



## Students' Behaviors in Using Sunscreen Based on the Health Belief Model



### ARTICLE INFO

#### Article Type

Descriptive Study

#### Authors

Azizi R.<sup>1</sup> PhD

Torabi F.<sup>2</sup> BSc

Beiranvand R.<sup>3</sup> PhD

Soltaninejad H.<sup>4</sup> PhD

Sharifi N.<sup>5</sup> PhD

#### How to cite this article

Azizi R, Torabi F, Beiranvand R, Soltaninejad H, Sharifi N. Students' Behaviors in Using Sunscreen Based on the Health Belief Model. Health Education and Health Promotion. 2025;13(3):587-594.

### ABSTRACT

**Aims** Given that the skin is the body's largest organ, it is not surprising that skin cancer is considered the most prevalent type of cancer among humans. This study aimed to investigate the behavior of students at Khomein University of Medical Sciences regarding the use of sunscreen to prevent skin cancer based on the health belief model.

**Instrument & Methods** This cross-sectional study was conducted with students of Khomein University of Medical Sciences in Markazi Province in central Iran from February to January 2024. Given the small student population, a census sampling method was used, resulting in the participation of 353 students. The research tool comprised a demographic information questionnaire, along with a researcher-made questionnaire on the use of sunscreen in skin cancer prevention based on the health belief model. Data analysis was performed using STATA 17 software, employing descriptive statistics and simple and multiple linear regression analyses, with a significance level set at  $\alpha=0.05$ .

**Findings** A one-unit increase in the scores of perceived benefits, perceived barriers, cues to action, and perceived self-efficacy led to increases of 0.13 (95% CI=0.05, 0.26;  $p=0.041$ ), 0.10 (95% CI=0.02, 0.17;  $p=0.007$ ), 0.14 (95% CI=0.07, 0.22;  $p\leq 0.001$ ), and 0.18 (95% CI=0.07, 0.29;  $p=0.001$ ) in the mean behavioral score.

**Conclusion** Gender, socioeconomic status, parental occupation, and level of education are associated with the adoption of sunscreen use behavior and perceived benefits, cues to action, and self-efficacy are strong predictors of sunscreen use.

**Keywords** Sunscreening Agents; Behavior; Students; Self-Efficacy; Health Belief Model

<sup>1</sup>Department of Biochemistry and Genetics, Faculty of Medicine, Arak University of Medical Sciences, Arak, Iran

<sup>2</sup>Student Research Committee, Khomein University of Medical Sciences, Khomein, Iran

<sup>3</sup>Department of Biostatistics and Epidemiology, Faculty of Health and Nutrition, Lorestan University of Medical Sciences, Khorramabad, Iran

<sup>4</sup>Department of Occupational Therapy, Faculty of Rehabilitation Sciences, Arak University of Medical Sciences, Arak, Iran

<sup>5</sup>Department of Public Health, Faculty of Health, Khomein University of Medical Sciences, Khomein, Iran

#### \*Correspondence

Address: Department of Public Health, Faculty of Health, Khomein University of Medical Sciences, Qods Boulevard, Khomein, Iran. Postal Code: 3881858573  
Phone: +98 (917) 1040795  
nadersharifi81@yahoo.com

#### Article History

Received: July 15, 2025

Accepted: August 28, 2025

ePublished: September 6, 2025

### CITATION LINKS

[1] Indoor tanning and the risk of overall ... [2] Skin cancer detection ... [3] Advanced multifunctional nano-lipid ... [4] The human ... [5] Skin cancer: Understanding the journey ... [6] Cancer statistics ... [7] Formulation and development of novel lipid-based combinatorial ... [8] Global burden of bladder cancer mortality ... [9] Spatial epidemiology of skin cancer in Iran ... [10] The epidemiology of skin ... [11] The global burden of skin cancer ... [12] The impact of environmental factors ... [13] History of severe sunburn and risk of skin ... [14] Knowledge, attitude, practice and perception on ... [15] Environmental aging ... [16] Changing trends of types of skin cancer ... [17] Spatiotemporal analysis of solar ultraviolet radiation based ... [18] Knowledge, attitude, and practice of adults to ... [19] Perceptions and practices ... [20] Skin cancer preventive behaviors in Iranian ... [21] Knowledge and attitude of general population toward ... [22] Are FDA-approved sunscreen components ... [23] Differences in reported sun protection practices, skin ... [24] Correction to: Skin care ... [25] Knowledge and practice of ... [26] Knowledge, attitude, and practices toward sun ... [27] Sun awareness and sun ... [28] Sun exposure and usage of sun ... [29] Knowledge, attitude and practices about sun ... [30] Interventions developed with ... [31] The effect of educational intervention ... [32] A situational test of the health belief ... [33] The health belief model predicts vaccination ... [34] Public perception and preparedness for the ... [35] Public perception and preparedness for the ... [36] Promotion of nutritional behaviors in the prevention ... [37] The effect of educational intervention ... [38] Survey of knowledge, attitude ... [39] A review of Lawshe's method for ... [40] Tutorial on how to calculating content validity ... [41] Book review: Statistics ... [42] Sunscreen use and affordability attitudes ... [43] Influence of age, gender, educational ... [44] Men's attitudes and behaviors ... [45] Masculine norms and sunscreen ... [46] Sun tanning behaviors, health beliefs ... [47] Skin cancer knowledge ... [48] Skin cancer risk perception and ... [49] A study of factors influencing ... [50] The health belief ...

## Introduction

Skin cancer is a major public health concern and has emerged as one of the most burdensome malignancies in recent decades. According to global cancer statistics, it ranks as the fifth most frequently diagnosed cancer worldwide [1-3]. Given that the skin is the largest organ of the human body and is continuously exposed to environmental risk factors—particularly ultraviolet (UV) radiation—its high incidence rate is epidemiologically consistent and expected [4]. It is predicted that cancer will surpass heart disease as the leading cause of death in the coming decades, with the number of new cases expected to continue rising over the next 20 years [5-7].

Globally, skin cancer represents a substantial portion of the cancer burden. In 2021, the worldwide incidence of skin cancers reached approximately 6.64 million new cases, with an age-standardized incidence rate of 77.7 per 100,000 population [8-10]. Iran's national cancer registry data reveal a comparable pattern at the domestic level. In 2016, the registry documented about 11,700 new skin cancer cases out of a total of 126,982 cancers ( $\approx 15\%$ ), placing skin cancer ahead of breast, colorectal, and other sites, making it the single most commonly reported cancer in the country [7].

This form of cancer is classified into two main types: melanoma skin cancer (MSC) and non-melanoma skin cancers (NMSC) [11]. The rising incidence of skin cancer may be attributed to various factors, such as aging, extended periods of outdoor activities, genetic predisposition, and prolonged exposure to ultraviolet (UV) radiation from the sun [12]. UV radiation is a significant risk factor for skin cancer, as it contributes to this condition through diverse mechanisms, including increased damage to DNA and RNA, as well as genetic mutations [13].

Ninety-five percent of the UV radiation that reaches the Earth's surface is ultraviolet A (UVA; 320-400 nm), which is composed of UVA1 (340-400nm) and UVA2 (320-340nm) [14,15]. UVA is responsible for skin pigmentation and sun-induced aging. Taking precautions such as avoiding peak sun exposure, wearing protective clothing, and using sunscreen is crucial in minimizing the potential harm caused by UV exposure [14].

In Iran, there is a high risk of developing skin cancer due to intense sunlight in most seasons of the year and the lack of proper protective clothing, such as hats and long-sleeved garments, when outdoors [16]. A nationwide study using OMI satellite data from 2005 to 2019 shows that much of Iran averages a midsummer UV Index above 10 [17]. Protective behavior, however, is lagging. A Tehran knowledge-attitude-practice survey reported that only approximately 32% of adults apply sunscreen "most of the time." Among community pharmacists in Mashhad, 68.8% used sunscreen, yet only 12.5%

followed the recommended 2- to 3-hour re-application schedule [18, 19]. Rural exposure is even worse: sunscreen use among western Iranian farmers was only 8.6% [20].

The regular application of sunscreen helps prevent the development of actinic keratoses, thereby reducing the risk of skin cancer. Consistent use of sunscreen can also prevent photo-induced and photo-exacerbated dermatoses [21]. Sunscreens are approved by the Food and Drug Administration for protection against sunburn, photo pigmentation, aging, and cancer [22]. Low sunscreen usage is linked to limited knowledge and a lower perception of the risk of skin cancer, highlighting areas that could be effectively addressed in skin cancer prevention initiatives [23].

The primary reasons for not following protective measures include a lack of knowledge, misunderstandings, incorrect use of sunscreen products, an inability to make behavior changes, and other factors such as time constraints or added expenses [24]. Sufficient knowledge and protective measures against the harmful effects of sun exposure are essential in preventing various skin issues [24, 25].

A cross-sectional study conducted by Almuqati *et al.* [26] among undergraduate students from non-medical colleges in Saudi Arabia found that, despite the participants' good level of knowledge, the utilization of sunscreen products remain low. In another study conducted in Saudi Arabia and Bahrain, participants have adequate knowledge and are aware of the adverse effects of sun exposure, but their commitment to protective measures is suboptimal [27]. A cross-sectional study by Shanshal *et al.* [28] among undergraduate students from medical and non-medical colleges in Iraqi universities reveals a low level of reported knowledge regarding the adverse effects of sun exposure and the adoption of sun protective measures. Yashovardhana *et al.* [29] demonstrated that Indian youth lack sufficient knowledge about the adverse consequences of sun exposure.

Identifying factors that influence behavior can be helpful in designing targeted interventions and educational programs [30]. The health belief model (HBM) is an effective framework for prevention [31]. According to this model, an individual engages in preventive health behaviors when they believe they are at risk of a disease (perceived susceptibility) [32] and that the disease can lead to severe complications and consequences (perceived severity) [33]. Additionally, there are behaviors that can effectively prevent diseases or reduce their severity and complications (perceived benefits); however, physical, psychological, or financial barriers may prevent the adoption of these behaviors (perceived barriers) [34]. Furthermore, for individuals to engage in these behaviors, they must perceive themselves as capable of performing preventive actions (perceived

self-efficacy). Another concept within this model is the presence of motivating factors that compel individuals to engage in the behavior (cues to action) [35, 36].

Iranians have poor knowledge and practices regarding protection from sun rays, and skin cancer is highly prevalent [7, 18, 19]. Additionally, Khomein city is exposed to high levels of sunlight due to its central location in Iran. Given that lifestyle habits formed during youth can persist throughout a person’s life [37], this study aimed to investigate the behavior of students at Khomein Faculty of Medical Sciences regarding the use of sunscreen to prevent skin cancer, based on the HBM.

**Instrument and Methods**

**Participants**

This cross-sectional study was conducted with students from Khomein Faculty of Medical Sciences in Markazi Province, central Iran, from January to February 2024. Based on the data from a study by Taheri et al. [38] and the subsequent formula, the sample size was determined to be 25,195 individuals ( $\alpha=0.05, d=0.05$ ).

$$n = \frac{Z^2_{1-\frac{\alpha}{2}} \times \sigma^2}{d^2} = 25195$$

Based on the small population size and the fact that the sample exceeded 5% of the population, the final sample size was determined to be 350 individuals ( $n_0=25195, N=350$ ).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

Due to the limited number of faculty students, a census sampling method was adopted to include all eligible individuals. Ultimately, 353 students participated in the study. Students involved in the

validity and reliability assessment of the questionnaire were excluded from the final sample. The inclusion criteria required students to be enrolled in at least one course during the academic semester at Khomein Faculty of Medical Sciences, while the exclusion criteria consisted of unwillingness to participate in the study and incomplete questionnaire responses.

**Instrument**

The research tool comprised a demographic information questionnaire covering gender, age, educational level, father’s education level, mother’s education level, father’s occupation, mother’s occupation, place of residence, and monthly household income. Additionally, a researcher-made questionnaire on the use of sunscreen in skin cancer prevention was used based on the HBM.

To develop the questionnaire, the constructs of the HBM (including perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy) were identified through a comprehensive and systematic review of the relevant scientific literature. Expert consultation further informed the alignment of questionnaire items with these theoretical domains. Specific items were then generated to reflect each construct of the HBM. During the tool development phase, adjustments were made to enhance the clarity and organization of the questions, and appropriate scoring mechanisms were implemented. Face validity was evaluated by 30 randomly selected students from Khomein Faculty of Medical Sciences (who were excluded from the main study), who provided feedback on item clarity, relevance, and difficulty. Based on their input, necessary revisions were made. Content validity was assessed using the content validity ratio (CVR) and content validity index (CVI) by a panel of seven experts in health education and promotion. CVR values above 0.75 were considered acceptable according to Lawshe’s criteria [39], and a CVI threshold of 0.79 was applied [40].

**Table 1.** The Likert scoring method and items for each health belief model (HBM) construct in the questionnaire

Construct	No. of items	Score range	Sample items	Scoring direction
Perceived susceptibility	4	4-20	"I may experience sunburn"; "Sunlight can harm my skin during any season"	Higher scores=greater susceptibility
Perceived severity	5	5-25	"Sunburn can lead to serious health issues"; "Sunburn can increase the risk of skin cancer"	Higher scores=greater perceived severity
Perceived benefits	5	5-25	"Using sunscreen helps maintain the beauty of my skin" "The cost of using sunscreen is much lower than benefits treating sunburn problems"	Higher scores=greater perceived
Perceived barriers	7	7-35	"I cannot afford sunscreen"; "Using sunscreen makes me subject to ridicule by friends and family"	Reverse-scored: Higher scores=fewer perceived barriers
Cues to action	7	7-35	"I receive information on managing sunburn from various reliable sources"; "My family members motivate me to use sunscreen"	Higher scores=more frequent cues to action
Perceived self-efficacy	6	6-30	"I can address issues associated with using sunscreen"; "I am confident in my ability to protect my skin from sunburn if needed"	Higher scores=greater self-
Behavior	6	6-30	"I use sunscreen in open environments"; "I encourage others to protect their skin from sunburn"	Higher scores=more protective behavior
Total questionnaire	40	40-200	-	Based on sum of all constructs

All items were rated on a 5-point Likert scale (e.g., 1=strongly disagree to 5=strongly agree)

Reliability was determined using Cronbach's alpha, based on responses from 20 students. The overall Cronbach's alpha for the questionnaire was 0.81, with subscale values as follows: perceived susceptibility (0.84), perceived severity (0.71), perceived barriers (0.79), perceived benefits (0.82), cues to action (0.89), perceived self-efficacy (0.73), and behavior (0.77; Table 1).

**Procedure**

To administer the questionnaires, the researchers visited various classes according to the class schedule across different fields and levels. After explaining the research objectives to the participants, written consent forms were collected from them to partake in the study. Subsequently, the questionnaires were distributed to the students, with a total of 353 students ultimately completing them.

**Statistical analysis**

Data analysis was conducted using STATA 17 software. According to the Hosmer and Lemeshow method [41], simple linear regression analyses were used to assess the crude relationship between the behavioral score and each of the baseline characteristics and HBM constructs at a significance level of  $\alpha=0.2$ . Given that the univariate models served as a screening step for identifying potentially relevant predictors to be included in the multiple regression model, a more liberal threshold (i.e.,  $\alpha=0.20$ ) was adopted in line with established statistical practices. In the univariate regression models, each HBM construct was entered separately as an independent parameter to examine its crude association with behavioral scores. In the multivariate regression model, all HBM constructs were entered simultaneously, along with key covariates (gender and maternal occupation), to assess their independent contribution to predicting behavioral scores. In the final multiple regression model, all HBM constructs were analyzed alongside key demographic parameters (gender and maternal occupation) selected for their theoretical relevance and significance in univariate analyses. This approach allowed for the assessment of independent associations while avoiding multicollinearity and overfitting by excluding less relevant baseline characteristics.

If a statistically significant relationship was observed between any of the baseline characteristics and the behavioral score, that parameter was included as a covariate in the multiple linear regression model at a significance level of  $\alpha=0.05$ .

**Findings**

A total of 353 students, with a mean age of  $21.01\pm 2.38$  years were assessed, of whom 13.39% were undergraduate students and 76.68% were graduate students. Additionally, 51.30% of the participants were female, and 13.11% resided in rural areas. Furthermore, 10.26% had a family

income of less than 100 dollars. In terms of parental education levels, 35.61% of the fathers and 34.47% of the mothers had a university education. The mean perceived susceptibility score was  $14.99\pm 3.45$ , while the mean perceived severity score was  $19.86 \pm 3.51$ . Participants had a mean perceived benefits score of  $20.36\pm 3.22$ , and the mean perceived barriers score was  $24.40\pm 5.34$ . The mean score for cues to action was  $25.23\pm 5.34$ , and the mean perceived self-efficacy score was  $22.21\pm 3.42$ . Finally, the mean behavioral score was  $16.30\pm 3.44$  (Table 2).

**Table 2.** Baseline characteristics of the subjects

Parameter		Frequency (%)
<b>Gender</b>	Female	181 (51.30)
	Male	172 (48.70)
<b>Father's job</b>	Employee	143 (40.17)
	Worker	56 (15.95)
	Freelance	148 (42.17)
	Unemployed	6 (1.71)
<b>Mother's job</b>	Employee	77 (21.94)
	Worker	2 (0.57)
	Freelance	18 (5.13)
	Housewife	256 (72.36)
<b>Father's education</b>	Illiterate	22 (6.27)
	Primary	31 (8.83)
	Secondary	61 (16.81)
	Diploma	114 (32.48)
	University	125 (35.61)
<b>Mother's education</b>	Illiterate	16 (4.56)
	Primary	40 (11.40)
	Secondary	55 (15.10)
	Diploma	121 (34.47)
	University	121 (34.47)
<b>Residence</b>	Urban	307 (86.89)
	Rural	46 (13.11)
<b>Family income (dollars)</b>	<100	36 (10.26)
	100-200	161 (45.87)
	$\geq 200$	154 (43.87)
<b>Level of education</b>	Associate	47 (13.39)
	Bachelor's degree	271 (76.64)
	Masters' degree and above	35 (9.97)

In univariate models, the average behavioral score for men was 2.08 points significantly lower than that of women (80% CI: -2.53, -1.63;  $p\leq 0.001$ ). Additionally, compared to individuals with a family income of less than 100, those with family incomes between 100 and 200 and those with 200 or more had average behavioral scores that were 0.82 and 0.97 points significantly higher, respectively (80% CI: 0.06, 1.63;  $p=0.196$ ) and (80% CI: 0.15, 1.79;  $p=0.128$ ). The average behavioral score for men was significantly lower than that of women (-1.96, 95% CI: -2.68, -1.23;  $p\leq 0.001$ ). Furthermore, the behavioral scores of students whose mothers were workers (5.31, 95% CI: 0.57, 10.04;  $p=0.027$ ) or employees (1.42, 95% CI: 0.33, 2.52;  $p=0.010$ ) were significantly higher than those of students whose mothers were housewives (Table 3).

There was a significant statistical relationship between the increase in scores of each HBM construct and the increase in behavioral scores. Specifically, for every one-unit increase in the scores of perceived severity, perceived benefits, perceived barriers, cues

to action, and perceived self-efficacy, the mean behavioral score significantly increased by 0.26, 0.39, 0.24, 0.28, and 0.42, respectively. In the multiple regression model, a one-unit increase in the scores of perceived benefits, perceived barriers, cues to action, and perceived self-efficacy led to a significant increase of 0.13 (95% CI: 0.05, 0.26; p=0.041), 0.10

(95% CI: 0.02, 0.17; p=0.007), 0.14 (95% CI: 0.07, 0.22; p≤0.001), and 0.18 (95% CI: 0.07, 0.29; p=0.001) in the mean behavioral score (Table 4).

Parameters, such as perceived self-efficacy, cues to action, and perceived benefits exhibited the strongest and most statistically significant effects on behavior (Figure 1).

**Table 3.** The relationship between baseline characteristics and behavioral score of students

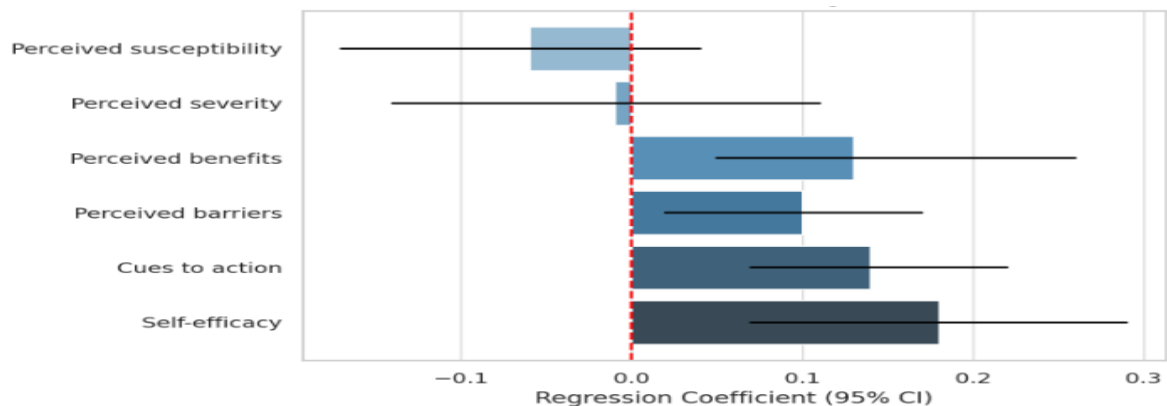
Parameter	Uni-variable model (80% CI)	p-value	Multivariate model (95% CI)	p-value
<b>Age</b>	-0.20 (-0.30, -0.10)	0.008	-0.14 (-0.29, 0.01)	0.068
<b>Gender (male/female)</b>	-2.08 (-2.53, -1.63)	≤0.001	-1.96 (-2.68, -1.23)	≤0.001
<b>Father's job</b>				
Unemployed (reference)	-	-	-	-
Freelance	3.25 (1.44, 5.07)	0.022	2.29 (-0.83, 5.43)	0.151
Worker	2.27 (0.40, 4.15)	0.120	1.75 (-1.24, 4.75)	0.251
Employee	2.24 (0.42, 4.06)	0.114	1.63 (-1.55, 4.82)	0.314
<b>Mother's job</b>				
Housewife (reference)	-	-	-	-
Freelance	-0.54 (-1.62, 0.52)	0.513	0.00 (-1.64, 1.64)	0.999
Worker	3.78 (0.65, 6.91)	0.122	5.31 (0.59, 10.04)	0.027
Employee	0.43 (-0.13, 1)	0.331	1.42 (0.33, 2.52)	0.010
<b>Father's education</b>				
Illiterate (reference)	-	-	-	-
Primary	1.53 (0.31, 2.74)	0.106	0.47 (-1.61, 2.56)	0.655
Secondary	2.28 (1.19, 3.36)	0.007	0.30 (-1.62, 2.23)	0.757
Diploma	0.82 (-0.19, 1.83)	0.298	-0.22 (-1.99, 1.55)	0.807
University	0.66 (-0.34, 1.67)	0.339	-0.02 (-1.88, 1.82)	0.976
<b>Mother's education</b>				
Illiterate (reference)	-	-	-	-
Primary	2.17 (0.87, 3.47)	0.032	0.33 (-1.93, 2.61)	0.770
Secondary	2.25 (1, 3.49)	0.021	0.89 (-1.21, 3)	0.404
Diploma	1.08 (-0.08, 2.24)	0.234	-0.17 (-2.19, 1.83)	0.862
University	1.33 (0.17, 2.50)	0.141	-0.62 (-2.77, 1.51)	0.563
<b>Residence (urban/rural)</b>	-0.75 (-1.44, -0.05)	0.167	-0.80 (-1.96, 0.34)	0.168
<b>Family income (dollars)</b>				
<100 (reference)	-	-	-	-
100-200	0.82 (0.06, 1.63)	0.196	0.19 (-1.13, 1.51)	0.777
≥200	0.97 (0.15, 1.79)	0.128	0.56 (-0.79, 1.93)	0.413
<b>Level of education</b>				
Associate (reference)	-	-	-	-
Bachelors' degree	-0.29 (-0.99, 0.40)	0.587	-	-
Masters' degree and above	-0.87 (-1.86, 0.11)	0.256	-	-

**Table 4.** Investigating the relationship between HBM constructs and the behavioral score of students participating in the study

Parameter	Univariate model* (80% CI)	p-value	Multivariate model** (95% CI)	p-value
<b>Perceived susceptibility</b>	0.08 (0.01, 0.14)	0.126	-0.06 (-0.17, 0.04)	0.222
<b>Perceived severity</b>	0.26 (0.20, 0.33)	≤0.001	-0.01 (-0.14, 0.11)	0.833
<b>Perceived benefits</b>	0.39 (0.32, 0.46)	≤0.001	0.13 (0.05, 0.26)	0.041
<b>Perceived barriers</b>	0.24 (0.20, 0.28)	≤0.001	0.10 (0.02, 0.17)	0.007
<b>Cues to action</b>	0.28 (0.24, 0.32)	≤0.001	0.14 (0.07, 0.22)	≤0.001
<b>Perceived self-efficacy</b>	0.42 (0.35, 0.48)	≤0.001	0.18 (0.07, 0.29)	0.001

\* Univariate linear regression at α=0.2

\*\* Multivariate linear regression adjusted for gender and mother's job at α=0.05



**Figure 1.** Association between health belief model (HBM) constructs and behavioral score (multivariate linear regression)

## Discussion

This study investigated sunscreen use behavior among students at Khomein Faculty of Medical Sciences, employing the HBM as a theoretical framework. Sunscreen use was significantly associated with several sociodemographic factors, including family income, gender, and maternal occupation. The majority of participants were urban residents with a family income exceeding \$100, while most had parents with education levels at a diploma or lower. Students from higher-income families demonstrated a greater likelihood of using sunscreen, suggesting that financial resources may facilitate access to sun protection products and health-related information. These findings align with those reported by Ullman *et al.* [42], observing higher rates of sunscreen use among individuals from middle- and high-income groups.

Gender differences were also prominent; women exhibited higher rates of sunscreen use than men. This is consistent with prior research, such as the study by Falk & Anderson [43], which found that sunscreen use is lower among individuals with limited educational attainment and that women are more likely than men to engage in sun-protective behaviors. Similarly, Roberts *et al.* [44] noted that daily sunscreen use among men is generally low and influenced by financial limitations. Sociocultural norms may help explain this disparity, as previous studies have highlighted that men often perceive sunscreen as a cosmetic product, potentially conflicting with traditional masculine ideals [45]. These perceptions may discourage men from using sunscreen or seeking assistance from peers.

The occupation of the mother also emerged as a significant factor. Students whose mothers were employed, either as workers or office employees, showed greater adherence to sunscreen use compared to those whose mothers were housewives. This may reflect broader patterns whereby maternal employment is associated with increased health literacy, autonomy, and exposure to public health messaging. Working mothers are also more likely to model self-care behaviors and instill preventive health practices in their children. Furthermore, employed women are often better positioned to access health-related information through workplace campaigns and broader social networks, all of which may contribute to more proactive health behaviors within the household.

There was a positive relationship between the HBM constructs and sunscreen use behavior, suggesting that higher scores across these cognitive domains were associated with increased behavior adoption. Among the constructs, perceived benefits, cues to action, and self-efficacy emerged as the strongest predictors. These findings corroborate the work of Mirzaei-Alavijeh *et al.* [24], emphasizing the role of cues to action and self-efficacy in promoting

consistent sunscreen use. Dunn [46] and Nahar *et al.* [47] also report self-efficacy as a key determinant of sun protection behaviors.

Interestingly, constructs, such as perceived susceptibility and perceived severity did not emerge as strong predictors in this study, which diverges from the findings of Butera *et al.* [48], reporting significant associations between these constructs and sunscreen use. However, our results are more aligned with those of Kim & Bae [49], reporting that self-efficacy and perceived susceptibility positively influence sunscreen use, while perceived barriers has a negative impact.

The strong predictive power of self-efficacy is particularly noteworthy. Initially conceptualized as part of the perceived barriers construct within the HBM, self-efficacy has since been recognized as an independent and essential cognitive construct [50]. Confidence in one's ability to perform a behavior, such as applying sunscreen regularly, appears to be a decisive factor, particularly among youth. Likewise, cues to action, including support from peers, family influence, media exposure, and professional health advice, play a critical role in prompting individuals to adopt sun protection measures.

These findings suggest that future interventions should prioritize enhancing self-efficacy, strengthening perceptions of benefits, and addressing barriers to sunscreen use. Educational programs tailored to male students and those from lower-income households may be particularly beneficial, given their lower likelihood of adopting sunscreen. Public health campaigns should also consider gender-sensitive messaging and leverage culturally appropriate channels to increase outreach and effectiveness. To our knowledge, this study is the first to apply the HBM framework to analyze sunscreen use behavior in Markazi Province, central Iran, thereby addressing a regional gap in the literature. The inclusion of both male and female medical science students provides valuable insight into the sun protection practices of future healthcare professionals. By integrating sociodemographic factors with HBM constructs in a multivariate analysis, this study offers a comprehensive understanding of the cognitive and contextual determinants of sunscreen behavior.

Due to the limited student population at Khomein Faculty of Medical Sciences, statistical techniques were employed to minimize the required sample size, which may have affected the overall robustness of the study. While the HBM is particularly effective in interventional research, the current study adopted a cross-sectional design due to certain constraints, limiting its ability to infer causality. Data were collected through self-reported questionnaires, which may be subject to response bias. Furthermore, in the absence of a standardized instrument suitable for the study's objectives, a researcher-designed

questionnaire was used. Although efforts were made to evaluate its psychometric properties, its reliability may be lower compared to that of a validated standard instrument, potentially influencing the precision of the findings.

It is recommended that health education and promotion interventions be designed and implemented at both the individual and community levels, focusing on improving self-efficacy, cues to action, and perceived benefits, while reducing perceived barriers to promote sunscreen use behaviors. For example, peer-led education programs can be implemented to enhance cues to action by leveraging the influence of classmates or student leaders. To improve self-efficacy, workshops and skill-building sessions could be organized to teach proper sunscreen application and integrate sun protection into daily routines. Campaigns highlighting the benefits of sunscreen use, such as preventing premature aging and skin cancer, can increase perceived value.

## Conclusion

Gender, socioeconomic status, parental occupation, and level of education are associated with the adoption of sunscreen use behavior and perceived benefits, cues to action, and self-efficacy are strong predictors of sunscreen use.

**Acknowledgments:** The authors express their gratitude to all the students who participated in this study.

**Ethical Permissions:** Ethical approval was obtained from the Human Research Ethics Committee at Khomein University of Medical Sciences (Code IR.KHOMEIN.REC.1402.022). After explaining the project goals to the participants and ensuring the confidentiality of their information, we obtained a written consent form for their participation in the research.

**Conflicts of Interests:** The authors declared no competing interests.

**Authors' Contribution:** Azizi R (First Author), Methodologist/Main Researcher (20%); Torabi F (Second Author), Introduction Writer/Assistant Researcher (15%); Beiranvand R (Third Author), Discussion Writer/Statistical Analyst (15%); Soltaninejad H (Fourth Author), Introduction Writer/Assistant Researcher/Discussion Writer (15%); Sharifi N (Fifth Author), Introduction Writer/Methodologist/Assistant Researcher/Discussion Writer (35%)

**Funding/Support:** This research was supported by Khomein University of Medical Sciences (No: 402000003).

## References

- 1- An S, Kim K, Moon S, Ko KP, Kim I, Lee JE, et al. Indoor tanning and the risk of overall and early-onset melanoma and non-melanoma skin cancer: Systematic review and meta-analysis. *Cancers*. 2021;13(23):5940.
- 2- Dildar M, Akram S, Irfan M, Khan HU, Ramzan M, Mahmood AR, et al. Skin cancer detection: A review using deep learning techniques. *Int J Environ Res Public Health*. 2021;18(10):5479.

- 3- Hasan N, Imran M, Sheikh A, Tiwari N, Jaimini A, Kesharwani P, et al. Advanced multifunctional nano-lipid carrier loaded gel for targeted delivery of 5-fluorouracil and cannabidiol against non-melanoma skin cancer. *Environ Res*. 2023;233:116454.

- 4- Byrd AL, Belkaid Y, Segre JA. The human skin microbiome. *Nat Rev Microbiol*. 2018;16(3):143-55.

- 5- Hasan N, Nadaf A, Imran M, Jiba U, Sheikh A, Almalki WH, et al. Skin cancer: Understanding the journey of transformation from conventional to advanced treatment approaches. *Mol Cancer*. 2023;22(1):168.

- 6- Siegel RL, Miller KD, Wagle NS, Jemal A. Cancer statistics, 2023. *CA Cancer J Clin*. 2023;73(1):17-48.

- 7- Hasan N, Imran M, Nadeem M, Jain D, Haider K, Moshahid Alam Rizvi M, et al. Formulation and development of novel lipid-based combinatorial advanced nanoformulation for effective treatment of non-melanoma skin cancer. *Int J Pharm*. 2023;632:122580.

- 8- Wéber A, Vignat J, Shah R, Morgan E, Laversanne M, Nagy P, et al. Global burden of bladder cancer mortality in 2020 and 2040 according to GLOBOCAN estimates. *World J Urol*. 2024;42(1):237.

- 9- Kiani B, Tabari P, Mohammadi A, Mostafavi SM, Moghadami M, Amini M, et al. Spatial epidemiology of skin cancer in Iran: Separating sun-exposed and non-sun-exposed parts of the body. *Arch Public Health*. 2022;80(1):35.

- 10- Razi S, Enayatrad M, Mohammadian-Hafshejani A, Salehiniya H, Fathali-Loy-Dizaji M, Soltani S. The epidemiology of skin cancer and its trend in Iran. *Int J Prev Med*. 2015;6(1):64.

- 11- Urban K, Mehrmal S, Uppal P, Giesey RL, Delost GR. The global burden of skin cancer: A longitudinal analysis from the Global Burden of Disease Study, 1990-2017. *JAAD Int*. 2021;2:98-108.

- 12- Haji-Maghsoudi S, Farshchian M, Sadeghifar M, Roshanaei G, Mahjub H. The impact of environmental factors on skin cancer. *Int J Cancer Manag*. 2022;15(10):e119906.

- 13- Wu S, Cho E, Li WQ, Weinstock MA, Han J, Qureshi AA. History of severe sunburn and risk of skin cancer among women and men in 2 prospective cohort studies. *Am J Epidemiol*. 2016;183(9):824-33.

- 14- Low QJ, Teo KZ, Lim TH, Cheo SW, Yap WYE. Knowledge, attitude, practice and perception on sunscreen and skin cancer among doctors and pharmacists. *Med J Malaysia*. 2021;76(2):212-7.

- 15- Burke KE. Environmental aging of the skin: New insights. *Plast Aesthet Res*. 2020;7:59.

- 16- Razi S, Rafiemanesh H, Ghoncheh M, Khani Y, Salehiniya H. Changing trends of types of skin cancer in Iran. *Asian Pac J Cancer Prev*. 2015;16(12):4955-8.

- 17- Gholamnia R, Abtahi M, Dobaradaran S, Koolivand A, Jorfi S, Khaloo SS, et al. Spatiotemporal analysis of solar ultraviolet radiation based on Ozone Monitoring Instrument dataset in Iran, 2005-2019. *Environ Pollut*. 2021;287:117643.

- 18- Mousavi F, Golestan B, Vaseie M, Vaseie L, Khajeh-Kazemi R. Knowledge, attitude, and practice of adults to the protective actions against sun in northwest Tehran, Iran. *Arch Iran Med*. 2011;14(2):126-31.

- 19- Nahar VK, Hasani Z, Martin B, Boyas JF, Chabok R, Philip LS, et al. Perceptions and practices of the Iranian population regarding skin cancers: A literature review. *J Skin Cancer*. 2017;2017(1):4934108.

- 20- Moeini B, Ezati E, Barati M, Rezapur-Shahkolai F, Mohammad Gholi Mezerji N, Afshari M. Skin cancer preventive behaviors in Iranian farmers: Applying protection motivation theory. *Workplace Health Saf.* 2019;67(5):231-40.
- 21- Agarwal SB, Godse K, Patil S, Nadkarni N. Knowledge and attitude of general population toward effects of sun exposure and use of sunscreens. *Indian J Dermatol.* 2018;63(4):285-91.
- 22- Bode AM, Roh E. Are FDA-approved sunscreen components effective in preventing solar UV-induced skin cancer? *Cells.* 2020;9(7):1674.
- 23- Nagelhout ES, Parsons BG, Haaland B, Tercyak KP, Zaugg K, Zhu A, et al. Differences in reported sun protection practices, skin cancer knowledge, and perceived risk for skin cancer between rural and urban high school students. *Cancer Causes Control.* 2019;30(11):1251-8.
- 24- Mirzaei-Alavijeh M, Gharibnavaz H, Jalilian F. Correction to: Skin care prevention: Psychosocial predictors of sunscreen use in university students. *J Cancer Educ.* 2020;35(1):193.
- 25- Shanshal SA, Al-Qazaz HK. Knowledge and practice of cement factory workers in relation to respiratory symptoms: A cross-sectional study. *Syst Rev Pharm.* 2020;11(6):864-70.
- 26- Almuqati RR, Alamri AS, Almuqati NR. Knowledge, attitude, and practices toward sun exposure and use of sun protection among non-medical, female, university students in Saudi Arabia: A cross-sectional study. *Int J Womens Dermatol.* 2019;5(2):105-9.
- 27- Sultana N. Sun awareness and sun protection practices. *Clin Cosmet Investig Dermatol.* 2020;13:717-30.
- 28- Shanshal SA, Khaleel SM, Hammoodi SH. Sun exposure and usage of sun protection: Knowledge, perception and practice among university students. *Malays J Med Sci.* 2024;31(2):208-21.
- 29- Yashovardhana DP, Ravikiumar BC, Swamy SS, Raghukumar S, Aggarwal A. Knowledge, attitude and practices about sun exposure, photoprotection and sunscreen usage among college students of Hassan in Karnataka: A cross-sectional study. *J Pak Assoc Dermatol.* 2018;28(1):64-8.
- 30- Lamort-Bouché M, Sarnin P, Kok G, Rouat S, Péron J, Letrilliart L, et al. Interventions developed with the intervention mapping protocol in the field of cancer: A systematic review. *Psychooncology.* 2018;27(4):1138-49.
- 31- Khazar N, Jalili Z, Nazary Manesh L. The effect of educational intervention based on health belief model on nurses' stress management in intensive care units. *Iran J Health Educ Health Promot.* 2020;7(4):300-11. [Persian]
- 32- Taflinger S, Sattler S. A situational test of the health belief model: How perceived susceptibility mediates the effects of the environment on behavioral intentions. *Soc Sci Med.* 2024;346:116715.
- 33- Zampetakis LA, Melas C. The health belief model predicts vaccination intentions against COVID-19: A survey experiment approach. *Appl Psychol Health Well Being.* 2021;13(2):469-84.
- 34- Jose R, Narendran M, Bindu A, Beevi N, Manju L, Benny PV. Public perception and preparedness for the pandemic COVID 19: A Health Belief Model approach. *Clin Epidemiol Glob Health.* 2021;9:41-6.
- 35- Zhou C, Yue XD, Zhang X, Shangguan F, Zhang XY. Self-efficacy and mental health problems during COVID-19 pandemic: A multiple mediation model based on the Health Belief Model. *Pers Individ Dif.* 2021;179:110893.
- 36- Midjani N, Hossaini FA, Sharifi N. Promotion of nutritional behaviors in the prevention of cardiovascular diseases: Application of the health belief model in primary health care centers. *BMC Prim Care.* 2023;24(1):278.
- 37- Sharifi F, Sharifi N. The effect of educational intervention on lifestyle modification associated with osteoporosis in female students. *Iran J Obstet Gynecol Infertil.* 2017;20(7):36-43. [Persian]
- 38- Taheri F, Salehpour M, Taheri AR. Survey of knowledge, attitude, and practice of female high school students regarding sun protection in Birjand, Iran. *Mod Care J.* 2022;19(2):e122395.
- 39- Romero Jeldres M, Díaz Costa E, Faouzi Nadim T. A review of Lawshe's method for calculating content validity in the social sciences. *Front Educ.* 2023;8:1271335.
- 40- Madadzadeh F, Bahariniya S. Tutorial on how to calculating content validity of scales in medical research. *Perioper Care Oper Room Manag.* 2023;31:100315.
- 41- Harbord RM. Book review: Statistics for epidemiology. *Int J Epidemiol.* 2004;33(5):1158-9.
- 42- Ullman LE, Nasir-Moin M, Hoffman V, Ghadersohi S, Swartzman I, De Weever M, et al. Sunscreen use and affordability attitudes based on ethnicity, socioeconomic status, and Fitzpatrick skin type. *Arch Dermatol Res.* 2024;316(6):266.
- 43- Falk M, Anderson CD. Influence of age, gender, educational level and self-estimation of skin type on sun exposure habits and readiness to increase sun protection. *Cancer Epidemiol.* 2013;37(2):127-32.
- 44- 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;20(1):88-93.
- 45- McKenzie C, Rademaker AW, Kundu R V. Masculine norms and sunscreen use among adult men in the United States: A cross-sectional study. *J Am Acad Dermatol.* 2019;81(1):243-4.
- 46- Dunn MS. Sun tanning behaviors, health beliefs, attitudes and intentions among college students. *Californian J Health Promot.* 2014;12(2):69-77.
- 47- Nahar VK, Ford MA, Hallam JS, Bass MA, Hutcheson A, Vice MA. Skin cancer knowledge, beliefs, self-efficacy, and preventative behaviors among north Mississippi landscapers. *Dermatol Res Pract.* 2013;2013:496913.
- 48- Butera CL, Clark MJ, Georges J, Bush RA. Skin cancer risk perception and sunscreen use in adolescent female soccer athletes. *J Dermatol Nurses Assoc.* 2015;7(2):89-96.
- 49- Kim JW, Bae S. A study of factors influencing sunscreen use among Koreans: Application of the Health Belief Model (HBM). *J Korean Appl Sci Technol.* 2024;41(2):472-83. [Korean]
- 50- Alyafei A, Easton-Carr R. The health belief model of behavior change. Treasure Island: StatPearls Publishing; 2024.