

Knowledge, Attitudes, and Practices Regarding Sunscreen Use Among Undergraduate Medical Students: A Cross-Sectional Study

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Abstract

Background: Appropriate sunscreen use is an essential component of photoprotection and plays a significant role in preventing photoaging, pigmentary disorders, and ultraviolet (UV)-induced skin damage. As future healthcare providers, medical students are expected to possess adequate knowledge and adopt appropriate photoprotective practices. However, the relationship between knowledge and actual sunscreen use remains inadequately explored.

Objectives: To assess the knowledge, attitudes, and practices regarding sunscreen use among undergraduate medical students and to evaluate the association between knowledge and sunscreen practices.

Materials and Methods: A questionnaire-based cross-sectional study was conducted among 50 undergraduate medical students at a tertiary care teaching institution in Bengaluru, India. Data were collected using a structured, self-administered online questionnaire comprising sociodemographic details, knowledge, attitude, and practice domains. Knowledge, attitude, and practice scores were calculated using predefined scoring systems. Statistical analysis was performed using IBM SPSS Statistics for Windows, Version 26.0. Continuous variables were summarized using mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), while categorical variables were expressed as frequencies and percentages. Non-parametric tests were used for inferential analysis. Spearman's rank correlation coefficient was used to assess the association between knowledge and practice scores, with a p-value of <0.05 considered statistically significant.

Results: A total of 50 medical students participated in the study. The mean knowledge, attitude, and practice scores were 6.00 ± 1.07 , 21.50 ± 4.25 , and 2.73 ± 1.93 , respectively. Most participants demonstrated satisfactory knowledge regarding sunscreen use and expressed positive attitudes towards photoprotection. However, sunscreen practices were comparatively suboptimal, with only 46% reporting daily sunscreen use and consistent reapplication being uncommon. A weak positive correlation was observed between knowledge and practice scores; however, the association was not statistically significant (Spearman's $\rho = 0.126$, $p = 0.383$).

Conclusion: Undergraduate medical students demonstrated satisfactory knowledge and favourable attitudes regarding sunscreen use; however, these did not consistently translate into appropriate sunscreen practices. The observed knowledge-practice gap suggests that improving awareness alone may be insufficient to promote sustained behavioural change. Incorporating practical photoprotection education and behavioural interventions into undergraduate medical training may help improve sunscreen practices among future healthcare professionals.

Keywords: Sunscreen; Photoprotection; Knowledge; Attitude; Practice; Medical Students; Ultraviolet Radiation.

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Introduction

Ultraviolet (UV) radiation is one of the most significant environmental factors contributing to both acute and chronic skin damage. Excessive exposure to UV radiation induces oxidative stress, DNA damage, immunosuppression, and inflammatory responses, ultimately leading to sunburn, photoaging, pigmentary disorders, and

photocarcinogenesis[1,13]. While the incidence of melanoma and non-melanoma skin cancers is relatively lower among individuals with darker skin phototypes, chronic UV exposure remains an important cause of photoaging, melasma, post-inflammatory hyperpigmentation, and other pigmentary disorders that are highly prevalent in

the Indian population [4,7]. Consequently, photoprotection has become an integral component of preventive dermatology and routine skin care. Sunscreen is regarded as one of the most effective photoprotective interventions when used in conjunction with other sun-protective measures such as protective clothing, seeking shade, and avoiding peak sunlight hours. Broad-spectrum sunscreens protect against both ultraviolet A (UVA) and ultraviolet B (UVB) radiation, thereby reducing UV-induced erythema, photoaging, pigmentary alterations, and the long-term risk of skin cancer [3,9]. Current recommendations advocate the regular use of broad-spectrum sunscreen with a minimum sun protection factor (SPF) of 30, applied generously 15–30 minutes before sun exposure and reapplied every two hours or after swimming or excessive sweating [4,5]. However, the effectiveness of sunscreen depends not only on the quality of the product but also on appropriate application practices, including adequate quantity, timely application, and consistent reapplication.

Despite increasing awareness regarding photoprotection, studies across different populations have consistently demonstrated that adequate knowledge does not necessarily translate into appropriate sunscreen use. Knowledge, attitude, and practice (KAP) studies have reported that although many individuals recognize the harmful effects of UV radiation, regular sunscreen use, correct application techniques, and reapplication remain suboptimal [6,8]. Medical students constitute a particularly important group because they are future physicians who are expected to educate patients regarding sun protection and skin cancer prevention. Their personal health behaviours may influence both their credibility and the quality of preventive counselling they provide in clinical practice. Nevertheless, previous studies among medical students have reported considerable variability in sunscreen-related knowledge and inconsistent adherence to recommended photoprotection practices. In India, evidence regarding sunscreen-related knowledge, attitudes, and practices among medical students remains limited. Differences in geographical location, climatic conditions, ultraviolet exposure, Fitzpatrick skin phototypes, cosmetic preferences, and cultural perceptions may influence sunscreen use and limit the generalizability of findings from other populations.

Furthermore, recent consensus recommendations from the Indian Sunscreen Forum have highlighted the need for context-specific guidance and improved patient adherence to photoprotection practices in the Indian setting [4]. Assessing the knowledge, attitudes, and practices of medical students is therefore essential to identify existing

gaps and guide educational interventions that promote evidence-based photoprotection. Accordingly, the present study aimed to evaluate the knowledge, attitudes, and practices regarding sunscreen use among medical students and to examine the relationship between knowledge and sunscreen practices.

Materials and Methods

Study Design and Participants: A questionnaire-based cross-sectional study was conducted among undergraduate medical students at a tertiary care teaching institution in Bengaluru, Karnataka, India. Undergraduate MBBS students aged 18 years and above who were willing to participate and provided informed electronic consent were included in the study. Students who declined participation or submitted incomplete questionnaires were excluded from the analysis.

Sampling: All eligible undergraduate medical students who voluntarily responded to the online questionnaire were included in the study. A total of 50 complete responses were obtained and included in the final analysis.

Study Instrument: Data were collected using a structured, self-administered questionnaire developed on Google Forms after reviewing relevant literature on sunscreen use and photoprotection. The questionnaire consisted of four sections:

1. Sociodemographic characteristics, including age, gender, and year of study.
2. Knowledge assessment, comprising eight multiple-choice questions evaluating participants' understanding of ultraviolet radiation, sunscreen, sun protection factor (SPF), broad-spectrum protection, timing of application, reapplication, and sunscreen use under cloudy conditions.
3. Attitude assessment, consisting of five statements assessed using a five-point Likert scale ranging from "Strongly disagree" to "Strongly agree."
4. Practice assessment, which evaluated sunscreen usage habits, frequency of use, SPF preference, timing of application, reapplication practices, and barriers to regular sunscreen use.

Participation was voluntary and anonymous, and no personally identifiable information was collected.

Scoring System: Knowledge was assessed using eight objective questions. Each correct response was awarded one point, while incorrect responses received zero points, resulting in a maximum score of eight.

Knowledge scores were categorized as poor (0–3), moderate (4–6), and good (7–8). Attitude was assessed using five Likert-scale statements scored from one (strongly disagree) to five (strongly

agree), yielding a total score ranging from 5 to 25. Higher scores indicated a more positive attitude toward sunscreen use. Practice was evaluated using a structured scoring system based on sunscreen use, frequency of application, SPF selection, timing of application, and reapplication practices. Higher scores reflected better sunscreen practices.

Statistical Analysis: Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), depending on the distribution of data, while categorical variables were presented as frequencies and percentages. The normality of continuous variables was assessed using the Shapiro–Wilk test. As the data were not normally distributed, non-parametric statistical tests were employed. Spearman's rank

correlation coefficient was used to assess the association between knowledge and practice scores. Comparisons between two independent groups were performed using the Mann–Whitney U test, whereas comparisons among multiple groups were performed using the Kruskal–Wallis test. A two-tailed p -value of <0.05 was considered statistically significant.

Results

A total of 50 undergraduate medical students completed the questionnaire and were included in the final analysis. Of these, 25 (50.0%) were male, 24 (48.0%) were female, and 1 (2.0%) preferred not to disclose their gender. The study population comprised 9 (18.0%) third-year and **41 (82.0%) fourth-year MBBS students. The demographic characteristics of the participants are presented in Table 1.

Table 1: Demographic characteristics of the study participants (N = 50)

Characteristic	Frequency (n)	Percentage (%)
Gender		
Male	25	50.0
Female	24	48.0
Prefer not to disclose	1	2.0
Year of study		
Third MBBS	9	18.0
Fourth MBBS	41	82.0

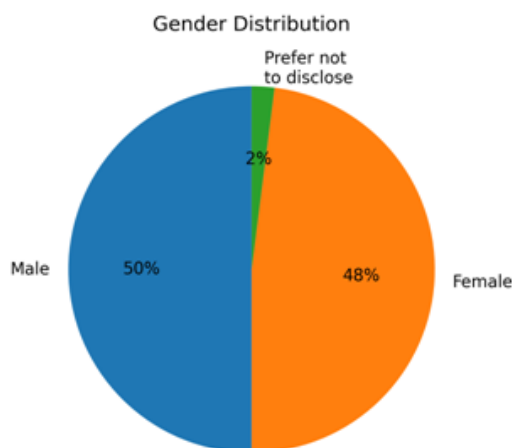


Figure 1: Gender distribution

Knowledge Regarding Sunscreen Use: The responses to the knowledge questionnaire are presented in Table 2. Nearly all participants correctly identified the benefits of sunscreen (98.0%) and the protective role of broad-spectrum sunscreen against both UVA and UVB radiation (96.0%). Most respondents correctly identified UVB as the radiation against which SPF provides protection (76.0%), the recommended timing of

sunscreen application (82.0%), the need for sunscreen use on cloudy days (92.0%), and the recommended frequency of sunscreen reapplication (76.0%).

Slightly more than half of the participants correctly identified SPF 30 as the recommended minimum SPF for routine daily use (52.0%), while only 28.0% correctly identified UVA radiation as the primary cause of skin ageing. The mean knowledge

score was 6.00 ± 1.07 out of a maximum possible score of 8.

Table 2: Knowledge regarding sunscreen use among the study participants (N = 50)

Knowledge Question	Correct Answer	Correct Responses, n (%)
Benefits of sunscreen	All of the above	49 (98.0)
SPF mainly indicates protection against	UVB	38 (76.0)
Ultraviolet radiation primarily responsible for skin ageing	UVA	14 (28.0)
Broad-spectrum sunscreen protects against	Both UVA and UVB	48 (96.0)
Recommended minimum SPF for routine daily use	SPF 30	26 (52.0)
Ideal time of sunscreen application	15–30 minutes before sun exposure	41 (82.0)
Recommended frequency of sunscreen reapplication	Every 2 hours	38 (76.0)
Should sunscreen be used on cloudy days?	Yes	46 (92.0)

Attitude Towards Sunscreen Use: Participants generally demonstrated a favourable attitude towards sunscreen use. The distribution of responses to the attitude statements is shown in Table 3. The mean attitude score was 21.50 ± 4.25 out of a maximum score of 25, indicating an overall positive perception regarding the importance of sunscreen and photoprotection.

Table 3: Overall knowledge, attitude and practice (KAP) scores

Variable	Maximum Score	Mean $\pm$ SD	Median (IQR)
Knowledge	8	6.00 ± 1.07	6 (5–6.75)
Attitude	25	21.50 ± 4.25	23 (20–25)
Practice	6	2.73 ± 1.93	3.25 (0–4.50)

Sunscreen Practices: The sunscreen practices of the participants are summarized in Table 4. Thirty-six participants (72.0%) reported currently using sunscreen, while 14 (28.0%) did not. Daily sunscreen use was reported by 23 (46.0%) participants. SPF 50 was the most commonly used sunscreen strength (46.0%), followed by SPF 30 (16.0%) and SPF greater than 50 (10.0%). Most participants reported applying sunscreen just before

leaving home (56.0%), whereas only one participant (2.0%) reported always reapplying sunscreen.

The most commonly reported barriers to regular sunscreen use were lack of time and forgetfulness. The mean practice score was 2.73 ± 1.93 .

Table 4: Sunscreen practices among the study participants (N = 50)

Variable	Frequency (n)	Percentage (%)
Current sunscreen use		
Yes	36	72.0
No	14	28.0
Frequency of sunscreen use		
Daily	23	46.0
Only during outdoor activities	5	10.0
Only on sunny days	4	8.0
Occasionally	3	6.0
Rarely	1	2.0
Not applicable	14	28.0
SPF used		
SPF 30	8	16.0
SPF 50	23	46.0
> SPF 50	5	10.0
Not applicable	14	28.0
Timing of sunscreen application		
Just before leaving home	28	56.0
Before outdoor activities	5	10.0
Just before sun exposure	2	4.0
Rarely	1	2.0
Not applicable	14	28.0

Sunscreen reapplication		
Always	1	2.0
Sometimes	23	46.0
Never	12	24.0
Not applicable	14	28.0

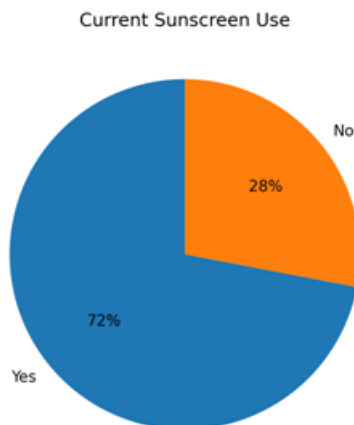


Figure 2: Current Sunscreen use

Overall KAP Scores and Inferential Analysis:

The overall knowledge, attitude, and practice scores are summarized in Table 5.

The Shapiro–Wilk test demonstrated that the knowledge, attitude, and practice scores were not normally distributed. Consequently, non-parametric statistical tests were used for inferential analysis.

Spearman's rank correlation demonstrated a weak positive correlation between knowledge and practice scores; however, the association was not statistically significant ($\rho = 0.126$, $p = 0.383$). Comparison of practice scores between male and female participants using the Mann–Whitney U test revealed no statistically significant difference ($U = 221.5$, $p = 0.111$).

Table 5: Inferential statistical analysis

Analysis	Statistical Test	Result	p-value
Knowledge score normality	Shapiro–Wilk test	Non-normal	<0.001
Attitude score normality	Shapiro–Wilk test	Non-normal	<0.001
Practice score normality	Shapiro–Wilk test	Non-normal	<0.001
Knowledge vs Practice	Spearman's rank correlation	$\rho = 0.126$	0.383
Practice score by gender	Mann–Whitney U test	$U = 221.5$	0.111

Discussion

The present study evaluated the knowledge, attitudes, and practices (KAP) regarding sunscreen use among undergraduate medical students. The findings revealed that although participants demonstrated satisfactory knowledge and a positive attitude towards sunscreen use, their actual sunscreen practices were comparatively suboptimal. Furthermore, no statistically significant correlation was observed between knowledge and practice scores, indicating that adequate knowledge alone may not necessarily translate into appropriate photoprotective behaviour. These findings highlight the persistence of a knowledge–practice gap even among future healthcare professionals. The mean knowledge score in the present study was 6.00 ± 1.07 out of a maximum possible score of eight,

suggesting an overall satisfactory level of awareness regarding sunscreen use.

Most participants correctly identified the benefits of sunscreen, the concept of broad-spectrum protection, the recommended timing of sunscreen application, and the importance of sunscreen use even on cloudy days. However, gaps were observed regarding the role of UVA radiation in photoaging and the recommended minimum SPF for routine daily use. Similar findings have been reported by Xavier et al. (2024), who observed that while medical students possessed good overall knowledge regarding sunscreen, misconceptions persisted regarding specific technical aspects of photoprotection. Likewise, Narla and Lim (2020) emphasized that public understanding of sunscreen terminology, SPF interpretation, and UVA

protection remains inadequate despite increasing awareness campaigns.

Participants in the present study demonstrated a favourable attitude towards sunscreen use, with a mean attitude score of 21.50 ± 4.25 . Most respondents acknowledged the importance of sunscreen in preventing sun damage and maintaining skin health. Similar positive attitudes have been reported among medical students and healthcare professionals in previous studies [8,12]. This encouraging finding suggests that awareness regarding the benefits of photoprotection is increasing among future physicians. However, favourable attitudes alone do not appear sufficient to ensure adherence to recommended sunscreen practices.

Although nearly three-fourths of the participants reported using sunscreen, only 46% reported daily use, and regular reapplication was uncommon. The mean practice score of 2.73 ± 1.93 reflected only moderate adherence to recommended photoprotection practices. These findings are consistent with previous studies demonstrating that sunscreen use is often irregular despite adequate knowledge [6,8]. Several behavioural and practical factors, including forgetfulness, lack of time, inconvenience, cosmetic acceptability, and perceived low risk of sun exposure, have been identified as barriers to regular sunscreen use. Such barriers may explain why improved awareness does not necessarily result in sustained behavioural change.

One of the most important findings of the present study was the absence of a statistically significant correlation between knowledge and sunscreen practices (Spearman's $\rho = 0.126$, $p = 0.383$). Although participants with higher knowledge scores tended to have slightly better practices, the association was weak and not statistically significant. This observation supports the concept that health-related behaviours are influenced by multiple determinants beyond knowledge alone.

Behavioural theories suggest that personal beliefs, perceived susceptibility, accessibility of sunscreen products, cosmetic preferences, peer influence, lifestyle, and habitual behaviour all contribute to the adoption of preventive health practices. Therefore, educational interventions aimed solely at improving knowledge may have limited effectiveness unless accompanied by strategies that facilitate behavioural change and improve adherence.

From a public health perspective, these findings have important implications. Medical students represent future physicians who will play a critical role in promoting sun-safe behaviours and counselling patients regarding photoprotection. Healthcare professionals who personally adopt

appropriate photoprotective practices are more likely to recommend these behaviours confidently and effectively to their patients. Recent Indian recommendations from the Indian Sunscreen Forum have emphasized the importance of improving awareness and adherence to sunscreen use in the Indian population, particularly considering differences in climate, skin phototypes, and patterns of ultraviolet exposure [4]. Strengthening photoprotection education during undergraduate medical training may therefore improve not only personal health practices but also future patient education and preventive dermatological care.

The present study has certain limitations. It was conducted at a single tertiary care teaching institution with a relatively small sample size, which may limit the generalizability of the findings. The use of a self-administered questionnaire may have introduced recall bias and social desirability bias. Additionally, the cross-sectional design limits the ability to establish causal relationships between knowledge, attitudes, and practices. Future multicentric studies with larger sample sizes and longitudinal follow-up may provide a better understanding of factors influencing sunscreen-related behaviour among medical students.

Despite these limitations, the present study contributes valuable information regarding sunscreen-related knowledge and behaviour among undergraduate medical students. To the best of our knowledge, contemporary Indian studies comprehensively evaluating sunscreen-related knowledge, attitudes, and practices using a structured scoring system remain limited. The findings highlight the persistence of a knowledge–practice gap despite satisfactory awareness and favourable attitudes. These observations underscore the need for behavioural interventions, curriculum-based photoprotection education, and targeted awareness programmes that encourage the consistent adoption of evidence-based sunscreen practices among future healthcare professionals.

Conclusion

The present study demonstrated that undergraduate medical students possessed satisfactory knowledge and a positive attitude regarding sunscreen use; however, these did not consistently translate into appropriate sunscreen practices. Despite good awareness of the benefits of photoprotection, regular sunscreen application and reapplication remained suboptimal, highlighting a persistent knowledge–practice gap. No significant association was observed between knowledge and sunscreen practices, suggesting that improving awareness alone may be insufficient to promote sustained behavioural change. These findings emphasize the

need for targeted educational strategies that integrate practical training, behavioural interventions, and reinforcement of evidence-based photoprotection practices within the undergraduate medical curriculum. Strengthening sunscreen-related education among future healthcare professionals may not only improve their personal photoprotective behaviours but also enhance their ability to effectively counsel patients on sun-safe practices.

Conflict of Interest

The authors declare that they have no conflicts of interest related to this study.

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