# A Randomized Controlled Trial on the Efficacy of Ultraviolet Index Education on Sunscreen Use Among Patients in a Tertiary Hospital in Manila

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## ABSTRACT

**Rationale:** Skin cancer is the most common cancer in fair-skinned populations. Overall, strategies focus on modifiable risk factors such as reducing ultraviolet (UV) radiation exposure through physical, topical or systemic protection. Currently, data on knowledge, attitude and practices of Filipino patients on UV index in relation to sun protection is unavailable.
**Objectives:** The objective of this study is to improve sunscreen use among patients seen in a tertiary hospital in Manila, specifically after UV index education.
**Methodology and Population:** The study will be conducted among patients at the outpatient department of the University of Santo Tomas Hospital, Department of Dermatology, after UV index education. Patients who will be included are aged 18 to 65 years old, belonging to both sexes and able to understand English or Filipino. The exclusion criteria includes children, elderly greater than the age of 65, prisoners, mentally handicapped or those with incurable diseases.
**Time Frame:** 3 weeks
**Expected Outcomes:** The outcome is the improvement in sunscreen use among patients seen in a tertiary hospital in Manila, specifically after UV index education.

## BACKGROUND

Skin cancer is the most common cancer in fair-skinned populations. The most prevalent forms include carcinomas, which are basal cell carcinoma (BCC), squamous cell carcinoma (SCC) and cutaneous melanoma. Other types include Merkel cell carcinoma, dermatofibrosarcoma protuberans, adnexal carcinomas, among others.[1]

The estimated incidence of BCC and SCC in 2019 in the United States was 2.8 million and 1.5 million cases, respectively, with 4472 deaths attributed to SCC. Melanoma, alternatively, accounts for a smaller percentage of skin cancer incidence, but a large percentage of skin cancer-related mortality.[1]

Ultraviolet (UV) radiation exposure is the most common and important modifiable, environmental risk factor for skin cancer. Thus, it is the target of most prevention strategies worldwide. UV radiation protection strategies can be physical by limiting exposure, topical through sunscreens and chemoprevention, and systemic.[1]

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Physical protection from natural and artificial UV radiation such as tanning beds can be achieved by avoiding or limiting exposure and using protective clothing or accessories. Strong evidence suggests that regular sunscreen use decreases the risks of melanoma or carcinomas. The overall consensus is to apply a water-resistant, broad-spectrum sunscreen with sun protection factor (SPF) 15 to 30 or higher on sun-exposed areas, 15 to 20 minutes before exposure, and reapply every two hours or after swimming, sweating and toweling off. As many of the harmful effects of UV radiation exposure are mediated by oxidative stress and reactive oxygen species, antioxidants may counteract these mechanisms by suppressing the formation of reactive oxygen species and possibly preventing the inactivation of protective enzymes and induction of DNA damage. Therefore, systemic administration of antioxidants has been proposed as an alternative or additional method for UV radiation protection.[1]

## Review of Related Literature

BCC is the most common cancer in humans. It is estimated that more than three million new cases occur each year in the United States.

The malignancy accounts for approximately 75% of all nonmelanoma skin cancers (NMSCs) and almost 25% of all cancers diagnosed in the United States. Epidemiological data indicates that the overall incidence is increasing worldwide significantly by 3% to 10% per year. SCC is the second most common skin cancer after BCC in immunocompetent white individuals and the most common skin cancer in immunosuppressed organ transplantation recipients worldwide.[2]

The published study on Filipino patients to date included only 40 patients with histopathologic diagnoses of malignant skin tumors in the University of the East Ramon Magsaysay Memorial Medical Center (UERMMMC). Among these, 22 (55%) patients had BCC, 17 (27.5%) had SCC and 7 (17.5%) had malignant melanoma (MM). BCC was more common in females, while SCC and MM had almost equal sex distribution. Most of the cases were diagnosed in the older age group. Predilection sites for BCC and SCC were on areas of greater sun exposure like the nose and lids and acral areas for MM. The profile of malignant skin tumors at UERMMMC approximated foreign studies.[3]

(UV rays are a part of sunlight that is an invisible form of radiation. UV rays can penetrate and change the structure of skin cells. There are three types of UV rays: ultraviolet A (UVA), ultraviolet B (UVB) and ultraviolet C (UVC). UVA is the most abundant source of solar radiation at the earth's surface and penetrates beyond the top layer of human skin. Scientists believe that UVA radiation can cause damage to connective tissue and increase a person's risk for developing skin cancer. UVB rays penetrate less deeply into skin, but can still cause some forms of skin cancer. Natural UVC rays do not pose a risk to workers because they are absorbed by the earth's atmosphere.[4]

Exposure to UV radiation, both UVB and UVA, has been recognized as the most important environmental risk factor for the development of SCC with a strong dose-response association, as suggested by the preferential localization of actinic keratosis and SCC on sun-exposed and chronically photodamaged sites and in sun-sensitive phenotypes such as patients with fair complexions, with increasing age and high cumulative UV irradiation.[2]

The UV exposure measurement of cyclists or bikers is between 0.2 minimal erythema dose (MED) and 17.2 MED. The mean daily personal exposure was 8.1 MED. The personal exposure level determined exceeded exposure limits by more than 30 times.[5] There are 38,932 cyclists in the National Capital Region. In terms of location, the largest number was recorded in Quezon City (16,709), followed by Pasig (11,159), Marikina (6,778) and San Juan (4,286), respectively,[6] which makes this population an appropriate and convenient study of interest. Riders in Metro Manila are from age 15 to 65, with majority of them within the age range of 21 to 35 years old (73%).[7]

For every 10 miles or 16 kilometers of pedaling, it equates to about an hour of sun exposure. A 2000 study published in the Journal of Dermatology found that cyclists who were training for the Tour de Suisse were exposed to sunshine levels of more than 30 times the recommended limit. According to information from the Centers for Disease Control and Prevention, the sun can damage unprotected skin in as little as 15 minutes, and a history of sunburns can increase your risk of getting skin cancer.[8] Biking for 2.5 miles or 4 kilometers equates to a duration of 15 minutes.

The US Preventive Services Task Force recommends that fair-skinned individuals aged 6 months to 24 years and their parents should be counseled about minimizing UV radiation exposure. Fair-skinned adults aged 24 years should be counseled based on risk factors such as phenotype, family history, indoor tanning, sunburn, skin cancer history, multiple nevi or atypical nevi, human immunodeficiency virus (HIV) and organ transplant recipient.[2]

The Food and Drug Administration regulates sunscreens as an over-the-counter drug in the United States. Labels should include SPF, coverage spectrum, cancer/aging warnings if they do not satisfy broad-spectrum tests/SPF 15+, water resistance or duration, encouragement for regular use or liberal application to exposed areas 15 minutes before sun exposure, reapplication instructions, storage recommendations and expiration dates.[1] Photoprotection measures must be more emphasized during the peak UVB hours of 10:00 am to 2:00 pm.[2]

Although official guidelines are lacking, primary prevention recommendations for organ transplant recipients include the use of physical sunscreens containing titanium dioxide with SPF 30+, 50+ if other risk factors, to apply daily whether UV radiation exposure is expected or not, application of one teaspoon to each sun-exposed body part and use of 4-inch wide-brimmed hats and UV protection factor-rated clothing.[1] Most adults need about 1 ounce — or enough to fill a shot glass — to fully cover their body.[9] Physicians should emphasize UV radiation protection at every follow-up visit and monitor vitamin D levels.[1]

The UV index (UVI) was first developed in Canada in 1992 and adopted by the United States National Weather Service (NWS) and Environmental Protection Agency (EPA) as well as the World Meteorological Organization (WMO) and World Health Organization (WHO) in 1994. The UVI, a measure of the ultraviolet radiation (UVR) levels at the earth's surface, was published in 1995 as a result of the collaboration between the WMO, WHO, United Nations Environment Programme, the International Commission on Non-Ionizing Radiation Protection and the German Federal Office for Radiation Protection. The UVI was intended to raise awareness and alert the public to the need for sun protection in order to reduce skin cancer risk. Although various versions of the UVI existed around the world before the standardization of the Global Solar UVI in 2002, they shared many similar qualities. Despite slight changes in color scheme, labeled exposure categories and range of values, the actual UVR levels have not changed. The values of UVI range from 1 to 11+ and are associated with varying recommendations for sun protection. For example, at a UVI value of 3, sun protection is recommended (ie, seeking shade during midday, increasing clothing coverage, sunscreen and hat use) and at a UVI value of 8, extra sun protection is recommended (ie, avoid being outdoors during midday, greater emphasis on sun protection).[10]

UV index values are determined from measurements made by ground-based spectrometers, broad-band filter radiometers and multi-filter radiometers. Radiative transfer models are used to estimate UV Index values from other types of geophysical observations, primarily column ozone and cloud thickness. UV index values can also be retrieved from satellite measurements of atmospheric ozone and cloud cover. Forecasts of UV index values are now widely available and intended to be used by the public as a guide to avoid excessive exposure to UV radiation.[4] Whether it is from your local news channel or the weather app on your phone, information about the UV index forecast is available at your fingertips. The forecast is useful as a guide to certain choices, such as whether to apply sunscreen, or wear a pair of sunglasses when going out.

## Significance of the Study

In a study done in 2018 among Filipino individuals, 19 years old and above, an increased awareness for sun protection was necessary to establish future recommendations on proper sunlight exposure in this population. The use of caps and hats was a common feature of males. Umbrella use, meanwhile, was found in most females. Active shade-seeking was a common feature of those commonly in the outdoors. Shades or sunglasses were the least commonly employed form of sun protection and was mostly worn for fashion purposes instead.[11]

Sun-protective behavior includes avoiding intense sun when possible and seeking shade to reduce the risk of sunburn, wearing sun-protective clothing such as long sleeve shirt, long pants, wide brim hat and sunglasses. Broad spectrum sunscreen protects against UVA and UVB with a SPF of 15 or higher, should be used in combination with other

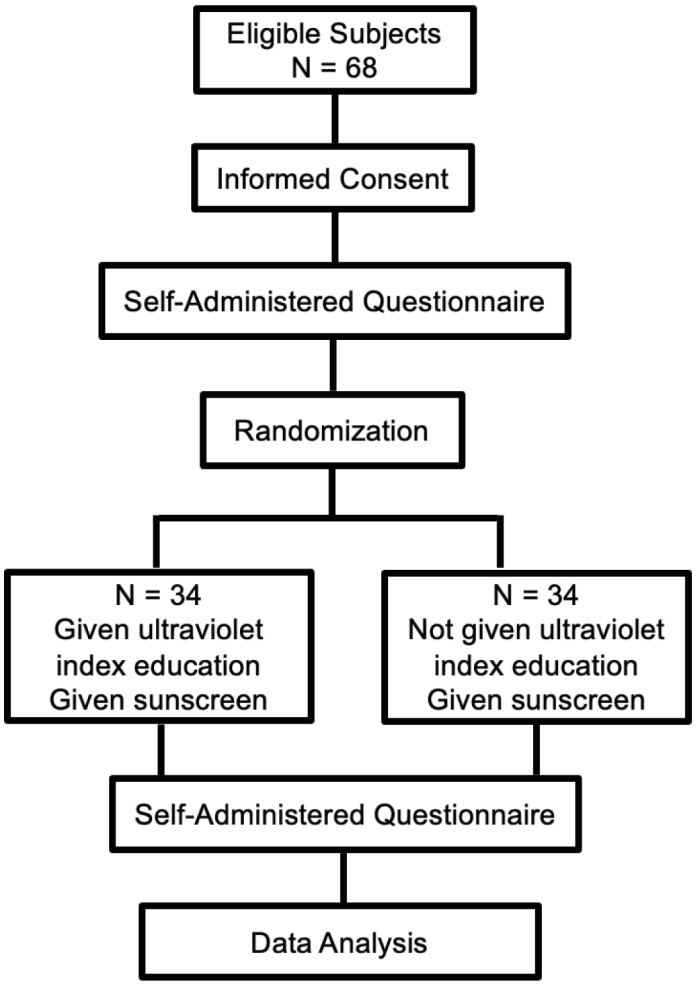


**Figure 1.** Schematic diagram of the study design

sun-protective behaviors and applied appropriately using a proper amount applied prior to sun exposure and with timely reapplication.[12]

Many believe that habits take 21 days to form. This myth appears to have originated from anecdotal evidence of patients who had received plastic surgery treatment and typically adjusted psychologically to their new appearance within 21 days.[13] For this study, the patients will also be seen after 21 days.

Results of this study will impact the community in future endeavors such as using UV index to raise awareness and alert the public to the need for sun protection to reduce skin cancer risk and modify health promotion and primary prevention strategies.

This study aims to improve sunscreen use among patients at the outpatient department of the University of Santo Tomas Hospital, Department of Dermatology.

The specific objective of this study is to determine the knowledge, attitude and practices of patients on UV index in relation to sun protection through a validated questionnaire before and after UV index education.

## METHODOLOGY

### Research Design

This is a 4-week randomized controlled trial that aims to improve sunscreen use among patients at the outpatient department of the University of Santo Tomas Hospital, Department of Dermatology from October 2024 to November 2024, after UV index education determined using a validated questionnaire on the knowledge, attitude and practices of UV index in relation to sun protection.

### Patient Selection and Withdrawal

Patients who will be included are aged 18 to 65 years old, belonging to both sexes, who are able to understand written English or Filipino. Exclusion criteria includes children, elderly greater than the

age of 65, prisoners, mentally handicapped or those with incurable diseases.

## Data Collection

A validated questionnaire on the knowledge, attitude and practices on UV index in relation to sun protection (Appendix C-D) will be utilized in this study. The primary investigator will give the questionnaire to the patients seen at the outpatient department of the University of Santo Tomas Hospital, Department of Dermatology, this October to November 2024. Participation is for those who are willing to spare approximately 15 minutes to answer the questionnaire, with verbal and written consent (Appendix A). The primary investigator will assist the participants in answering the questionnaire, and will be with the participants until they finish the questionnaire.

The sociodemographic profile will be obtained through age, sex, educational attainment, family history of skin cancer, source of information for their knowledge on UV index in relation to sun protection and sun exposure time period, duration per day, frequency and duration in years (Appendix B). The skin type will be determined by the researcher.

## Sampling and Randomization

Convenience sampling will be done by distributing the study questionnaires and informed consent forms during the researcher's most convenient time while at the outpatient department of the University of Santo Tomas Hospital, Department of Dermatology. Recruitment will be done among the patients present, with the targeted sample size to be obtained this October to November 2024. Patients seen in private clinics of the University of Santo Tomas Hospital, Department of Dermatology will also be included.

A second visit is needed, after three weeks, to answer the same questionnaire answered during the first visit.

After eligible subjects answer the validated questionnaire during the first visit, the primary investigator generates the allocation schedule. A list of patient numbers are randomly assigned in a 1:1 ratio into two groups.

## Interventions

In this study, providing UV index education (Appendix E) with sunscreen is compared to providing sunscreen alone, after a validated questionnaire on the knowledge, attitude and practices on UV index in relation to sun protection has been answered. Education will be done individually at a private cubicle when a patient is seen at the outpatient department. This is to be done by the primary investigator, as a lecture type, lasting for approximately 40-45 minutes.

## Assessment

The primary outcome of this study is to determine the improvement in knowledge, attitude and practices of patients on UV index in relation to sun protection through a validated questionnaire after UV index education. The use of sunscreen will also be checked by weighing the given sunscreen at the beginning of the study and upon follow-up, which is after 21 days. During this follow-up, all participants will also answer the validated questionnaire again.

## Statistical Considerations and Data Analysis

### Sample Size

Using G*Power 3.1.9.7, a minimum of 68 patients or 34 per group are required for this study based on assumed large effect size between patients with and without UV index education given in terms of their total score of either knowledge, attitude or practice after 21 days. This computation also accounts for 5% level of significance and 90% power.

### Statistical Test

Descriptive statistics will be used to summarize the demographic and clinical characteristics of patients. Frequency and proportion will be used for categorical variables and mean and standard deviation for normally distributed continuous variables. Independent sample t-test, and Fisher's exact test will be used to determine the difference of mean and frequency, respectively, between patients given with and without UV index education. Paired sample t-test and McNemar test will be used to determine the difference of mean and frequency, respectively, on patients from before education or baseline to after 21 days. All statistical tests will be two-tailed tests. Shapiro-Wilk test will be used to test the normality of continuous variables. Missing

**Table 1.** Baseline demographic profile of patients

| | Treatment group | | | *P*-value |
|---|---|---|---|---|
| | **Total (n=68)** | **Experimental (n=34)** | **Control (n=34)** | |
| | **Frequency (%); Mean ± SD; Median (IQR)** | | | |
| Age, years | 25.69 ± 2.44 | 25.47 ± 2.49 | 25.91 ± 2.42 | 0.461 |
| Sex | 19 (27.94) | 12 (35.29) | 7 (20.59) | 0.177 |
| Male | 49 (72.06) | 22 (64.71) | 27 (79.41) | |
| Female | | | | |
| Educational Attainment | 22 (32.35) | 9 (26.47) | 13 (38.24) | 0.300 |
| College | 46 (67.65) | 25 (73.53) | 21 (61.76) | |
| Post-graduate | | | | |
| Skin Type | 1 (1.47) | 0 | 1 (2.94) | 0.551 |
| Type I | 12 (17.65) | 8 (23.53) | 4 (11.76) | |
| Type II | 19 (27.94) | 8 (23.53) | 11 (32.35) | |
| Type III | 31 (45.59) | 16 (47.06) | 15 (44.12) | |
| Type IV | 5 (7.35) | 2 (5.88) | 3 (8.82) | |
| Type V | | | | |
| Personal and Family History of Skin Cancer | | | | |
| Without | 65 (95.59) | 32 (94.12) | 33 (97.06) | 0.555 |
| With | | | | |
| | 3 (4.41) | 2 (5.88) | 1 (2.94) | |
| Sun Exposure Time | 23 (33.82) | 13 (38.24) | 10 (29.41) | 0.736 |
| 5 AM to 9 AM | 36 (52.94) | 17 (50) | 19 (55.88) | |
| 10 AM to 2 PM | 9 (13.24) | 4 (11.76) | 5 (14.71) | |
| 3 PM to 7 PM | | | | |
| Amount of Sun Exposure Per Day | 15 (22.06) | 8 (23.53) | 7 (20.59) | 0.758 |
| Less than 15 minutes | 26 (38.24) | 14 (41.18) | 12 (35.29) | |
| 15 minutes | 27 (39.71) | 12 (35.29) | 15 (44.12) | |
| More than 15 minutes | | | | |
| Frequency of Sun Exposure | 41 (60.29) | 19 (55.88) | 22 (64.71) | 0.655 |
| Everyday | 16 (23.53) | 8 (23.53) | 8 (23.53) | |
| Five times a week | 10 (14.71) | 6 (17.65) | 4 (11.76) | |
| Thrice a week | 1 (1.47) | 1 (2.94) | 0 | |
| Once a week | | | | |
| Sunscreen use | 60 (88.24) | 30 (88.24) | 30 (88.24) | 1.000 |
| Yes | 8 (11.76) | 4 (11.76) | 4 (11.76) | |
| No | | | | |
| If Yes, please indicate the number of years of sunscreen use | 5 (2 to 8) | 5 (3 to 8) | 4 (2 to 9) | 0.640 |

values will neither be replaced nor estimated. Null hypotheses will be rejected at 0.05$\alpha$-level of significance. Microsoft Excel and STATA 13.1 will be used for data management and analysis, respectively.

## RESULTS AND DISCUSSION

The study involved 68 participants equally divided into experimental and control groups (n=34 each). The mean age of participants was 25.69 ± 2.44 years, with no significant difference between groups (p = 0.461). Females constituted the majority in both groups accounting for 72.06% of the total sample. Educational attainment showed a similar distribution, with most participants having postgraduate education (67.65%, p = 0.300). Skin type distribution and personal/family history of skin cancer were comparable across groups with no significant differences.

Sun exposure characteristics, such as exposure time, duration and frequency did not differ significantly between groups. Most participants reported using sunscreen (88.24%), with an average usage duration of five years (IQR 2–8), reflecting no group differences (p = 1.000). These findings confirm that the experimental and control groups were well-matched at baseline, ensuring comparability.

**Table 2.** Baseline knowledge, attitude and practice on efficacy of ultraviolet index education on sunscreen use

| | Treatment group | | | *P*-value |
|---|---|---|---|---|
| | Total (n=68) | Experimental (n=34) | Control (n=34) | |
| | Frequency (%) | | | |
| ***Knowledge*** | | | | |
| 1. The ultraviolet (UV) index is a measure of the UV radiation levels at the earth's surface | 68 (100) | 34 (100) | 34 (100) | - |
| 2. UV index is intended to raise awareness and alert the public to the need for sun protection to reduce skin cancer risk | 65 (95.59) | 32 (94.12) | 33 (97.06) | 0.555 |
| 3. UV index ranges from 1 to 11+ and is associated with varying recommendations for sun protection | 59 (86.76) | 32 (94.12) | 27 (79.41) | 0.074 |
| 4. Sun protection is recommended at a UV index of 3 | 59 (86.76) | 30 (88.24) | 29 (85.29) | 0.720 |
| 5. Extra sun protection is recommended at a UV index value of 8 | 64 (94.12) | 34 (100) | 30 (88.24) | **0.039** |
| 6. Forecasts of UV index are now widely available and are intended to be used by the public as a guide to avoid excessive exposure to UV radiation | 62 (91.18) | 30 (88.24) | 32 (94.12) | 0.393 |
| 7. Forecasts of UV index from the weather app on the phone is free and readily available | 57 (83.82) | 27 (79.41) | 30 (88.24) | 0.323 |
| ***Attitude*** | | | | |
| 1. The ultraviolet (UV) index is a good measure of the UV radiation levels at the earth's surface | 66 (97.06) | 33 (97.06) | 33 (97.06) | 1.000 |
| 2. UV index can raise awareness and alert the public to the need for sun protection to reduce skin cancer risk | 66 (97.06) | 33 (97.06) | 33 (97.06) | 1.000 |
| 3. The higher the UV index, the greater the need for sun protection | 67 (98.53) | 34 (100) | 33 (97.06) | 0.314 |
| 4. Seeking shade during midday, increasing clothing coverage, using a hat and sunscreen are needed at a UV index of 3 | 58 (85.29) | 28 (82.35) | 30 (88.24) | 0.493 |
| 5. Staying indoors during midday and reapplying sunscreen is needed at a UV index value of 8 and above | 65 (95.59) | 34 (100) | 31 (91.18) | 0.076 |
| 6. Forecasts of UV index are essential to be used by the public as a guide to avoid excessive exposure to UV radiation | 64 (94.12) | 34 (100) | 30 (88.24) | **0.039** |
| 7. Forecasts of UV index from the weather app on the phone is a practical and helpful guide for sun protection | 63 (92.65) | 33 (97.06) | 30 (88.24) | 0.163 |
| ***Practice*** | | | | |
| 1. I check the UV index regularly as a guide for sun protection | 21 (30.88) | 11 (32.35) | 10 (29.41) | 0.793 |
| 2. I seek shade during midday, increase clothing coverage, use a hat and sunscreen when the UV index is 3 | 47 (69.12) | 26 (76.47) | 21 (61.76) | 0.189 |
| 3. I avoid being outdoors during midday and reapply sunscreen when the UV index is eight and above | 48 (70.59) | 26 (76.47) | 22 (64.71) | 0.287 |
| 4. I check the weather app on my phone regularly to know the UV index | 15 (22.06) | 7 (20.59) | 8 (23.53) | 0.770 |

**Table 3.** Follow-up knowledge, attitude and practice on efficacy of ultraviolet index education on sunscreen use

| | Total (n=68) | Treatment group | | *P*-value |
|---|---|---|---|---|
| | | Experimental (n=34) | Control (n=34) | |
| | | Frequency (%) | | |
| ***Knowledge*** | | | | |
| 1. The ultraviolet (UV) index is a measure of the UV radiation levels at the earth's surface | 67 (98.53) | 33 (97.06) | 34 (100) | 0.314 |
| 2. UV index is intended to raise awareness and alert the public to the need for sun protection to reduce skin cancer risk | 67 (98.53) | 33 (97.06) | 34 (100) | 0.314 |
| 3. UV index ranges from 1 to 11+ and is associated with varying recommendations for sun protection | 64 (94.12) | 32 (94.12) | 32 (94.12) | 1.000 |
| 4. Sun protection is recommended at a UV index of 3 | 66 (97.06) | 32 (94.12) | 34 (100) | 0.151 |
| 5. Extra sun protection is recommended at a UV index value of 8 | 68 (100) | 34 (100) | 34 (100) | - |
| 6. Forecasts of UV index are now widely available and are intended to be used by the public as a guide to avoid excessive exposure to UV radiation | 64 (94.12) | 32 (94.12) | 32 (94.12) | 1.000 |
| 7. Forecasts of UV index from the weather app on the phone is free and readily available | 65 (95.59) | 33 (97.06) | 3 (94.12) | 0.555 |
| ***Attitude*** | | | | |
| 1. The ultraviolet (UV) index is a good measure of the UV radiation levels at the earth's surface | 68 (100) | 34 (100) | 34 (100) | - |
| 2. The UV index can raise awareness and alert the public to the need for sun protection to reduce skin cancer risk | 68 (100) | 34 (100) | 34 (100) | - |
| 3. The higher the UV index, the greater the need for sun protection | 67 (98.53) | 34 (100) | 33 (97.06) | 0.314 |
| 4. Seeking shade during midday, increasing clothing coverage, using a hat and sunscreen are needed at a UV index of 3 | 65 (95.59) | 32 (94.12) | 33 (97.06) | 0.555 |
| 5. Staying indoors during midday and reapplying sunscreen is needed at a UV index value of 8 and above | 67 (98.53) | 33 (97.06) | 34 (100) | 0.314 |
| 6. Forecasts of UV index are essential to be used by the public as a guide to avoid excessive exposure to UV radiation | 68 (100) | 34 (100) | 34 (100) | - |
| 7. Forecasts of UV index from the weather app on the phone is a practical and helpful guide for sun protection | 68 (100) | 34 (100) | 34 (100) | - |
| ***Practice*** | | | | |
| 1. I check the UV index regularly as a guide for sun protection | 34 (50) | 17 (50) | 17 (50) | 1.000 |
| 2. I seek shade during midday, increase clothing coverage, use a hat and sunscreen when the UV index is 3 | 57 (83.82) | 30 (88.24) | 27 (79.41) | 0.323 |
| 3. I avoid being outdoors during midday and reapply sunscreen when the UV index is 8 and above | 54 (79.41) | 27 (79.41) | 27 (79.41) | 1.000 |
| 4. I check the weather app on my phone regularly to know the UV index | 36 (52.94) | 21 (61.76) | 15 (44.12) | 0.145 |

**Table 4.** Comparison of score of baseline and follow-up weight of sunscreen, knowledge, attitude and practice on efficacy of ultraviolet index education on sunscreen use

| | Treatment group | | | *P*-value |
|---|---|---|---|---|
| | **Total (n=68)** | **Experimental (n=34)** | **Control (n=34)** | |
| | **Mean ± SD** | | | |
| Baseline score | | | | |
| Weight of Sunscreen | 588 | 588 | 588 | - |
| Knowledge | 6.38 ± 1.02 | 6.44 ± 0.99 | 6.32 ± 1.07 | 0.639 |
| Attitude | 6.60 ± 0.99 | 6.74 ± 0.61 | 6.47 ± 1.26 | 0.276 |
| Practice | 1.93 ± 1.27 | 2.06 ± 1.20 | 1.79 ± 1.34 | 0.395 |
| Follow-up score | | | | |
| Weight of Sunscreen | 432.4 ± 49.5 | 426.3 ± 45.4 | 438.6 ± 53.31 | 0.312 |
| Knowledge | 6.78 ± 0.59 | 6.74 ± 0.67 | 6.82 ± 0.52 | 0.545 |
| Attitude | 6.93 ± 0.31 | 6.91 ± 0.38 | 6.94 ± 0.24 | 0.703 |
| Practice | 2.66 ± 1.40 | 2.79 ± 1.32 | 2.53 ± 1.48 | 0.440 |
| Baseline versus follow-up score | **<0.001** | **<0.001** | **<0.001** | |
| Weight of Sunscreen | **0.006** | 0.155 | **0.017** | |
| Knowledge | **0.012** | 0.161 | **0.036** | |
| Attitude | **0.002** | **0.019** | **0.034** | |
| Practice | | | | |

At baseline, both experimental and control groups demonstrated high levels of knowledge regarding the UV index, its role in public awareness and its practical applications for sun protection, with no statistically significant differences in most knowledge questions. However, awareness of the recommendation for extra sun protection at a UV index of 8 was significantly higher in the experimental group ($p = 0.039$). Attitudes were similarly positive in both groups, reflecting high appreciation of the UV index as a practical measure and guide for sun protection, with no significant differences. Practices regarding checking the UV index and applying sun-protection strategies showed low adherence across groups, with no significant variations. This suggests a knowledge-practice gap at baseline that could be targeted for improvement.

At follow-up, knowledge and attitudes were uniformly high across both groups, with perfect scores for several items, such as the practical importance of the UV index for sun protection ($p$ = insignificant). Practices showed notable improvement, with a significant increase in adherence to recommended behaviors, such as avoiding the midday sun and using the weather app to check the UV index. The experimental group displayed slightly higher adherence to seeking shade and checking UV index levels, although differences were not statistically significant. The findings suggest that both groups benefited from educational intervention, though the experimental group showed marginally better engagement in practice-related behaviors.

At baseline, knowledge, attitude and practice scores were similar between groups. The mean knowledge score was 6.38 ± 1.02, attitude score was 6.60 ± 0.99 and practice score was 1.93 ± 1.27 for the total sample. Follow-up assessments showed significant improvements in practice ($p = 0.002$), weight of sunscreen used ($p<0.001$), and knowledge ($p = 0.006$) scores overall.

In the experimental group, practice scores improved significantly from baseline (2.06 ± 1.20) to follow-up (2.79 ± 1.32, $p = 0.019$). Similar trends were observed for knowledge and attitude scores, though group comparisons revealed no significant differences in follow-up scores between experimental and control groups. Changes in sunscreen weight were also significantly greater from baseline to follow-up ($p<0.001$) in both groups, indicating enhanced sunscreen application practices post-intervention.

## CONCLUSION

The findings demonstrate that both educational interventions improved participants' knowledge, attitudes and practices concerning UV index use and sunscreen application. Although both experimental and control groups showed significant within-group improvements, the experimental group exhibited

a slightly higher engagement in certain practice behaviors. These results highlight the effectiveness of UV index education in promoting sun-safe behaviors and suggest that targeted educational efforts can bridge the knowledge-practice gap observed at baseline. Future interventions could explore additional strategies to sustain and further enhance adherence to protective behaviors.

## Limitations and Recommendations

This study serves as an initial evaluation of the efficacy of UV index education on sunscreen use. A larger sample size for greater demographic diversity and overall generalizability is recommended. A follow-up period of 21 days is not sufficient to ensure habit formation; hence long-term follow-up can be done in future studies. Community campaigns and digital tools would help strengthen sun protective practices and broaden the public's knowledge. Other ways to determine sunscreen use such as UV-sensitive stickers is recommended as an additional objective measure to further enhance accuracy of the study. More convenient educational methods can be explored such as group or online lectures, which can include a larger population size.

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## APPENDIX A. INFORMED CONSENT FORM

Dear participants,

You are respectfully invited to join an experimental study entitled, **"A Randomized Controlled Trial on the Efficacy of Ultraviolet Index Education on Sunscreen Use Among Patients in a Tertiary Hospital in Manila."**

Please carefully read this informed consent form and take your time before deciding whether to participate in this experimental study. Feel free to ask your physician about anything that needs further explanation. Your voluntary involvement in the study will be highly appreciated.

The main contents of this study are as follows:

1. The purpose of this experimental study is to improve sunscreen use among patients seen in a tertiary hospital in Manila, specifically after UV index education.
2. This is an experimental study that will be conducted among 68 patients. Data collection will only start once the study has been approved by the UST Hospital - Research Ethics Committee.
3. Upon consult, participants will be asked to fill out three forms: 1) Informed Consent Form; 2) Data Collection Sheet and a 3) Self-administered Questionnaire. It will take approximately 15 minutes to answer the questionnaire, which is composed of three parts, for assessment of knowledge, attitude and practices. The knowledge will be assessed through seven statements, answerable with a Yes or No. The attitude will be assessed through seven statements, answerable with a Yes or No. The practices will be assessed through four statements, answerable with a Yes or No.
4. After answering the validated questionnaire during the first visit, the primary investigator generates the allocation schedule. A list of patient numbers is randomly assigned in a 1:1 ratio into two groups using www.randomization.com, for assignment into the control and intervention groups. The control group will just be given free sunscreen, while the intervention group will be given free sunscreen and UV index education.
5. Education for the intervention group will be done individually at a private cubicle, when a patient is seen at the outpatient department. This is to be done by the primary investigator, as a lecture type, lasting for approximately 40-45 minutes. A simple snack will also be provided.
6. Sunscreen given must be used and will be checked by weighing the sunscreen at the beginning of the study and upon follow-up, which is after 21 days. During this follow-up, all participants will also answer the validated questionnaire again and be given a transportation allowance for compensation.
7. Inconvenience is a study-related risk, hence only patients who seek consult at the outpatient department of University of Santo Tomas Hospital, Department of Dermatology will be included. Participation is for those who are willing to spare approximately 15 minutes to answer the questionnaire. This study will have direct benefit to participants, through the free sunscreen that will be given, which will be an incentive for participants to come back to retake the questionnaire.
8. There is a risk of possible breach of confidentiality and in order to address this, all patient files will be kept confidential by the primary investigator and no patient identifiers such as name and patient pictures will be disclosed in forms.
9. Only the primary investigators, study coordinators and biostatistician will have access to the forms and database. Questionnaires will be locked in a cabinet, and data will be kept in a password-encrypted computer for three years. All forms and data will be disposed and deleted thereafter, respectively.
10. Currently, data on knowledge, attitude and practices of Filipino patients on UV index in relation to sun protection is unavailable. Forecasts of UV index values from the weather app on the phone are now widely available and are intended to be used by the public as a guide to avoid excessive exposure to UV radiation and practice sun protection.
11. Results of this study will impact the community in future endeavors such as using UV index to raise awareness and alert the public to the need for sun protection to reduce skin cancer risk and modify health promotion and primary prevention strategies.
12. The information obtained from patients' participation will be invaluable for health promotion and primary prevention strategies for skin cancer.
13. Participation in this study is free of charge.
14. Participants or their legal representatives will be informed results of the study once it has been completed.

15. The study participant or legally acceptable representative shall receive a copy of the signed and dated written consent form, prior to study participation. Participants will have free full access to the data that will be derived from the study.

As your participation is voluntary, you may have the right to withdraw from this experimental study at any time. Refusal or withdrawal will not affect the quality of health care that they will receive. The primary investigator can also remove a participant if deemed necessary. If you have any questions related to this experimental study, please directly contact the primary investigator, **Dr. Gail Boco** at **0925 759 1521.**

The primary investigators guarantee that there will never be any personal identification of participants in the research results, even if the research manuscript will be published in a journal. All patient records will be in the custody of the research team indefinitely. However, the USTH-REC and regulatory authorities will be granted direct access to participant's medical records ONLY for verification of experimental study procedures and data.

The study has been reviewed and approved by the USTH-REC, a PHREB-accredited REC. For information regarding rights of study participants, including grievances and complaints, participants may visit the **REC Office, 6/F Clinical Division Building, University of Santo Tomas Hospital,** or contact **Dr. Josephine M. Lumitao** at **+632 731-3001 local 2610** or email **usth_irb@yahoo.com.ph**

You will receive a copy of this informed consent form prior to study participation. This study is investigator-initiated and not company sponsored. There is no potential conflict of interest.

**CERTIFICATE OF CONSENT**

Protocol Title: **A Randomized Controlled Trial on the Efficacy of Ultraviolet Index Education on Sunscreen Use Among Patients in a Tertiary Hospital in Manila**

I voluntarily consent to take part in this study. This study has been explained to me in a language that I understand. The purpose and procedures of this study have been fully discussed and understood by me. I have been given enough time to ask any questions that I have about the study, and all my questions have been answered. I have received a copy of the informed consent form. I am aware that after completion of the study, I will be informed of the results.

Name of Participant/Signature/Date:

**Witness Statement**

I, the undersigned, certify to the best of my knowledge that the participant signing this informed consent form had the study fully explained in a language understood by him/her and clearly understands the nature, risks and benefits of his/her participation in the study.

Witness Signature Date

**Investigator Statement**

I, the undersigned, certify that I explained the study to the participant. To the best of my knowledge, the participant signing this informed consent form clearly understands the nature, risks and benefits of his/her participation in the study.

Investigator Signature Date

## APPENDIX B. DATA COLLECTION SHEET

| **Data collection will only start once the study has been approved by the UST Hospital - Research Ethics Committee** | |
|---|---|
| STUDY NUMBER: _____ | |
| SOCIODEMOGRAPHIC PROFILE | |
| Age | _____ years old |
| Sex | O Male O Female |
| Educational Attainment | • Elementary<br>• High School<br>• College<br>• Post-graduate |
| Skin Type<br>(Determined by the researcher) | • Type I<br>• Type II<br>• Type III<br>• Type IV<br>• Type V<br>• Type VI |
| Personal and Family History of Skin Cancer | • With<br>• Without |
| Source of Information for Knowledge on Sun Exposure and Sun Protection | |
| Sun Exposure Time | • 5 am to 9 am<br>• 10 am to 2 pm<br>• 3 pm to 7 pm |
| Amount of Sun Exposure Per Day | • Less than 15 minutes<br>• 15 minutes<br>• >15 minutes |
| Frequency of Sun Exposure | • Once a week<br>• Twice a week<br>• Thrice a week<br>• Five times a week<br>• Everyday |
| Sun Exposure Duration in Years | ____ Years |
| Sunscreen Use | Yes ___<br>If Yes, how long? ____ Years<br>No ____ |

## APPENDIX C: KNOWLEDGE, ATTITUDE AND PRACTICES OF BIKERS ON ULTRAVIOLET INDEX IN RELATION TO SUN PROTECTION QUESTIONNAIRE

Study Number: _____ Date: _____

Knowledge

| | Yes | No |
|---|---|---|
| The ultraviolet (UV) index is a measure of the UV radiation levels at the earth's surface | | |
| UV index is intended to raise awareness and alert the public to the need for sun protection in order to reduce skin cancer risk | | |
| UV index ranges from 1 to 11+ and are associated with varying recommendations for sun protection | | |
| Sun protection is recommended at a UV index of 3 | | |
| Extra sun protection is recommended at a UV index value of 8 | | |
| Forecasts of UV index are now widely available and are intended to be used by the public as a guide to avoid excessive exposure to UV radiation | | |
| Forecasts of UV index from the weather app on the phone is free and readily available | | |

Attitude

| | Yes | No |
|---|---|---|
| The ultraviolet (UV) index is a good measure of the UV radiation levels at the earth's surface | | |
| UV index can raise awareness and alert the public to the need for sun protection in order to reduce skin cancer risk | | |
| The higher the UV index, the greater the need for sun protection | | |
| Seeking shade during midday, increasing clothing coverage, using a hat and sunscreen are needed at a UV index of 3 | | |
| Staying indoors during midday and reapplying sunscreen are needed at a UV index value of 8 and above | | |
| Forecasts of UV index are important to be used by the public as a guide to avoid excessive exposure to UV radiation | | |
| Forecasts of UV index from the weather app on the phone is a practical and useful guide for sun protection | | |

Practices

| | Yes | No |
|---|---|---|
| I check the UV index regularly as a guide for sun protection | | |
| I seek shade during midday, increase clothing coverage, use a hat and sunscreen when the UV index is 3 | | |
| I avoid being outdoors during midday and reapply sunscreen when the UV index is 8 and above | | |
| I check the weather app of my phone regularly to know the UV index | | |

## APPENDIX D: KAALAMAN, SALOOBIN AT MG A GAWI NG MGA MOTORISTA HINGGIL SA ULTRAVIOLET INDEX KAUGNAY SA PROTEKSIYON LABAN SA ARAW NA TALATANUNGAN

Bilang ng Pag-aaral: _____ Petsa: _____

Kaalaman

| | Oo | Hindi |
|---|---|---|
| Ang ultraviolet (UV) index ay sukatan ng mga antas ng radiyasyon ng UV sa ibabaw ng Mundo | | |
| Ang UV index ay inilaan upang itaas ang kamalayan at alertuhin ang publiko hinggil sa proteksiyon laban sa araw upang mabawasan ang panganib ng kanser sa balat | | |
| Ang UV index ay mula 1 hanggang 11+ at batay sa iba't ibang rekomendasyon para sa proteksyion laban sa araw | | |
| Inirerekomenda ang proteksiyon laban sa araw sa UV index na 3 | | |
| Inirerekomenda ang dagdag na proteksiyon laban sa araw sa UV index na 8 | | |
| Ang mga pagtataya ng UV index ay malawak na magagamit na ngayon at nilalayon na gamitin ng publiko bilang gabay upang maiwasan ang labis na pagkakalantad sa radiyasyon ng UV | | |
| Ang mga pagtataya ng UV index mula sa weather app sa telepono ay libre at madaling makuha | | |

Saloobin

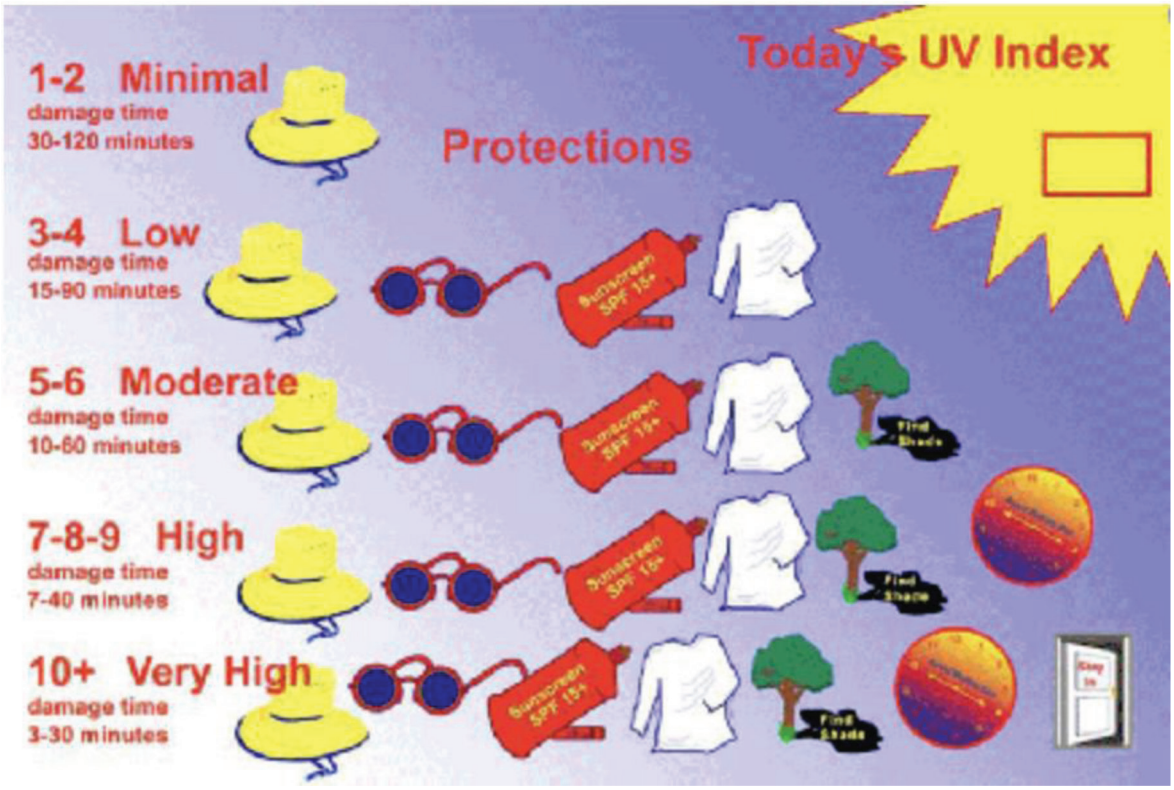
| | Oo | Hindi |
|---|---|---|
| Ang ultraviolet (UV) index ay mahusay na sukatan ng mga antas ng radiyasyon UV sa ibabaw ng Mundo | | |
| Ang UV index ay maaaring magtaas ng kamalayan at alertuhin ang publiko hinggil sa proteksiyon laban sa araw upang mabawasan ang panganib ng kanser sa balat | | |
| Kung mas mataas ang UV index, mas malaki ang pangangailangan para sa proteksiyon laban sa araw | | |
| Ang pagpapalilim sa tanghali, ang pagsusuot ng damit upang matakpan ang malaking bahagi ng balat, ang paggamit ng sumbrero at sunscreen ay kailangan sa isang UV index na 3 | | |
| Ang pananatili sa loob ng bahay sa tanghali, at ang muling paglalagay ng sunscreen ay kailangan sa UV index na 8 pataas | | |
| Ang mga pagtataya ng UV index ay mahalaga upang magamit ng publiko bilang gabay upang maiwasan ang labis na pagkakalantad sa radiyasyon ng UV | | |
| Ang mga pagtataya ng UV index mula sa weather app sa telepono ay isang praktikal at kapaki-pakinabang na gabay para sa proteksiyon laban sa araw | | |

Mga Gawi

| | Oo | Hindi |
|---|---|---|
| Regular kong tinitingnan ang UV index bilang gabay para sa proteksiyon laban sa araw | | |
| Naghahanap ako ng lilim sa tanghali, dinadamitan ang malaking bahagi ng balat, gumagamit ng sumbrero at sunscreen kapag ang UV index ay 3 | | |
| Iniiwasan kong lumabas sa tanghali, at muling naglalagay ng sunscreen kapag ang UV index ay 8 pataas | | |
| Regular kong tinitingnan ang weather app ng aking telepono para malaman ang UV Index | | |

## APPENDIX E. ULTRAVIOLET INDEX EDUCATIONAL SHEET

| UV Index | Exposure Level |
|---|---|
| 1-2 | Minimal |
| 3-4 | Low |
| 5-6 | Moderate |
| 7-9 | High |
| 10 and greater | Very High |




**Limit Time in the Midday Sun**

The sun's rays are strongest between 10 a.m. and 4 p.m. Whenever possible, limit exposure to the sun during these hours.

**Seek Shade**

Staying under cover is one of the best ways to protect yourself from the sun. Remember the shadow rule: "Watch Your Shadow—No Shadow, Seek Shade!"

**Always Use Sunscreen**


A broad spectrum sunscreen with a Sun Protection Factor (SPF) of at least 15 blocks most UV radiation. Apply sunscreen liberally on exposed skin and reapply every 2 hours when working or playing outdoors. Even waterproof sunscreen can come off when you towel off sweat or water.

**Wear a Hat**

A hat with a wide brim offers good sun protection for your eyes, ears, face, and the back of your neck—areas particularly prone to overexposure to the sun.

Reference: Action Steps For Sun Protection. EPA430-F99-026,Sept 1999.