

# THE DANIEL K. INOUE COLLEGE OF PHARMACY SCRIPTS

## A Collaborative Community-Based Sun Protection Education Program

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### Abbreviations

DKICP = Daniel K. Inouye College of Pharmacy  
KAB = knowledge, attitudes, and behaviors  
SPF = sun protection factor  
UHCC = University of Hawai'i Cancer Center  
UPF = ultraviolet protection factor  
UV = ultraviolet  
UVA = ultraviolet A radiation  
UVB = ultraviolet B radiation  
UVR = ultraviolet radiation

### Introduction

In the United States (U.S.), skin cancer has become the most commonly diagnosed cancer. It affects nearly 5 million people at an estimated annual cost of approximately \$8.1 billion.<sup>1</sup> The annual number of new U.S. cases of melanoma of the skin increased from 40,791 in 1999 to 82,476 in 2016. This trend reflects increases in new melanoma of the skin cases reported in Hawai'i which rose from 180 in 1999 to 447 in 2016.<sup>2</sup> The Surgeon General's 2014 Report was a call to action for the prevention of skin cancer.<sup>1</sup>

Most ultraviolet (UV) exposure comes from UVA rays that penetrate deep into the dermis and cause unseen skin cell damage. While most UVB rays are filtered by the ozone layer in the atmosphere, they affect the superficial layers of the skin, causing sunburn and cellular DNA damage.<sup>3-4</sup> The UV index expresses sun exposure risk using a scale of 0-15, where higher numbers indicate greater overexposure risk.<sup>3</sup> Hawai'i's UV index during the winter months has been reported to average 6 (High) and during the summer averages 11-12 (Extreme). By comparison, Miami, Florida has an average winter UV index of 4 (Moderate) and that of Portland, Oregon 1 (Low).<sup>5</sup> Many individuals in Hawai'i, including Asian Americans, Native Hawaiians, Filipinos, other Pacific Islanders, and multiethnic individuals, may have skin which is moderately to markedly pigmented. While skin cancers are less common in people with darker complexions, inaccurate skin cancer risk perceptions in non-whites may

contribute to prolonged ultraviolet radiation (UVR) exposures, increased sunburn prevalence, delayed skin cancer diagnosis, and greater risks for death in comparison to Caucasian individuals.<sup>6-9</sup>

Pickleball is a rapidly growing sport in the U.S. with approximately 2.5 million active players. This sport is a cross between tennis, ping pong, and badminton, and is traditionally played outdoors.<sup>10</sup> Skin cancer risk perceptions addressing pickleball have not been previously reported. In this project, skin protection knowledge, attitudes, and behavioral propensities (KABs) were assessed through an adapted sun protection survey. In addition, information regarding age, ethnicity, and gender as cofactors regarding sun protection KABs were gathered. This study intended to build awareness, perceived susceptibility, and a better understanding of risk-to-appearance as important motivational factors towards modifying sun protection behaviors in an often multiethnic population in Hawai'i. This project is particularly important to our local pickleball community because Hawai'i has a high UV index throughout the year.

### Methods

Study participants were recruited at open play outdoor pickleball sessions in Honolulu during the summer of 2018. Pickleball players were welcome to participate. Pickleball sessions were chosen because players often spend significant time in the sun which increases their risks for UVR skin damage.

This educational project was a collaborative effort between the Daniel K. Inouye College of Pharmacy (DKICP), the University of Hawai'i Cancer Center (UHCC), the O'ahu Pickleball Association, and the Hawai'i Skin Cancer Coalition. The project development team included two faculty members from the DKICP, fourth-year pharmacy students, and an Assistant Professor at the University of Hawai'i Cancer Center. The team developed the study protocol, survey instrument, and educational materials. The survey items were adapted from a previously validated survey tool and a modified survey for a multiethnic population in Hawai'i.<sup>8,11</sup> (Table 1)

Table 1. Sun Protection Survey Questions	
Content	Response Set
1. To work best, sunscreen needs a half hour to be absorbed by the skin.	True/False (True)
2. You don't need to worry about skin cancer if you only go out for short periods of time (10 to 20 minutes).	True/False (False)
3. A sun protection factor (SPF) rating of 15 or greater means you can stay outside for 3 hours without getting a burn.	True/False (False)
4. People with light hair and light skin have the greatest risk of getting skin cancer.	True/False (True)
5. Sunburn is painful, but not really harmful in the long run.	True/False (False)
6. People who only go out in the sun for two weeks a year are not likely to get skin cancer.	True/False (False)
7. Being in water provides natural sun protection.	True/False (False)
8. Sun exposure during childhood can increase a person's chance of getting skin cancer later in life.	True/False (True)
9. People are more attractive if they have a tan.	Strongly disagree...strongly agree (5-point scale)
10. It's too much bother to put on a hat when I go outside.	Strongly disagree...strongly agree (5-point scale)
11. I find it difficult to protect myself from the sun.	Strongly disagree...strongly agree (5-point scale)
12. I am confident with properly selecting a sun screen/sun protection product and using it correctly.	Strongly disagree...strongly agree (5-point scale)
13. It helps to wear a shirt with sleeves.	Not at all...a great deal (4-point scale)
14. It helps to have a good base suntan.	Not at all...a great deal (4-point scale)
15. It helps to stay in the shade or under an umbrella	Not at all...a great deal (4-point scale)
16. It helps to use sunscreen.	Not at all...a great deal (4-point scale)
17. It helps to wear a hat.	Not at all...a great deal (4-point scale)
18. It helps to limit the number of hours outdoors when the sun's rays are strongest, at mid-day.	Not at all...a great deal (4-point scale)
19. It helps to wear sunglasses.	Not at all...a great deal (4-point scale)

Note: The correct answer for the true/false questions is in parentheses.

The DKICP team and an UHCC undergraduate intern attended four pickleball sessions at three venues in Honolulu to conduct sun projection education. Standardized orientation and training were provided for all study team members in using the educational materials and tools utilized. After consenting to participate, participants completed a survey regarding sun protection practices. In addition, fourth-year student pharmacists delivered a 10-minute educational session on sun protection. Using visuals printed in a large flip chart format (18" X 24"), the student pharmacists covered an array of topics related to sun projection including:

Table 2. Education Session Topics
Skin cancer prevalence in Hawai'i compared to the nation
What to look for in skin cancer (photos with types of skin cancer)
Facts about skin cancer
Difference between SPF and UPF
Sun Protective alternatives
Mineral versus chemical sunscreens
UVA versus UVB rays
How to protect your skin
Hawai'i law that limited sale of sunscreens with certain chemicals <sup>12</sup>
Review of studies of banned chemicals
Conflicting opinions regarding the ban
Acknowledgements of funding

Following the educational presentation, participants explored sun damage using tools provided by the UH Cancer Center: APRIL<sup>®</sup> and UV exposure assessment. APRIL<sup>®</sup>, manufactured by AprilAge Inc., was used to illustrate the long-term effects of UV exposures in multiethnic participants.<sup>13,14</sup> APRIL<sup>®</sup> face aging software product provided a personal “before and after” view of an individual’s own face as they age, decade by decade. The APRIL<sup>®</sup> “aging engine” extracts specific aging characteristics from a database of several thousands of 3D head scans from real people across five ethnic groups including male/female from ages 7 to 70. It is currently used in more than 25 countries in health education, science museums, employee health programs, and brand marketing for cosmetics and beauty. The software demonstrates to participants how they will look as they get older due to the effects of heavy sun exposure. Results are produced in a “contrast and compare” output that can be shared, emailed, or printed.

Advanced photography methods of UV and polarized light photographs were used for assessing participants’ current levels of sun damage. UV and polarized light photography displays the immediate effects of overexposure to UVR in multiethnic populations as visible irregularities in the skin’s complexion.<sup>15</sup> The goal was to present multiethnic participants with the immediate and long-term effects of UVR exposures. The digital photos used for APRIL<sup>®</sup> and UV damage assessment were deleted from all digital sources after viewing by the participant. Personal information was omitted from the participant’s picture.

By calculating the percentage of respondents providing each response, this descriptive project summarizes the participants' sun protection survey results. Because of minimal risk, this project was deemed exempt by the University of Hawai'i Institutional Review Board. All analyses were conducted in Stata V10 (College Station, TX).

## Results

Forty-three participants were recruited. The mean age of the participants was 58.9 years (SD 9.3 years), with a range of 41 to 83 years. Females (n=29) comprised 67.4% of respondents, males (n=13) 30.2% of respondents. One respondent did not report sex. In terms of self-reported race/ethnicity, 20.9% of the study population were white, 27.9% Japanese, 27.9% Chinese, 4.7% Native Hawaiian, 2.3% Other Pacific Islanders, and 16.3% were other race/ethnicity (Table 3).

Eight survey questions assessed sun protection knowledge (Figure 1). Ninety-three percent of respondents correctly said the statement that childhood sun exposures increase risk of cancer was true. Similarly, over 83% correctly said that having lighter skin or hair increased risk and over 76% correctly said that sunscreen needs to be absorbed for at least half an hour. Approximately 11% incorrectly said that being out in the sun for only 2 weeks per year reduces risk, and about 9% incorrectly reported that an individual could go out for 3 hours with and SPF 15 sunscreen and not get burnt. Respondents were correct in stating that the following statements were false: (1) water provides sun protection (96%); (2) you do not need to worry about cancer if you're only out for a short time (98%); (3) sunburn is painful but not harmful (98%).

Characteristic	
Age	58.9, SD(9.3) range[41-83]
Female	67.4%
Ethnicity	
White	20.9%
Japanese	27.9%
Chinese	27.9%
Native Hawaiian	4.7%
Other Pacific Islander	2.3%
Other	16.3%

The level of agreement with four sun protection attitude statements varied (Table 4). The strongest agreement came in response to the statement of being confident of sun protection methods with over 74% either responding that they agree or strongly agree. Twenty-eight percent of respondents said they agreed that having a tan was attractive, while approximately 23% said that it was difficult to protect themselves from the sun. In contrast, over 75% of respondents said that they strongly disagreed with the statement that it is too much of a bother to wear a hat.

Finally, seven questions asked whether certain behaviors helped avoid skin cancer (Table 5). Approximately 79% of respondents said that wearing a hat and using sunscreen helped a great deal to protect, while 76% said limiting midday hours outdoors helped a great deal. Approximately 70% said wearing a hat helped to protect, while 63% said wearing a shirt with sleeves helped, and 60% said that staying in the shade helped a great deal. In contrast, only 20% said having a good base tan helped.

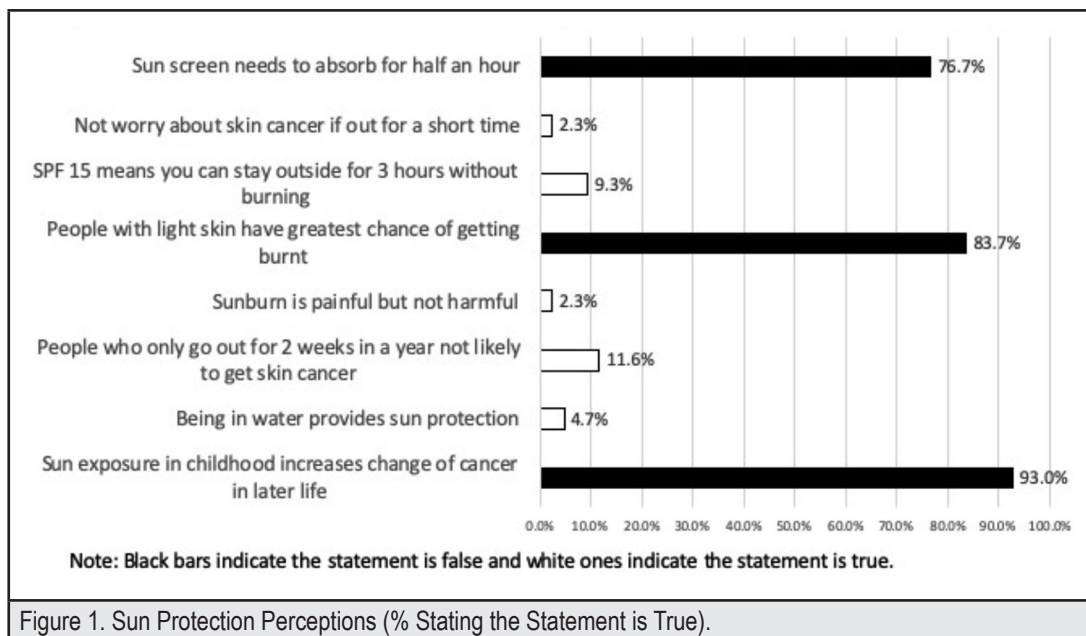


Figure 1. Sun Protection Perceptions (% Stating the Statement is True).

Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
Confident in selecting sun screen	0%	12%	14%	53%	21%
Difficult to protect myself from sun	23%	47%	7%	23%	0%
Too much of a bother to put a hat on	33%	42%	9%	14%	2%
People are more attractive with a tan	12%	14%	47%	28%	0%

Statement	Not at all	A little	Somewhat	A great deal
Wear sunglasses	4.7%	2.3%	14.0%	79.1%
Limit hours outdoors at midday	2.3%	2.3%	18.6%	76.7%
Wear a hat	0%	11.6%	18.6%	69.8%
Use sunscreen	2.3%	2.3%	16.3%	79.0%
Good base suntan	25.6%	25.9%	27.9%	20.9%
Wear a shirt with sleeves	4.7%	2.3%	30.2%	62.8%

## Discussion

The study population possessed a general understanding of skin cancer risk related to childhood exposure, influence of skin complexion, and sunscreen application timing. The participants also recognized that sun protection garments including hats and long-sleeve shirts could reduce sun exposure. While 74% of the participants agree or strongly agree with their confidence in selecting sun protection methods, 28% believed a tan to be attractive and nearly 21% felt having a good base tan helped. A systematic review described the contribution of appearance-based interventions in promoting positive sun protection behaviors and included photoaging and UV photography interventions.<sup>16</sup>

In Hawai‘i, multiethnic individuals, whose skin tans or is moderately to markedly pigmented, can underestimate their cancer risk. As described by the UHCC report, melanoma has been reported to be the fourth most common type of cancer in men and seventh most common in women in Hawai‘i from 2009-2013. Caucasians and Native Hawaiians are the first and second highest ethnic groups to experience this type of cancer, respectively. The age-adjusted melanoma incidence rate (per 100,000) in white males was 84.5 with a mortality rate of 6.1. For Native Hawaiian males, the age-adjusted melanoma incidence rate was 6.7 with a mortality rate of 3, which reflects a worse incidence to mortality ratio for the Native Hawaiian males.<sup>17</sup> Previous studies identified racial disparities in non-white populations who experience lower melanoma survival rates and presented with more advanced disease as compared to white populations.<sup>18,19</sup>

Other studies targeting outdoor recreation groups including recreational cyclists, snow sports, runners, and surfers have assessed

various aspects of sun protection and cancer prevention.<sup>20-23</sup> The study by Petty et al involved a younger study population (mean age of 48 years) which were made up of predominantly male participants (75.1%). Evaluated were components of sun screen use such as costs, rewards, self-efficacy, and photoaging.<sup>20</sup> In this study, only 6% of cyclists responded as wanting a tan. In comparison, our study had a mean age of 58.9 years, a majority of female participants (67.4%), and demonstrated a 28% response rate regarding perceiving a tan to be attractive. This response may be influenced by the possibility that those with nonwhite complexions may not see their normal tanned skin tone as unattractive. This was reported in a previous Hawai‘i-based multiethnic study of youths.<sup>8</sup>

In July 2018, Hawai‘i approved a ban of two widely used chemical sunscreen ingredients, oxybenzone and octinoxate. This was the first law passed in the U.S. to prohibit these compounds in sunscreens supporting marine ecosystem preservation. The law becomes effective January 1, 2021.<sup>12</sup> Following this new law, Key West, Florida approved legislation banning the sunscreen chemicals oxybenzone and octinoxate. The nation of Palau has also banned ten sunscreen chemicals.<sup>24</sup>

It will be important to educate consumers on the risks of sun exposure and address issues that may lead to confusion and reduced sunscreen utilization. During our study, numerous questions regarding the banned sunscreen components came to the attention of the local media. Additionally, a recent JAMA publication that identified systemic absorption of oxybenzone in humans may potentially contribute to hesitancy with sunscreen use.<sup>25</sup> Newer broad-spectrum sunscreen agents have already been used in other counties and may provide additional options for those agents legislatively banned in 2021.<sup>26</sup>

We were fortunate to have the support of the O‘ahu Pickleball Association who were enthusiastic about sun safety. Ally, et al, described their experience with educational efforts to promote sun-protective behavior changes in NCAA athletes.<sup>27</sup> Their study found that the impact of positive reinforcement by coaching staff should not be underestimated.

Limitations with this study include the sample of participants recruited within urban Honolulu. This may overlook differences in survey responses from samples representing rural participants. Second, this study sample was of limited size. Finally, a post-intervention assessment was not included. An observation noted with UV photography was the relatively frequent participant finding of incomplete sunscreen application. Additional aspects of sunscreen application patterns have previously identified the applied sunscreen quantity being less than optimal to achieve the labeled SPF rating.<sup>28</sup> Further research is needed to determine the subsequent effects of the ban on sunscreen use and skin cancer risks.

Pharmacists and health care professionals have a key role in championing sun protection education. Addressing unique community concerns may help to remove barriers to effective sun protection practices. Pharmacists have an important opportunity to create greater clarity for consumers from the myriad of sun protection products available in retail settings. Elaborating on key topics such as broad-spectrum designation, water-resistance, SFP ratings, and common practices leading to improper application can promote informed consumer sunscreen product selection and use. There is also an ongoing need to understand the populations who may be at high risk from the impact of excessive sun exposure to help prevent disproportionately worse health outcomes.

In conclusion, our study identified sun protection KABs of pickleball players within Honolulu. Future research could address education regarding the perception of sun tanning and its ability to confer protection, validation of participant confidence in sun protection application methods, explore barriers to utilizing sun protection modalities, and appearance-based interventions. Additional activities could further engage leaders and coaches within the pickleball community to establish consistent sun protection messaging.

## Acknowledgements

The study was supported by a seed grant from the DKICP Department of Pharmacy Practice. We would like to acknowledge the support of the O‘ahu Pickleball Association and the Hawai‘i Skin Cancer Coalition. We would also like to thank Edward Siu, an undergraduate student and intern at the University of Hawai‘i Cancer Center, for assisting with the educational efforts.

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