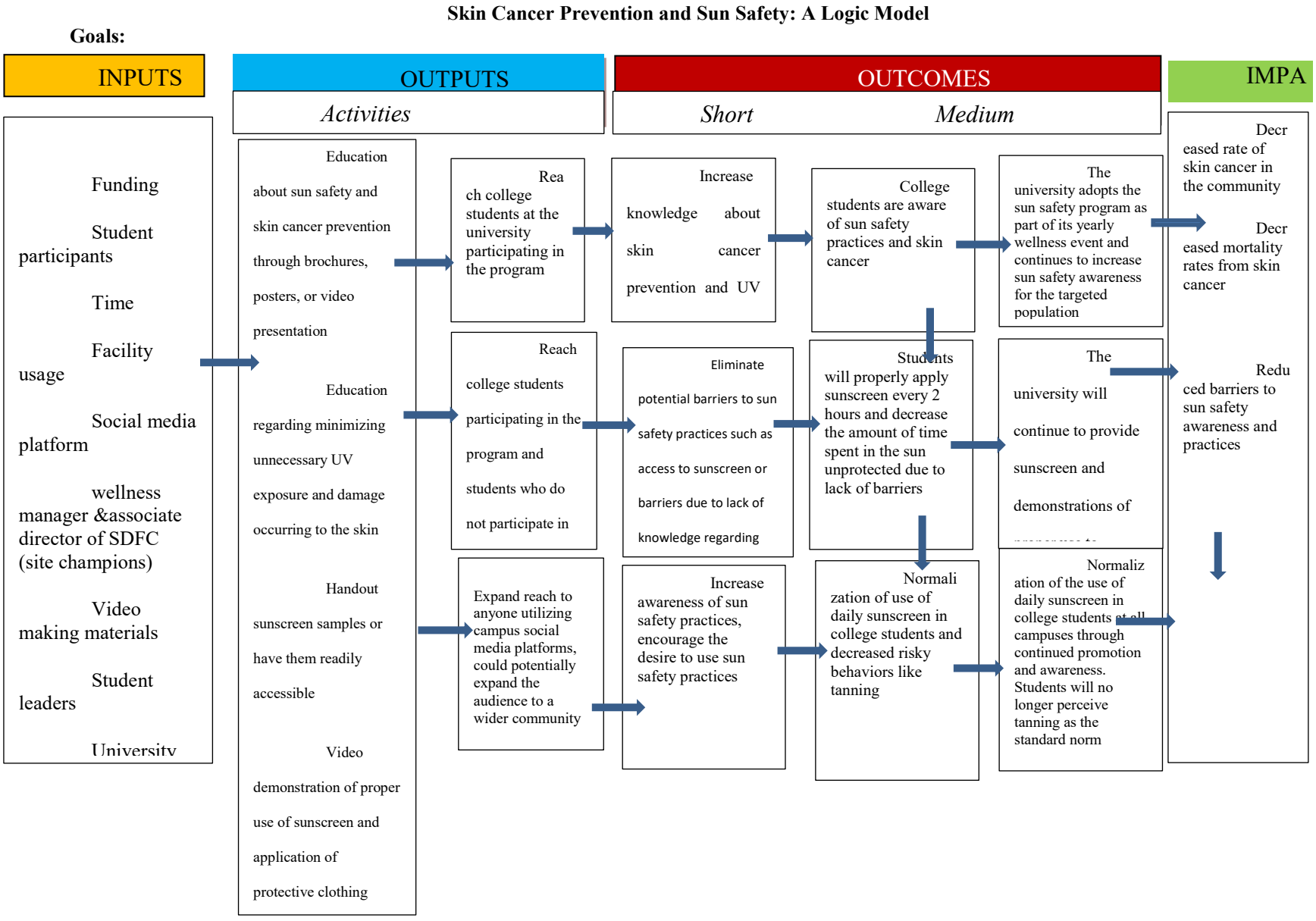
Appendix A

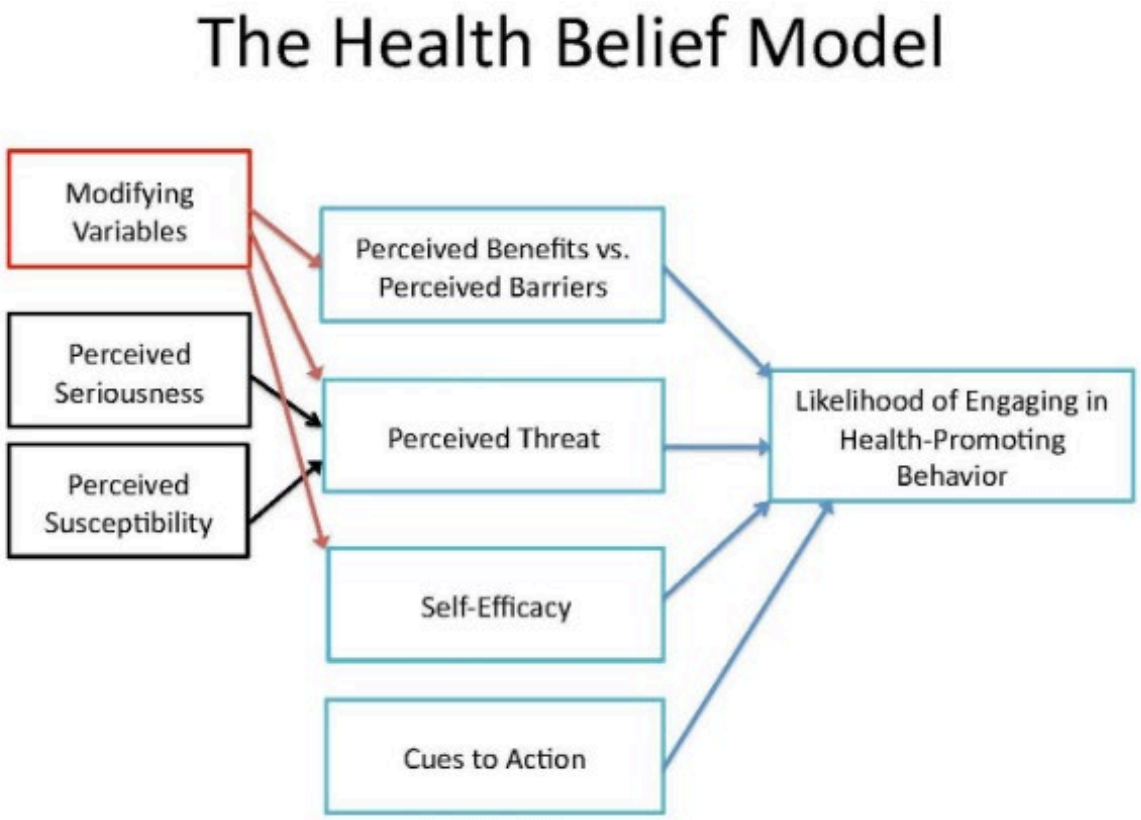
Figure 1
Logic Model



Assumptions: Students will want to participate in the education program, Elimination of barriers will increase access to sunscreen and improve adherence to sun safety practices, Students will participate in the pre and post surveys, Social media promotion will normalize sun safety practices, Behaviors are influenced by perceived norms

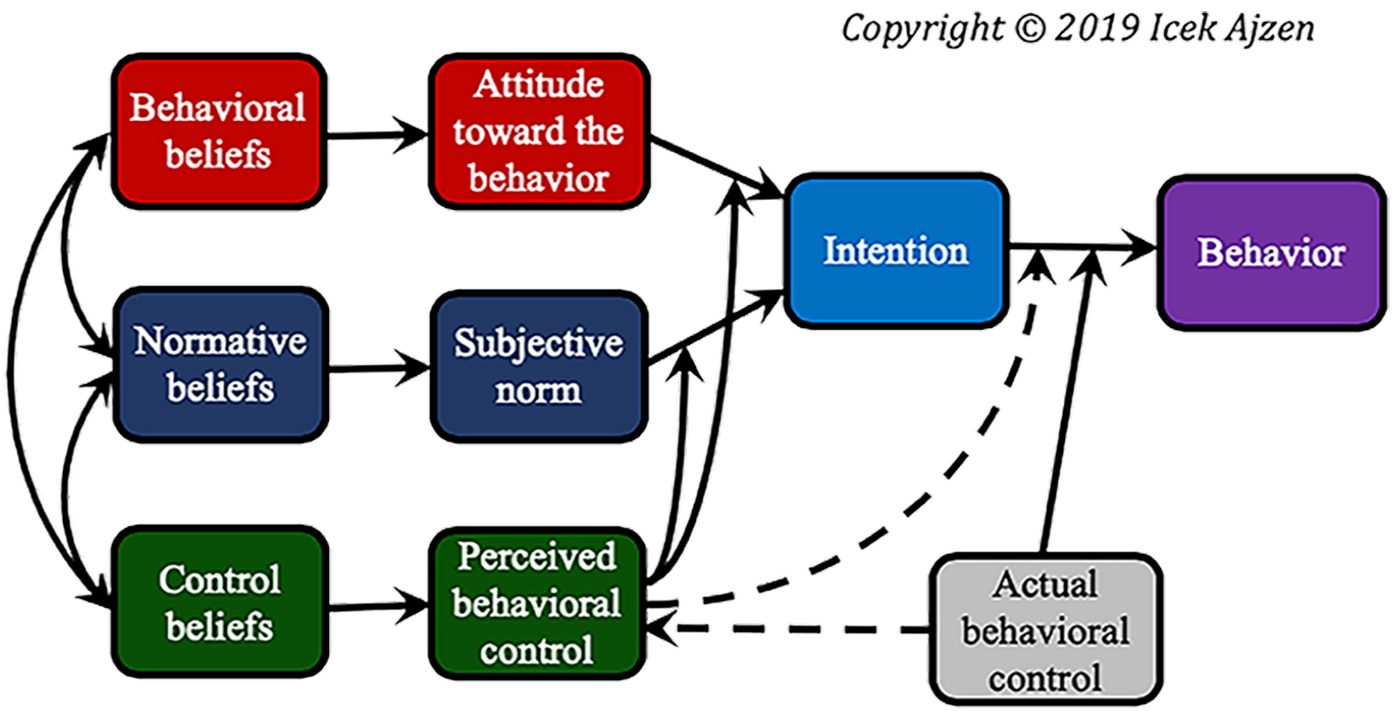
Appendix B

Figure 2
Health Belief Model



Appendix C

Figure 3
Theory of Planned Behavior



Appendix D

Table 5
Evaluation Table

Citation	Theory / Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/ application to practice
White et al., 2019. Effectiveness of a theory-based sun-safe randomized behavioural change trial among Australian adolescents. **Funding**: This study was funded by the Australian Research Council (project ID: LP0991856) and the Cancer Council Queensland. **Country**: Australia **Bias**: none observed	**TPB**	**Design**: Randomized control trial, LS (Baseline test, 1-week f/u & 4-week f/u) **Purpose**: To evaluate a school-based intervention based on the theory of planned behavior that aimed to encourage sun-protective behaviors in adolescents.	**N**: 382 **n:** 199 (IG) **n**: 183 (CG) **setting**: Large sample size in a school setting from a variety of populations **Sample demographics**: Control groups included 1 public school and 3 private	**IV:** school-based intervention TPB aiming to improve sun-protective behaviour in adolescent **DV1**: sun-safe behavior intervention on school days and weekends	A questionnaire based on guidelines of **TPB** administered at baseline, 1-week post-intervention, and 4 weeks post-intervention. Skin color, hair color, and eye color were used as control variables	Kernel logistic function, ANOVA, MANOVA, Box M's test, Mardia's test, Wald's test, multigroup path analysis	**DV 1:** Time 1: school day sun-safe behavior intervention time 2: M 2.91, 1.80 SD 1.63, 3.23 time 3: M 3.29, 1.82 SD .56 .40 .68 , 3.191.63 time 1:weekend sun-safe behavior time 2: M 3.32, 1.92 SD 1.89, 3.42 time 3: M 3.04, 1.83 SD 1.663.371.88, 3.751.76 **DV 2**: time 1 intention, time 2: M 4.99, 1.16 SD 1.31, 4.64 time 3: M 4.59, 1.29 SD 1.314.711.32, 4.741.25 **DV 3:** time 1: attitude time 2: M 4.92, 0.91 SD 0.97, 4.65 time 3: M 4.91 0.86 SD 1.064.890.99, 4.810.90 **DV 4:** time 1: subjective norm intervention	**LOE:** II **Strengths:** RCT, large sample size, a detailed discussion of results, attrition rates discussed **Weakness:** imbalanced school types in each condition could have altered results, behaviors were self-reported, questionnaires were conducted on different days which could have confounded results **Conclusions:** This intervention showed a positive change for adolescents' sun-protective

Appendix D

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			schools while intervention groups included 2 private and 2 public schools. Both groups comprised of mixed locations in urban, coastal, and regional areas. Participants were students aged 12-17. mean age 13.13 (CG),	**DV2:** intention intervention **DV3:** attitude intervention **DV4:** subjective norm intervention **DV5**: PBC intervention			time 2: M 5.58, 1.00 SD 1.16, 5.37 time 3: M 5.25, 1.19 SD 1.345.251.25, 5.341.09 **DV 5**: time 1: perceived behavioral intervention time 2: M 5.75, 0.79 SD 0.72, 5.53 time 3: M 5.42, 1.07 SD 1.005.331.15, 5.481.04	behavior during weekends, although significant effects were not detected for weekdays or on other TPB constructs. **Feasibility/Applicability to pt. population:** Feasible intervention that could apply to PICOT question.

Appendix D

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			14.32 (IG).					
Bowers & Moyer, 2019. Self-Affirmation Ineffective for Promoting Positive Skin Cancer Attitudes and Behavioral Intentions Among Female College Students **Funding:** none listed **Bias**: none recognized **Country**: United States	Self-affirmation theory	**Design**: RCT **Purpose:** To examine the effectiveness of self-affirmation to improve receptivity to information related to skin cancer prevention	**N**=310 **VA**: n=78 **VC:** n=82 **TA:** n=72 **TC:** n=78 The entire sample population of female gender Ages ranged from 18 to 47, with a	**IV:** self-affirmation theory groups **DV 1:** Attitudes **DV 2:** Behavioral intentions	TFS, DS, AS. These scales were reliable in the sample, with .92, .95, and .88 Likert-type scale items measured participants' beliefs and attitudes The scale had acceptable reliability (α.65).	ANOVA, Two-way ANOVA	Neither values nor trait self-affirmations were effective; indoor tanners reported higher intentions to tan in the future across all manipulation groups. **DV 1:** **VA**: mean 4.39 (SD .41) **VC**: mean 4.35 (SD .46) **TA**; mean 4.40 (SD .39) **TC**: mean 4.41 (SD .46) **Total**: mean 4.39 (SD.43) **DV 2:**	**LOE:** II **Strengths:** RCT, a detailed discussion of how study can be improved, relied on previous studies and theory to guide interventions, reliable data **Weaknesses**: relatively small population sample, female gender inclusion

Appendix D

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			mean of 20.72 (SD = 3.55). Fifty-eight percent were White, 24% were Asian, and 5% were Black. Forty-four percent reported ever indoor tanning, and among those, 47% in the past year. Ever-indoor		Behavioral intentions to tan were measured using five items. The scale had acceptable reliability in the sample (α.63).		**VA:** mean 2.34 (SD 1.20) **VC**: mean 2.44 (SD 1.19) **TA**: mean 2.28 (SD 1.05) **TC**: mean 1.97 (SD .99) **Total** mean 2.26 (SD 1.11)	only limits the study **Conclusions:** self-affirmation interventions in this study were not effective for promoting positive attitudes and behavioral intentions related to skin cancer prevention in female college students reporting ever-indoor tanning. More effective interventions are needed to institute behavioral change. **Feasibility/ applicability to patient**

Appendix D

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			tanning was significantly correlated with frequency of outdoor tanning ($r = .51$, $p < .01$).					**population** This study applies to colleges, thus feasible to the PICOT question

Appendix D

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Anderson et al., 2017. A randomized trial of an advanced sun safety intervention for vacationers at 41 north American resorts **Funding**: National Cancer Institute **Country**: the United States and Canada **Bias**: potential reporting bias	Diffusion of innovation theory, transportation theory	**Design**: RCT (pre/ post test design) **Purpose**: This study tested a multi-component **sun** protection intervention designed to increase vacationers' comprehensive **sun** protection, i.e., use of clothing, hats, and shade, and use, pre-application, and reapplication of sunscreen	**N=**6757 **n**=3531 (pretest total) **n**= 1701 (pretest control) **n** = 1830 (Pretest intervention) **n**= 3226 (post test) **setting**: vacationers at various North American resorts **sample demogra**	**IV:** an intercept survey **DV**: GSS intervention	GSS intervention, pre/ post survey - promote comprehensive sun protection beyond the application of sunscreen. This included pre-application of SPF 15 or higher sunscreen a half-hour before going outside and reapplication after two hours. Also, the intervention	ANCOVA	Only any sun protection index (i.e., full shade use or 85% clothing coverage or SPF 15+ sunscreen use) demonstrated statistically significant pre-post differences **n=**73.3% pretest, 76.6% post test	**LOE**: II **Strengths**: High level of evidence, discussed limitations and potential bias, **Weaknesses:** potential reporting bias due to self-reporting surveys Conclusions: The most positive result of the *GSS* resort intervention was that it was effective at waterside recreation venues. While *GSS* did not have an overall impact

Appendix D

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			phics: **M**age for pretest **CG** was 47.38, for pretest **IG** was 47.32, for posttest **CG** was 47.02, and for post-test, **IG** was 47.3 gender: female predominant ethnicity: non-Hispanic white predominant		encouraged guests to wear protective clothing, sunglasses, and a broad brim hat, seek shade, and stay out of the sun during the most intense UV hours of the day			throughout the resorts, *GSS* showed a significant moderation effect such that a positive effect of the intervention was observed at pools, beaches, and marinas **Feasibility**: This study is feasible and applicable to the PICOT since the only statistically significant result was near pools. Students at the university are constantly at pools, and this intervention could be useful

Appendix D

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								in this particular setting.
Cassel et al., 2018. Adapting a skin cancer prevention intervention for multiethnic adolescents **Funding:** Grant from the Hawai'i Comprehensive Cancer Control Program through the CDC Cooperative Agreement **Bias**: no known bias **Country:**	Grounded theory	**Design**: NRCT (pre/post-test) **LS** (over 12 months) **Purpose**: the aim was to use input from teachers and students to adapt a school-based intervention entitled "SunSafe in the Middle School Years" for use with multiethnic high school students to obtain input on modifying the SunSafe	**N**=208 (pretet) **N**=208 (post test) **N**=42 (12 months follow up) **Setting**: 10th-grade students in a health class **Sample distribution:**	**IV:** A standardized 28-item Sun Habits Survey (SHS) **DV:** modified IG	The tests consisted of 18 core items derived from a 28-item survey (SHS) that measured changes in student knowledge, attitudes, and self-reported sun protection.	Paired T-test, chi-square test, d McNemar's tests for dichotomous data	Survey questions 1, 4, 6, 7, 8. 10, 11, 12, 14, 15, 16, 17, 18 showed statistical significance from pre/post test and 12 month follow up P values: .023, .000, .017, .001, .004, .000, .010, .000, .003, .000, .000, .000, .000	**LOE:** V **Strengths**: mixed design method, discussed limitations, tools used were reliable and valid, no known bias **Weaknesses:** low level of evidence, small sample size limited to only students in a health class

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Citation	Theory / Conceptual Framework	Design/ Method	Sample/ Setting	Major Variables & Definitions	Measurement/ Instrumentation	Data Analysis	Findings/ Results	Level/Quality of Evidence; Decision for practice/ application to practice
United States		intervention to appeal to high school-aged multiethnic students	**M-** age 15-17 years old, 51.6% Asian, 30.4% Native Hawaiian/ Pacific Islander, 8.4% white, 3.5% Hispanic, 2.7 % black, and 3.2% 2 or more ethnicities		for the SHS subscales, α ranged from .45 to .85. Test-retest reliability of the measure was good at .87 using the **ICC**			**Conclusions:** significant increases in student knowledge, attitudes, and intended sun protection behaviors at posttest compared to pretest **feasibility**: this study is feasible and applicable to the PICOT and can be used to promote sun safety in the population

Appendix E

Table 2

Synthesis Table

Author	White et al.	Bowers & Moyer	Anderson et al	Cassel et al	Heckman et al	Basch et al	Basch et al	Calderón et al.	Trad & Estaville,	Willoughby & Myrick
Year	2019	2019	2017	2018	2016	2017	2014	2019	2017	2019
LOE II	X	X	X		X					
LOE V				X		X	X	X	X	X
N	382	310	6757	208	965	312	780	1554	521	502
Demographics										
CS		X	X		X	X	X	X	X	X
Female predominance			X						X	X
Caucasian Predominance		X	X			X			X	X
Non-white predominance				X				X		
IV										
Sun safety Intervention	X		X	X	X					
DV										
Attitudes	X	X	X	X	X					
Behaviors Outcomes	X	X	X	X	X					
Outcomes Positive behavioral	X		X	X	X	X	X	X	X	X

change post-intervention										
Themes of sun safety behaviors				X		X	X	X	X	X
Measurement tool										
Pre/post survey	X	X	X	X	X	X	X	X	X	X