Scientific Reports

https://doi.org/10.1038/s41598-026-38144-z

Article in Press

Sunscreen use and adherence to traditional masculinity ideologies among young adult males: a cross-sectional study

Received: 26 August 2025

Accepted: 29 January 2026

Published online: 08 February 2026

Cite this article as: Taha S., Hamad S., Hanani A. *et al.* Sunscreen use and adherence to traditional masculinity ideologies among young adult males: a cross-sectional study. *Sci Rep* (2026). https://doi.org/10.1038/s41598-026-38144-z

Sari Taha, Samia Hamad, Ahmad Hanani & Sa'ed H. Zyoud

Sunscreen use and adherence to traditional masculinity ideologies among young adult males: A cross-sectional study

Sari Taha [1,2,*]

Email: saritaha1993@gmail.com

Samia Hamad [3]
Email: samiahamadd21@gmail.com

Ahmad Hanani [2]

Email: a.hanani@najah.edu

Sa'ed H. Zyoud [4,5,6]

Email: saedzyoud@yahoo.com

[1] An-Najah Global Health Institute (GHI), An-Najah National University, Nablus P.O. Box 7, Palestine

[2] Division of Public Health, Faculty of Medicine and Health Sciences, An-Najah National University, Nablus P.O. Box 7, Palestine

[3] Department of Medicine, Faculty of Medicine and Health Sciences, An-Najah National University, Nablus P.O. Box 7, Palestine

[4] Department of Clinical and Community Pharmacy, Faculty of Pharmacy, An-Najah National University, Nablus 44839, Palestine

[5] Poison Control and Drug Information Center (PCDIC), An-Najah National University, Nablus 44839, Palestine

[6] Clinical Research Centre, An-Najah National University Hospital, Nablus, 44839, Palestine

#Corresponding author: saritaha1993@gmail.com - Telephone: +970-597215667 - Nablus P.O. Box 7, Palestine

Abstract

Males are less likely to routinely use sunscreen than females across settings. This study aimed to examine the association between adherence to traditional masculinity ideologies on sunscreen use among young adult males. A cross-sectional study was conducted among male university students in Palestine. Data were collected via the validated Male Role Norms Inventory-Short Form (MRNI-SF), with responses made on a 7-point Likert scale. The mean age of the 485 participants was 20.2 years, of whom only 18.8% reported routine sunscreen use. In multivariate analysis, lower odds of routine daily sunscreen use were associated with greater adherence to traditional masculinity norms (aOR = 0.53, 95%-CI 0.41-0.69), and higher scores on toughness (aOR = 0.76, CI = 0.62-0.92); avoidance of femininity (OR = 0.81, CI =0.69-0.96); restrictive emotionality (aOR = 0.64, CI =0.54-0.77); and dominance (aOR = 0.66, CI =0.57-0.76). However, self-reliance through mechanical skills and importance of sex were not statistically significant. To reduce gender disparities in sun protection, sunscreen marketing should follow inclusive, gender-conscious approaches. Moreover, social media should encourage male participation and reframe sunscreen as a practical, healthy tool rather than a beauty item. The single-site design and overrepresentation of health-science students limit generalizability.

Keywords: melanoma; preventive medicine; skin cancer; sun protection; sunscreen

1. Introduction

Skin cancer is among the most common malignancies worldwide. Excluding basal cell carcinoma, the global incidence of non-melanoma and melanoma skin cancer was estimated at 1,198,000 and 324,635, respectively, accounting for 1.2% of total cancer-related deaths[1,2]. While the pathogenesis of skin cancer is multifactorial, it has been consistently linked to UV radiation exposure, which induces DNA damage through multiple molecular mechanisms[3]. Nearly 85.9% of melanomas are attributed to exposure to UV radiation[4]. Consequently, public health agencies in the US, Canada, and Australia recommend protective measures, including avoiding peak hours of sun exposure, wearing sun-protective clothing, seeking shade, and routinely applying sunscreens[5–7]. Among these, routine use of sunscreen has been shown to slow skin photoaging and reduce the incidence of melanoma and non-melanoma skin cancers[8–10].

Previous studies have shown that gender roles may influence access to health services, health-seeking behaviors, and health-related practices, contributing to disparities in health outcomes[11–13]. Particularly, gender may influence sun protection behaviors, in addition to a variety of other demographic, social, and biological factors, such as educational level and age[14–16]. Although rates of skin cancers are higher in males than females globally[2], males are less likely to adopt sun protection behaviors, and to use sunscreen in particular, than females across cultures, age groups, and settings[15–23].

The discourse around sun protection and sunscreen has been largely concentrated in Western countries, where populations tend to have lighter skin tones[24]. Palestine, located in the Mediterranean climatic zone, has an annual mean sunshine duration ranging between 7.8 and 8.4 hours per day[25]. Most Palestinians, as Mediterranean Caucasians with diverse skin tones, tend to have type IV Fitzpatrick skin phototype, which is less strongly associated with skin cancer than lighter phototypes[26,27]. Nonetheless, substantial UV exposure, combined with moderately light skin tones, increases the risk of photodamage, albeit to a lesser extent than in populations with lighter skin phototypes. Skin cancer, excluding basal cell carcinoma, is the ninth most common cancer among Palestinian males, accounting for 4% of all cancer cases[28]. A recent study revealed that the majority of Palestinian males had never used sunscreens in their lifetimes, in contrast to females[29].

Palestinian society is generally patriarchal, with ingrained traditional masculinity and gender norms that influence health-seeking behaviors[30]. While several studies have addressed the association between gender and sunscreen use globally, only few have explored the mechanisms through which gender influences sunscreen use[31,32]. None, however, have examined multiple constructs of the traditional masculinity ideology, with only one using avoidance of femininity as a proxy [32]. This study, conducted among American males, reported that participants with greater adherence to masculinity norms were less likely to use sunscreen routinely[32]. Other studies, conducted in different locations globally, demonstrated that gender consciousness may influence sunscreen use among males[19,33,34].

In Palestine, sunscreens are often portrayed as female-oriented beauty products, and their use is considered challenging to masculinity[29]. To the best of the authors' knowledge, no local study has yet explored the potential association between adherence to traditional masculinity ideologies and sunscreen use. The Male Role Norms Inventory-Short Form (MRNI-SF) is a valid, reliable tool that measures multiple constructs of traditional masculinity ideology. Although this tool has not been translated and validated in Arabic, its constructs have conceptual analogues in gender scholarship and are relevant to the Palestinian context, where gender norms and traditional masculinity ideologies influence health-related behaviors [30,35]. Understanding the social dimensions of sun protection behaviors is essential for developing public health interventions and informing policymaking and medical practice aimed at encouraging sunscreen use among males. This study aimed to investigate the influence of adherence to traditional masculinity ideologies on sunscreen use among young adult males in Palestine.

2. Methods

2.1. Study design and settings

This was a cross-sectional study based on a self-administered questionnaire, targeting male university students. It was conducted from March to December 2024 at An-Najah National University (ANNU) in Nablus, Palestine.

2.2. Population and Sampling

All male students aged 17 or older and studying at ANNU were eligible for participation. The following equation was used to calculate the minimum sample size: $n = z^2.P.(1-P)/E^2$., *where:*

n: the sample size

z: the *z* value corresponding to a confidence level of 95% (z=1.96)

E: desired margin of error (set at 5%)

P: expected prevalence of routine sunscreen use, which was reported to be 47.2% by a local study[36].

The equation yielded a minimum sample size of nearly 383. The sample size was increased to 485 to enhance the power of the study. Post-hoc, the final sample size is powered to detect an absolute difference of 10-11 percentage points in routine sunscreen use between subgroups, using 80% power, alpha level of 0.05, and observed prevalence of routine sunscreen use (18.8%)[37,38].

A convenience sampling technique was employed to invite students to complete an online questionnaire during lectures and university gatherings, with a researcher available for clarification and follow-up.

2.3. Data collection tool and variables

Adherence to traditional masculinity ideologies was measured using the Male Role Norms Inventory-Short Form (MRNI-SF), a short, valid and reliable form of the longer 57-item Male Role Norms Inventory (MRNI) and the 39-item Male Role Norms Inventory–Revised (MRNI-R) [39–41]. The MRNI-SF consists of items rated on a 7-point Likert scale, ranging from 'strongly disagree' to 'strongly agree,' with higher scores indicating stronger adherence to a traditional masculinity ideology. The total scale score was calculated by averaging the scores of all items, ranging from low (1) to high (7). Similarly, the subscale scores were calculated by averaging the scores of items included in each subscale. Adherence to traditional masculinity ideology was categorized based on the averages reported in the validation study of the MRNI-SF: values above one standard deviation above the mean indicate moderately high adherence, and those above two standard deviations indicate very high adherence [39]. Permission to use the questionnaire was obtained from Prof. Ronald F. Levant on April 1, 2023 via form submission and email correspondence.

In addition to the MRNI-SF, the questionnaire included questions on age, field of study, year of study, and frequency of sunscreen use (routine, occasional, and no use). Routine use of sunscreen was defined as daily application of sunscreen, in line with recommendations made by international dermatology associations and the operational definitions used in observational studies and randomized controlled trials alike [10,42–45]. In other words, the evidence base supporting photoprotective benefits is largely limited to routine, daily use. Occasional use was defined as any frequency that is less than routine daily use. This nuanced operational definition was employed to capture both clinically meaningful use and socially constructed use, given the social aspect of the study.

Moreover, the questionnaire included a small set of heterogeneous, few items related to knowledge and attitudes for exploratory, descriptive purposes. These items were not combined into composite scores, as they do not constitute a scale reflective of latent constructs. Therefore, they were analyzed descriptively at the item level without inferential statistics. The knowledge items included four questions on whether routine sunscreen use can protect against skin cancer and photoaging; whether tanning is beneficial for the skin; and whether early detection of skin cancer improves treatment outcomes. Knowledge questions could be answered with true, false, or I don't know options. Attitude items measured the perceived importance of maintaining youthful-looking skin and concerns about harmful radiation effects. Responses to attitude items were made on a four-point Likert scale, ranging from 'not important' to 'very important,' and 'not concerned' to 'very concerned.' The knowledge and attitude questions were developed through a literature review and checked for relevance by five public health and dermatology specialists afterwards [32,46]. The MRNI-SF was translated into Arabic by a bilingual translator and back-translated into English by a second translator, who was blinded to the original questionnaire. The English version resulting from the forward-back translation was similar to the original phrasing of the questionnaire. A pilot study was conducted with 40 participants, who were excluded from the final analysis. In this pilot study, participants filled in the questionnaire and provided qualitative feedback on linguistic clarity and cultural acceptability. The word choice and item phrasing were modified based on the findings of the pilot study. Cronbach's alpha (α) for the Arabic MRNI-SF was 0.871, indicating moderate internal consistency [47].

2.4. Data analysis:

The IBM SPSS software (version 23) was used to analyze the data descriptively and inferentially. The mean and standard deviation were reported for age. The median and interquartile range were reported for the knowledge and attitude items. Frequencies with proportions were reported for categorical variables, including categorized age group, field of study, year of study, sunscreen use, and individual items related to knowledge and attitudes. The chi-squared test was used to test for associations between the use of sunscreen and other categorical variables. To align with the MRNI-SF validation and allow comparison and categorization of masculinity ideology endorsement, the mean and standard deviation were used to report the scores of the MRNI-SF scale and subscales. One-way analysis of variance (one-way ANOVA) was used to assess associations of the averages of these scores with frequency of sunscreen use. At the multivariate level, binary logistic regression models were developed for the MRNI-SF total score and each subscale, with sunscreen use frequency (routine vs nonroutine use) as the dependent variable. Separate models were developed for each subscale to avoid multicollinearity. The variables were theoretically selected for inclusion in these models beforehand, including field of study (health vs non-health majors), year of study (first to sixth and more), and age group (categorical). These covariates were included because they may influence adherence to masculinity norms and sunscreen use, attributed to differences in life stage, health-related training, exposure to health-related information, and duration and settings of university socialization. In a sensitivity analysis, a regression model included the MRNI-SF total score and sunscreen use redefined as any use vs nonuse. Statistical significance was set at p value of < 0.05.

2.5. Ethical Considerations

Permission to conduct the study was granted by the IRB office at An-Najah National University. The purposes and nature of the research study were explained clearly to the respondents before obtaining informed consent. All methods used in the study were performed in accordance with the ethical guidelines of the Declaration of Helsinki (DoH). Data were kept confidential using a secure computer that could only be accessed by the researchers and were used only for research purposes.

3. Results

Of the 534 invited students, a total of 485 agreed to completed the questionnaire (response rate, 90.8%). The mean age was 20.2 years (*SD*=1.7). Second-year students constituted the largest

proportion (36.3%), followed by third-year (21.6%) and first-year students (15.9%). Over two-thirds were enrolled in health-science majors (69.9%), with a substantial minority in an engineering and technology major (15.1%) (Table 1).

Most participants provided correct answers on items regarding sunscreen protection against skin cancer (54.9%), harmful tanning effects (51.3%), and the importance of early detection of skin cancer (80.4%), whereas less than half answered an item about sunscreen protection against photoaging correctly (46.0%). Regarding attitudes, the majority said they are slightly concerned (42.1%) or fairly concerned (30.1%) about the harmful effects of solar exposure on the skin. Most also believed that maintaining a youthful skin look is either important (38.4%) or very important (29.1%).

Most participants reported not using sunscreen at all (58.1%) or using it occasionally (23.1%), whereas only 18.8% reported routine daily use. At the bivariate level, sunscreen use was significantly associated with field of study (p =.003), while age (p =.401) and year of study (p =.127) did not show statistical significance (Table 1).

The average score of the general traditional masculinity ideology was 4.99 (*SD* = 0.90). Subscale means were: restrictive emotionality 4.48 (*SD* =1.37); self-reliance through mechanical skills 5.80 (*SD* = 0.97); avoidance of femininity 5.01 (*SD* =1.40); importance of sex 3.78 (*SD*=1.47); toughness 5.69 (*SD* =1.11); and dominance 5.16 (*SD*=1.63) (Figure 1). The average scores of the general traditional masculinity ideology (total MRNI-SF score), restrictive emotionality, and dominance *indicate* moderately high endorsement of traditional masculinity ideologies, whereas the scores for the rest of the subscale constructs do not. In bivariate analyses, lower frequency of sunscreen use was associated with higher scores on general traditional masculinity ideology (p<.001), restrictive emotionality (p<.001), avoidance of femininity (p<.001), importance of sex (p=.026), toughness (p=.001), and dominance (p<.001), whearas only the score of self-reliance through mechanical skills did not demonstrate a significant association (p=.898) (Table 2).

At the multivariate level, results were nearly consistent with the bivariate analysis. Greater adherence to traditional masculinity ideology was significantly associated with lower odds of routine sunscreen use on daily basis (Table 3). The odds of routine use decreased by 46.9% for every one-point increase in the total score (aOR = 0.53, 95% CI 0.41-0.69). Moreover, field of study was significantly associated with routine use (aOR = 0.27, CI 0.14-0.55), while age group and year of study were not statistically significant. In the separate subscale models, higher scores

on toughness (aOR = 0.76, CI = 0.62-0.92); avoidance of femininity (aOR = 0.81, CI =0.69-0.96); emotionality (aOR = 0.64, CI =0.54-0.77); and dominance (aOR = 0.66, CI =0.57-0.76) were each associated with lower odds of routine daily use. On the other hand, mechanical skills (aOR = 0.913, CI =0.71-1.18) and importance of sex (aOR = 0.85, CI = 0.72-1.01) were not statistically significant. In a sensitivity analysis with the outcome redefined as any sunscreen use vs no use, the MRNI-SF total score remained significantly associated with sunscreen use (aOR = 0.54, CI =0.43-0.68) (Supplementary File 1). Similarly, in the sensitivity analysis with sunscreen use redefined as any use vs nonuse, greater adherence to traditional masculinity ideology was significantly associated with lower odds of any use of sunscreen (aOR = 0.54, CI 0.43- 0.68).

4. Discussion

The routine use of sunscreen reduces the risk of skin cancer and slows photoaging[8–10]. Gender norms and traditional masculinity ideologies may influence health-seeking behaviors, including those related to sunscreen use. This study used a validated, self-administered questionnaire to examine the association between adherence to traditional masculinity ideologies and sunscreen use among young adult males. The findings indicate high endorsement of traditional masculinity ideologies, including notions of dominance and restrictive emotionality. Only 18.8% reported routine use of sunscreen. Greater adherence to traditional masculinity ideology was associated with lower odds of routine sunscreen use. Similarly, subconstructs of traditional masculinity ideology were also associated with lower odds of routine sunscreen use, except for self-reliance through mechanical skills and importance of sex.

This study reported a low rate of routine sunscreen use among males (18.8%). While global studies targeting young adults have reported variable rates of sunscreen use, these rates are consistently higher among females than males[15–23]. Similarly, regional studies reported low rates of sunscreen use, especially among males. This is in line with broader trends of low sunscreen use in the region, regardless of gender[16,48–51]. Direct comparison to these studies, however, is challenging due to methodological differences in categorizing sunscreen use. Some studies relied on a binary dichotomy that lumps ‘sunscreen users’ in a single category, potentially overestimating the prevalence of effective sunscreen use by including those with rare-to-occasional use[16,48–51]. For example, a previous study conducted among university students in Palestine reported a rate of 47.2%, but the question framing was not specified [36]. Differences in

methodology and target population may explain the wide range of reported rates within the same country, as exemplified by several regional studies conducted in Jordan and Saudi Arabia[14,16,17,51–53].

Stronger adherence to traditional masculinity norms was associated with lower odds of sunscreen use in this study. While numerous studies have reported higher use of sunscreen among females, only few studies have examined the mechanisms through which gender norms may influence this behavior. Locally, participants in a mixed-methods study reported gender-influenced perceptions that sunscreen use poses a threat to masculinity. The participants also reported that these perceptions are sustained by promotional neglect of male concerns [29]. Globally, a quantitative study, conducted among males in the US, revealed that those with stronger adherence to traditional masculinity ideologies were less likely to use sunscreen [32]. The study used only the avoidance of femininity subscale as a measure of adherence to masculinity norms, unlike the present study that examined the subconstructs of traditional masculinity ideology included in the MRNI-SF. Another qualitative study interviewed young adults in the US and found that males harbor negative beliefs about sunscreen use and perceived seeking help from other males as a violation of same-gender body contact norms[31].

Traditional masculinity ideologies may influence sunscreen use through multiple pathways. Based on Courtenay's theory of gender and health, avoiding sunscreen use represents a social behavior that denotes masculinity and social power[54]. In line with this theory, higher adherence to traditional masculinity ideology was associated with lower odds of routine sunscreen use in this study. This also applies to subconstructs such as avoidance of femininity, explained by perceptions of sunscreens as beauty products traditionally linked to femininity[55]. More specifically, the texture and smell of sunscreens may be labelled as feminine properties[55]. In addition, females adopt preventive health behaviors more frequently than males, particularly those behaviors that potentially improve sex appeal, such as weight loss and teeth brushing[56,57]. Studies have also shown that females have greater knowledge of sun protection and sunscreens than males, which may contribute to better sun protection behaviors [14,58,59]. This is in addition to the impact of social support and group identification among females. One study, for example, found that supportive group norms were significantly associated with increased sunscreen use

among female athletes[60]. Another study revealed that females were more frequently encouraged by peers and mothers to use sunscreen than males[55].

The Health Belief Model also explains how perceptions of barriers can influence sunscreen use, as men may perceive sunscreen as a potential source of social stigma or fuel concerns about femininity[61]. These perceptions are shaped and reinforced by the feminine portrayal of sunscreen in popular culture, mass media, and social media, especially given that gender and masculinity are dynamic concepts shaped by experience[29]. The sunscreen industry has traditionally marketed sunscreens to females as end-users in design and promotion, neglecting the needs of males as a group and reinforcing a gendered market that privileges females[13,62]. This gendered approach may have contributed to exacerbating health disparities by overlooking gender as a social determinant of health. Although this study did not directly explore perceptions of sunscreen marketing, feminine product aesthetics and the observed association of femininity avoidance support adopting a marketing approach that aims to reduce perceived barriers. From an equity perspective, sunscreen design should be gender-inclusive and user-centered. Producers should consider the complexity of perceived affordance by introducing sunscreen products with physical and visual properties that appeal to male consumers, including variations in form, color, texture, and packaging[62,63]. Cosmetic brands such as Dove and Nivea are examples of successful introductions of gender-neutral or male-oriented products [62].

Above all, awareness campaigns promoting sun protection are scarce regionally[29]. While the multiple mass media campaigns that were implemented globally during the past decades can serve as models, regional awareness campaigns should be contextualized by moving beyond generic messaging and integrating gender-conscious strategies whereby the prevailing gender norms and perceptions of males are considered. Social media is a key communication tool for challenging the influence of traditional masculinity ideologies on sunscreen use, as obtaining dermatology information online is rising. A study conducted in Switzerland reported that 82.4% of participants sought dermatology information online[64]. Instagram, in particular, is a popular social media platform for skin health content, publishing the highest number of posts related to skin cancer globally, nearly tripling between 2018 and 2021[65,66]. However, using social media to mitigate the impact of traditional masculinity ideologies on sun protection behaviors is challenging. The online scene of sunscreen use is dominated by the beauty industry, overshadowing contributions from professional bodies, healthcare professionals, scientific

journals, and advocacy groups[67]. Moreover, male skincare advertising and discourse have historically focused on shaving while neglecting sun protection, which has extended to online platforms[62,63,68]. One study revealed that sunscreens only comprised 4.7% of male-oriented Instagram hashtags related to dermatology in 2023[69]. To shift perceptions and promote sun protection among males, awareness campaigns and the sunscreen industry should design targeted messaging tailored to male audiences, recruiting male influencers to reframe sunscreen use as a part of a practical, health-conscious lifestyle linked to sun protection.

Self-reliance and importance of sex were the only subscale constructs that were not associated with lower odds of routine sunscreen use. Self-reliance through mechanical skills may be linked to competence and independence, unlike restrictive emotionality, toughness, and avoidance of femininity which are more clearly linked to traditional masculine ideals of invulnerability, based on Courtenay's theory [54]. Therefore, self-reliance may be less relevant to personal care or may even encourage a problem-solving mindset that encourages prevention behaviors. This is especially relevant to the Palestinian cultural context, where self-reliance can be socially valued as a marker of resilience and steadfastness and as a key resource in the context of a protracted conflict [70,71]. This is embodied in the word '*Sumud*' (Arabic for steadfastness), increasingly used in social science literature as a construct reflective of Palestinian adaptive methods of distress management, coping, and resilience in harsh conditions[71]. Moreover, the average scores of self-reliance through mechanical skills among participants suggest that this subscale construct is an accepted norm among the majority of participants, undermining its predictability of sunscreen use.

5. Strengths and limitations

This study has several limitations. First, most participants were recruited from a single university, with over-representation of health-science students. The findings, therefore, may not be generalizable to male university students at other universities nor to males outside academic settings. In other words, interpretation of the findings should be limited to male university students, at best, rather than the general male population. Such a convenience sampling approach might have inflated positive knowledge and attitudes, as students enrolled in health majors may have higher knowledge and more positive attitudes toward health issues than those of the general population. Second, students who had less adherence to traditional masculinity ideology or

greater interest in health might have been more likely to participate in this study, potentially introducing selection bias. Moreover, as the questionnaire was self-reported, respondents might have attempted to conform to social norms by underreporting their sunscreen use or providing unrealistic responses related to traditional masculinity, potentially introducing social desirability bias. More importantly, the study did not account for some confounders that may influence sunscreen use, such as skin phototype, previous sunburns, and personal history of skin diseases. Finally, the evidence for the psychometric validity of the adapted Arabic questionnaire is limited, despite steps taken to improve this validity. This also applies to the knowledge and attitude items, as they were developed to provide exploratory, descriptive insights. However, developing and validating an extended set of items were beyond the scope and resources of this study and could have contributed to higher attrition rates by introducing a longer questionnaire. Based on these limitations, the study contributed exploratory cross-sectional evidence, while longitudinal studies are still required to confirm the findings. These limitations, however, were mitigated by including a larger-than-calculated sample recruited from the largest local university and representing diverse areas distributed across the West Bank. The study strength lies in its use of a multidimensional tool with young males, conducting a novel investigation of sunscreen use and masculinity in a resource-limited, conflict-affected setting.

6. Conclusions

Traditional masculinity ideologies may influence health behaviors, including sunscreen use, yet the mechanisms underlying this influence remain underexplored. This study examined the association between endorsement of traditional masculinity ideologies and sunscreen use among young adult males, using the validated MRNI-SF scale. The findings revealed a low prevalence of routine sunscreen use. Greater adherence to traditional masculinity ideology and its subconstructs were associated with lower odds of routine sunscreen use, with the exceptions of self-reliance through mechanical skills and importance of sex. Reducing gendered disparities in sun protection necessitates a marketing strategy that adopts inclusive, user-centered approaches. Sun protection campaigns, especially on social media, should design gender-conscious messaging to reframe sunscreen use as practical and health-promoting, rather than feminine. Furthermore, longitudinal studies are recommended to confirm the findings, given the limitations of this study.

7. References:

1. Arnold M, Singh D, Laversanne M, Vignat J, Vaccarella S, Meheus F, et al. Global Burden of Cutaneous Melanoma in 2020 and Projections to 2040. JAMA Dermatology. 2022 May 1;158(5):495–503.

2. Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. CA: A Cancer Journal for Clinicians. 2021;71(3):209–49.

3. Hussein MR. Ultraviolet radiation and skin cancer: molecular mechanisms. Journal of Cutaneous Pathology. 2005;32(3):191–205.

4. Parkin DM, Mesher D, Sasieni P. 13. Cancers attributable to solar (ultraviolet) radiation exposure in the UK in 2010. Br J Cancer. 2011 Dec;105(2):S66–9.

5. U.S. Food and Drug Administration (FDA). Sunscreen: How to Help Protect Your Skin from the Sun [Internet]. Available from: https://www.fda.gov/drugs/understanding-over-counter-medicines/sunscreen-how-help-protect-your-skin-sun

6. The Canadian Dermatology Association CDA. Sunscreen - Canadian Dermatology Association [Internet]. [cited 2022 Jan 9]. Available from: https://dermatology.ca/recognized-products/sunscreen/

7. The Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Sun protection using sunscreens [Internet]. ARPANSA. ARPANSA; 2017 [cited 2022 Jan 9]. Available from: https://www.arpansa.gov.au/understanding-radiation/radiation-sources/more-radiation-sources/sun-protection-sunscreen

8. Green AC, Williams GM, Logan V, Strutton GM. Reduced melanoma after regular sunscreen use: randomized trial follow-up. J Clin Oncol. 2011 Jan 20;29(3):257–63.

9. Green A, Williams G, Neale R, Hart V, Leslie D, Parsons P, et al. Daily sunscreen application and betacarotene supplementation in prevention of basal-cell and squamous-cell carcinomas of the skin: a randomised controlled trial. Lancet. 1999 Aug 28;354(9180):723–9.

10. Hughes MCB, Williams GM, Baker P, Green AC. Sunscreen and prevention of skin aging: a randomized trial. Ann Intern Med. 2013 June 4;158(11):781–90.

11. Thompson AE, Anisimowicz Y, Miedema B, Hogg W, Wodchis WP, Aubrey-Bassler K. The influence of gender and other patient characteristics on health care-seeking behaviour: a QUALICOPC study. BMC Family Practice. 2016 Mar 31;17(1):38.

12. Annandale E, Harvey J, Cavers D, Dixon-Woods M. Gender and access to healthcare in the UK: a critical interpretive synthesis of the literature. Evidence & Policy. 2007 Nov 1;3(4):463–86.

13. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. Soc Sci Med. 2000 May;50(10):1385–401.

14. Al-Balbeesi A, AlMukhadeb E, BinMayouf M, AlNasser S, Aldossari A, Alfaiz F, et al. Dermatology Patients’ Knowledge of Sunscreen Guidelines at a University Hospital in Saudi Arabia. CCID. 2022 Dec 29;15:2915–23.

15. Hourani LL, LaFleur B. Predictors of gender differences in sunscreen use and screening outcome among skin cancer screening participants. J Behav Med. 1995 Oct 1;18(5):461–77.

16. Al-Qarqaz F, Marji M, Bodoor K, Al ALshiyab D, Muhaidat J, Al Ghamdi S. Awareness about proper use of sunscreen in people of color: A Jordanian-based survey. Journal of Cosmetic Dermatology. 2020;19(5):1131–6.

17. AlJasser MI, Aljumah A, Alzaydi M, Alassaf A, Alassafi S, Alassafi MT, et al. Sunscreen Use among a Population of Saudi University Students. Dermatology Research and Practice. 2020;2020(1):4732721.

18. Chen J, Shih J, Tran A, Mullane A, Thomas C, Aydin N, et al. Gender-Based Differences and Barriers in Skin Protection Behaviors in Melanoma Survivors. Journal of Skin Cancer. 2016;2016(1):3874572.

19. Roberts CA, Goldstein EK, Goldstein BG, Jarman KL, Paci K, Goldstein AO. Men's Attitudes and Behaviors About Skincare and Sunscreen Use Behaviors. J Drugs Dermatol. 2021 Jan 1;20(1):88–93.

20. Mirzaei-Alavijeh M, Gharibnavaz H, Jalilian F. Skin Cancer Prevention: Psychosocial Predictors of Sunscreen Use in University Students. J Canc Educ. 2020 Feb 1;35(1):187–92.

21. Memon MM, Manzoor M, Ashrafi MM, Kumar S, Haq ZU, Irfan S, et al. Prevalence and Predictors of the Use of Sunscreen Amongst Medical Students: A Multi-center Cross-sectional Study. Cureus [Internet]. 2019 June 17 [cited 2024 Nov 26];11. Available from: https://www.cureus.com/articles/19818-prevalence-and-predictors-of-the-use-of-sunscreen-amongst-medical-students-a-multi-center-cross-sectional-study#!/

22. Baykal Selcuk L, Aksu Arica D, Ates E, Yayli S, Bahadir S. Sun-protective behaviours of Turkish young adults. Photodermatology, Photoimmunology & Photomedicine. 2019;35(3):178–86.

23. Wysong A, Gladstone H, Kim D, Lingala B, Copeland J, Tang JY. Sunscreen use in NCAA collegiate athletes: Identifying targets for intervention and barriers to use. Preventive Medicine. 2012 Nov 1;55(5):493–6.

24. Smith BJ, Ferguson C, McKenzie J, Bauman A, Vita P. Impacts from repeated mass media campaigns to promote sun protection in Australia. Health Promotion International. 2002 Mar 1;17(1):51–60.

25. Palestinian Meteorological Authority. Climate Bulletin [Internet]. Ramallah, Palestine.: Palestinian Meteorological Authority; 2018. Available from: https://www.pmd.ps/cached_uploads/download/2021/02/25/climate2018-1614293365.pdf

26. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA). Fitzpatrick skin phototype [Internet]. Australia: ARPANSA; 2024 [cited 2024 Sept 12] p. 2. Available from: https://www.arpansa.gov.au/sites/default/files/legacy/pubs/RadiationProtection/FitzpatrickSkinType.pdf

27. Coleman W, Mariwalla K, Grimes P. Updating the Fitzpatrick Classification: The Skin Color and Ethnicity Scale. Dermatologic Surgery. 2023 Aug;49(8):725.

28. Halahleh K, Gale RP. Cancer care in the Palestinian territories. Lancet Oncol. 2018 July;19(7):e359–64.

29. Taha S, Zyoud SH. Factors influencing sunscreen use among young adults in a conflict zone: A mixed-methods study. Journal of the European Academy of Dermatology and Venereology [Internet]. [cited 2025 Aug 22];n/a(n/a). Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/jdv.70014

30. Hussein E, Nusair L, Daoud S, Muhaidat F. Between the Hammer of Tradition and the Anvil of Occupation: Men and Masculinity in the Palestinian Occupied Territories. Men and Masculinities. 2025 Apr 1;28(1):3–22.

31. Abroms L, Jorgensen CM, Southwell BG, Geller AC, Emmons KM. Gender Differences in Young Adults' Beliefs About Sunscreen Use. Health Educ Behav. 2003 Feb 1;30(1):29–43.

32. McKenzie C, Rademaker AW, Kundu RV. Masculine norms and sunscreen use among adult men in the United States: A cross-sectional study. Journal of the American Academy of Dermatology. 2019 July 1;81(1):243–4.

33. Yu C, Zuo X, Blum RW, Tolman DL, Kågesten A, Mmari K, et al. Marching to a Different Drummer: A Cross-Cultural Comparison of Young Adolescents Who Challenge Gender Norms. Journal of Adolescent Health. 2017 Oct 1;61(4, Supplement):S48–54.

34. Li J, Zhang R, Luo Y, Na L. Gender consciousness and sun protection patterns among Chinese youth: A cross-sectional analysis. Health Education Journal. 2024 Feb 1;83(1):3–13.

35. Berrebbah I. Troubled constructions of patriarchal and masculine identities in Laila Halaby's West of the Jordan (2003): a gendered perspective. Contemporary Levant. 2022 July 3;7(2):153–66.

36. Zaid A naser, Ramahi R. Knowledge and attitudes of Palestinian university students toward the use of sunscreens. Asian Journal of Pharmaceutical and Clinical Research. 2012 May 1;5(3).

37. Agresti A. An Introduction to Categorical Data Analysis [Internet]. 3rd ed. Hoboken, New Jersey: John Wiley & Sons, Inc.; 2013 [cited 2025 Dec 13]. Available from: https://www.wiley.com/en-us/An+Introduction+to+Categorical+Data+Analysis%2C+3rd+Edition-p-9781119405283

38. Kim HY. Statistical notes for clinical researchers: Sample size calculation 2. Comparison of two independent proportions. Restor Dent Endod. 2016 Apr 5;41(2):154–6.

39. Levant RF, Hall RJ, Rankin TJ. Male Role Norms Inventory–Short Form (MRNI-SF): Development, confirmatory factor analytic investigation of structure, and measurement invariance across gender. Journal of Counseling Psychology. 2013;60(2):228–38.

40. Levant RF, Hirsch LS, Celentano E, Cozza TM, et al. The male role: An investigation of contemporary norms. Journal of Mental Health Counseling. 1992;14(3):325–37.

41. Levant RF, Rankin TJ, Williams CM, Hasan NT, Smalley KB. Evaluation of the factor structure and construct validity of scores on the Male Role Norms Inventory—Revised (MRNI-R). Psychology of Men & Masculinity. 2010;11(1):25–37.

42. Ulrich C, Jürgensen JS, Degen A, Hackethal M, Ulrich M, Patel MJ, et al. Prevention of non-melanoma skin cancer in organ transplant patients by regular use of a sunscreen: a 24 months, prospective, case–control study. Br J Dermatol. 2009 Nov 1;161(s3):78–84.

43. van der Pols JC, Williams GM, Pandeya N, Logan V, Green AC. Prolonged Prevention of Squamous Cell Carcinoma of the Skin by Regular Sunscreen Use. Cancer Epidemiol Biomarkers Prev. 2006 Dec 12;15(12):2546–8.

44. Sander M, Sander M, Burbidge T, Beecker J. The efficacy and safety of sunscreen use for the prevention of skin cancer. CMAJ. 2020 Dec 14;192(50):E1802–8.

45. American Academy of Dermatology. Sunscreen FAQs [Internet]. 2025 [cited 2025 Dec 13]. Available from: https://www.aad.org/media/stats-sunscreen

46. Hasbani DJ, Ghaoui N, Haddad F, Shahla WA, Saade S, Bandali T, et al. Sun protection knowledge, attitudes and practices: A Lebanese-based survey. JEADV Clinical Practice. 2024;3(2):565–74.

47. Nunnally JC, Bernstein IC. Psychometric theory. 3rd ed. New York, NY: McGraw-Hill.; 1994.

48. Haddad LE, Souaid T, Kadi D, Hindy JR, Souaid K, Kourie HR, et al. Knowledge and Behavior of Lebanese Parents Regarding Melanoma Prevention in Public and Private School Children. Melanoma Management. 2021 Dec 1;8(4):MMT59.

49. Stevens CR, Green M, Hinh K, Chaudhry S. Predictors of sunscreen use in United States high-school students. Skin Health Dis. 2024 Mar 11;4(4):e370.

50. Weig EA, Tull R, Chung J, Brown-Joel ZO, Majee R, Ferguson NN. Assessing factors affecting sunscreen use and barriers to compliance: a cross-sectional survey-based study. Journal of Dermatological Treatment. 2020 May 18;31(4):403–5.

51. Hafez SY, Alraddadi EA, Ramadan M, Alsalamah F, Alghumuy R, Aljuhani FF. Assessment of prevalence of sunscreen use and related practices among people living in Saudi Arabia: A cross-sectional survey-based study. Journal of Cosmetic Dermatology. 2024;23(5):1718–25.

52. AlGhamdi KM, AlAklabi AS, AlQahtani AZ. Knowledge, attitudes and practices of the general public toward sun exposure and protection: A national survey in Saudi Arabia. Saudi Pharmaceutical Journal. 2016 Nov 1;24(6):652–7.

53. Murshdi R, Ammouri R, Barghouthi Y, AlSamhouri J, Ammouri R, AlQaysi H, et al. Knowledge, Attitudes and Practices to Sunscreen Use among Dermatology Patients at University Hospital Amman, Jordan: A Cross-Sectional Study. Jordan Medical Journal [Internet]. 2024 Aug 27 [cited 2024 Nov 26];58(3). Available from: https://jjournals.ju.edu.jo/index.php/JMJ/article/view/1152

54. Courtenay WH. Constructions of masculinity and their influence on men's well-being: a theory of gender and health. Soc Sci Med. 2000 May;50(10):1385–401.

55. Abroms L, Jorgensen CM, Southwell BG, Geller AC, Emmons KM. Gender differences in young adults' beliefs about sunscreen use. Health Educ Behav. 2003 Feb;30(1):29–43.

56. Jones JL, Leary MR. Effects of appearance-based admonitions against sun exposure on tanning intentions in young adults. Health Psychol. 1994 Jan;13(1):86–90.

57. Spilman MA. Gender differences in worksite health promotion activities. Soc Sci Med. 1988;26(5):525–35.

58. Lee A, Garbutcheon-Singh KB, Dixit S, Brown P, Smith SD. The Influence of Age and Gender in Knowledge, Behaviors and Attitudes Towards Sun Protection: A Cross-Sectional Survey of Australian Outpatient Clinic Attendees. Am J Clin Dermatol. 2015 Feb 1;16(1):47–54.

59. Walsh LA, Stock ML. UV photography, masculinity, and college men's sun protection cognitions. J Behav Med. 2012 Aug 1;35(4):431–42.

60. Robinson NG, White KM, Hamilton K. Examining young recreational sportswomen's intentions to engage in sun-protective behavior: the role of group and image norms. Women Health. 2013;53(3):244–61.

61. Becker MH. The Health Belief Model and Sick Role Behavior*. Health Education Monographs. 1974 Dec 1;2(4):409–19.

62. Esfahani BK. Bridging gender and human-centered design: a design verification study. Procedia CIRP. 2020 Jan 1;91:824–31.

63. Canning C. Gender, design and marketing: How gender drives our perception of design and marketing. Journal of Marketing Management [Internet]. 2012 Dec 1 [cited 2025 Apr 7]; Available from: https://www.tandfonline.com/doi/abs/10.1080/0267257X.2011.558390

64. Gantenbein L, Navarini AA, Maul LV, Brandt O, Mueller SM. Internet and social media use in dermatology patients: Search behavior and impact on patient-physician relationship. Dermatologic Therapy. 2020;33(6):e14098.

65. De La Garza H, Maymone MBC, Vashi NA. Impact of Social Media on Skin Cancer Prevention. Int J Environ Res Public Health. 2021 May 9;18(9):5002.

66. Park JH, Christman MP, Linos E, Rieder EA. Dermatology on Instagram: An Analysis of Hashtags. J Drugs Dermatol. 2018 Apr 1;17(4):482–4.

67. DeBord LC, Patel V, Braun TL, Dao Jr. H. Social media in dermatology: clinical relevance, academic value, and trends across platforms. Journal of Dermatological Treatment. 2019 July 4;30(5):511–8.

68. AlGhamdi KM, AlHomoudi FA, Khurram H. Skin care: Historical and contemporary views. Saudi Pharm J. 2014 July;22(3):171–8.

69. Carboni A, Martini O, Kirk J, Marroquin NA, Ricci C, Cheng M, et al. Does Male Skin Care Content on Instagram Neglect Skin Cancer Prevention? JMIR Dermatology. 2024 Mar 13;7(1):e50431.

70. Busse J. Everyday life in the face of conflict: Sumud as a spatial quotidian practice in Palestine. J Int Relat Dev. 2022 Sept 1;25(3):583–607.

71. Hammad J, Tribe R. Culturally informed resilience in conflict settings: a literature review of Sumud in the occupied Palestinian territories. Int Rev Psychiatry. 2021;33(1–2):132–9.

Declarations:

Acknowledgements

The authors thank An-Najah National University (ANNU) for providing the logistical support to conduct the study.

Author contribution:

All authors contributed to the study design. Data collection was performed by SH, AH, and ST. Data analysis was performed by ST. The first draft of the manuscript was written by ST and all authors read, commented, and approved the final manuscript. ST and SH were responsible for the integrity of the data and coordination between research team members. SZ, AH, and ST provided valuable logistical support, and enhanced the intellectual content.

Data availability statement

The data collected and analyzed for this study are available from the corresponding author upon reasonable request.

Conflict of interest

The authors declare that they have no competing interests. For the work under consideration for publication, the authors and their institutions did not receive payments or services from or have financial relationships with a third party.

Funding

No funding was received for this study.

Ethical approval

The International Review Board (IRB) office at An-Najah National University (ANNU) reviewed and approved the study. All methods were done in accordance with the ethical guidelines of Declaration of Helsinki (DoH).

Ethics statement

Written informed consent was obtained from all participants. The interviewees were anonymized and identified only by numbers.

Tables and Figures

Figure 1: Bar chart depicting mean scores across MRNI-SF subscales differentiated by sunscreen use.

Legend:
- The Y axis represent the mean score out of 7 for each subscale.
- Sunscreen use was categorized into routine, occasional, and no use.

Table 1: Association between sunscreen use and background variables of the participants

	Total	Routine use	Occasionally	Rarely to never	*p*-value
Age					.414
18-19	185 (38.1)	36 (19.5)	40 (21.6)	109 (58.9)	
20-21	187 (38.6)	34 (18.2)	37 (19.8)	116 (62.0)	
22-23	93 (19.2)	18 (19.4)	29 (31.2)	46 (49.5)	
24 or older	20 (4.1)	3 (15.0)	6 (30.0)	11 (55.0)	
Field of study					.003*
Health Sciences	339 (69.9)	80 (23.6)	64 (18.9)	195 (57.5)	
engineering and technology	73 (15.1)	5 (6.8)	21 (28.8)	47 (64.4)	
Science	1 (0.2)	0 (0.0)	1 (100.0)	0 (0.0)	
Theology	1 (0.2)	0 (0.0)	0 (0.0)	1 (100.0)	
Law and political sciences	21 (4.3)	3 (14.3)	6 (28.6)	12 (57.1)	
Business and communication	20 (4.1)	0 (0.0)	7 (6.3)	13 (65.0)	
Humanities and educational sciences	8 (1.6)	0 (0.0)	5 (62.5)	3 (37.5)	
Fine arts	22 (4.5)	3 (3.3)	8 (36.4)	11 (50.0)	
Year of study					.127
First	77 (15.9)	15 (19.5)	21 (4.3)	41 (53.2)	
Second	176 (36.3)	37 (21.0)	32 (6.6)	107 (60.8)	
Third	105 (21.6)	16 (15.2)	23 (4.7)	66 (62.9)	
Fourth	55 (11.3)	8 (14.5)	10 (2.1)	37 (67.3)	

Fifth	49 (10.1)	11 (22.4)	18 (3.7)	20 (40.8)	
Sixth or more	23 (4.7)	4 (17.4)	8 (34.8)	11 (47.8)	

Table 2: Association between sunscreen use and endorsement of traditional masculinity ideologies among the participants

	Frequency of sunscreen use, mean (*SD*)			***p*-value**
	Routine	**Occasional**	**Non-use**	
General traditional masculinity ideology (total score)	4.55 (1.08)	4.86 (0.84)	5.18 (0.81)	<.001*
Restrictive emotionality	3.75 (1.56)	4.39 (1.27)	4.75 (1.26)	<.001*
Self-Reliance through mechanical skills	5.78 (0.94)	5.84 (0.93)	5.79 (0.99)	0.898
Avoidance of femininity	4.67 (1.60)	4.75 (1.40)	5.22 (1.30)	<.001*
Importance of sex	3.45 (1.39)	3.70 (1.44)	3.92 (1.49)	.026*
Toughness	5.47 (1.20)	5.49 (1.19)	5.85 (1.03)	.001*
Dominance	4.19 (1.95)	5.01 (1.57)	5.54 (1.40)	<.001*

Table 3: Binary logistic regression model involving frequency of sunscreen use, total MRNI-SF score, and other variables.

Variable	***p*-value**	**Exp (B)**	**Confidence interval (95%-CI)**
Total MRNI-SF score			
	<.001	0.531	0.410-0.690
Age (reference category: 24 or more)			
18-19	.730	1.364	0.234-7.939
20-21	.473	1.876	0.337-10.444
22-23	.763	1.277	0.262-6232
Study major (reference category: health major)			
Non-Health Major	<.001	0.272	0.136-0.545
Study year (reference category: sixth year or more)			
First	.715	0.724	0.128-4.093
Second	.712	0.729	0.136-3.899
Third	.416	0.493	0.090-2.711
Fourth	.661	0.701	0.143-3.435
Fifth	.702	1.349	0.291-6.264

* Variables included: dependent variable is frequency of sunscreen use (routine daily use coded as 1; non-routine use or no use coded as 0); total MRNI-SF score (continuous, out of maximum 7 points); age (categorical); study major (categorical); and study year (categorical).
* Exp (B) higher than 1 indicates higher odds of using sunscreen daily compared to the reference category.

* Hosmer and Lemeshow Test: (Chi-square = 12.310; df = 8; *p*-value = .138)
* Statistical significance is indicated by a *p*-value of less than .05