Effectiveness of Training Program about Skin Self-examination on Knowledge, Practices, and Attitudes of Outdoor Campus Security Personnel

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Abstract

Background: Outdoor workers are a high-risk group for certain types of skin cancer due to their routine and unavoidable sun exposure as part of their job responsibilities. Practicing effective skin self-examination (SSE) is essential for early detection and management of skin cancer. This study aimed to assess the effect of a training program about SSE on knowledge, self-reported practices, and attitudes of outdoor campus security personnel. **Method:** A quasi-experimental design was used, involving all 156 outdoor security personnel at Mansoura University Campus. Data were collected before and one month after a training program using four tools: two structured questionnaires covering the socio-demographic & general characteristics of the security personnel, skin health history and sun exposure, and knowledge about SSE; a self-reported SSE practice scale; and an attitude scale**. Results:** Median scores increased significantly after the training program: knowledge (7 to 31), self-reported SSE practices (0 to 44), and attitudes (20 to 32) ($P \leq 0.001$). Significant positive correlations were found in the pre-test between knowledge and both practices and attitudes scores ($P < 0.001$), and between practices and attitudes scores in both the pre-test ($P < 0.001$) and post-test ($P = 0.018$). **Conclusions:** Implementing the SSE training program for outdoor campus security personnel positively improves their knowledge, attitude, and self-reported practice. **Recommendations:** Incorporating periodic SSE training into occupational health and safety programs for outdoor campus security personnel can sustain knowledge, practices, and attitudes, potentially reducing future skin cancer incidence.

***Keywords*:** Skin cancer- Skin cancer screening- Skin self-examination- Outdoor workers

Introduction

Global climate change is among the most significant environmental challenges of the 21st century, with the potential to influence human health both directly and indirectly. Although widely acknowledged as a critical global issue now and in the future, the effects of climate change on human well-being, including occupational health and safety, have been relatively overlooked. Earlier studies have indicated that climate change may lead to ozone layer depletion and affect the amount of ultraviolet radiation (UVR) that reaches the Earth's surface **(Flouris et al., 2018; Moda, Filho, & Minhas, 2019).**

Prolonged unprotected exposure to the sun has been found to cause skin damage and a range of skin disorders. Short-term exposure to UVR can lead to immediate effects on the skin, such as sunburn and tanning. Over time, continued UV exposure can result in chronic conditions, including hyperpigmentation (such as solar lentigines, freckles, and melasma), premature skin aging (like telangiectasia and elastosis), and the development of non-melanoma and potentially melanoma skin cancers. Additionally, UVR has been linked to various eye conditions, including photokeratitis, pinguecula, pterygium, cataracts, and possibly eye tumors **(Almuqati, Alamri, & Almuqati, 2019; El-Shafei & Said, 2023).**

Outdoor workers face a heightened risk of excessive exposure to UVR and its associated harmful effects. In this context, outdoor workers are defined as individuals who spend at least three hours per day working outside, typically between 9 a.m. and 3 p.m., on most days of the week. These workers often experience UVR exposure levels that exceed recommended safety limits, frequently without sufficient sun protection. Campus safety and security staff, who are responsible for managing traffic flow on campus during sunlit hours, are considered part of this vulnerable group **(Ngo & Rivera, 2022).**

Exposure to sunlight in the workplace has been strongly associated with an increased risk of developing non-melanoma skin cancers and may also be linked to melanoma. Over half of all cancer cases and nearly two-thirds of deaths caused by cancer take place in low- and middle-income countries. Projections suggest that by 2025, cancer incidence in developing nations will rise to 45% **(Mehri et al., 2024).**

Skin cancer constitutes an escalating burden on both public health and

economic resources. Research indicates that both the direct and indirect expenses associated with its treatment place considerable pressure on healthcare systems. As a result, initiatives that support early detection of skin cancer possess the capability to reduce costs and enhance health outcomes significantly **(Baghani et al., 2024).**

In general, Skin self-examination (SSE) is a method aimed at encouraging the early identification of melanoma. A comprehensive SSE consists of a careful and systematic review of the entire body to spot any suspicious lesions based on recognized guidelines, commonly employing a mirror or assistance from another individual to examine areas that are hard to see. Early melanoma detection through SSE in individuals at high risk can potentially decrease both mortality and illness related to melanoma, thereby lessening the impact on patients and the healthcare system **(Niu & Heckman, 2022).**

Skin self-examination (SSE) plays a vital role in the early detection and management of skin cancers. It is a recommended early screening practice endorsed by organizations including the American Cancer Society, the Cancer Council Australia, and the Skin Cancer Foundation **(Göl & Erkin, 2018).**

Health awareness and preventive care are gaining greater significance within the healthcare system. Community health nurses play a crucial role by providing direct care, educating individuals and the public about the importance of preventive services such as health screenings, and advocating for overall health improvements. With ongoing healthcare reforms and a rising number of people affected by chronic illnesses, the role of nurses has expanded to include a stronger focus on raising community awareness and preventing disease **(Tushe & Karagjozi, 2025).**

Primary prevention, according to the International Agency for Research on Cancer, encompasses any measures taken to lower the risk of cancer development in humans. Central strategies for population-wide prevention involve creating and delivering targeted health education and training programs. Educational interventions are one of several approaches aimed at reducing workers' exposure to UVR and have proven effective in enhancing their knowledge and promoting sun-protective behaviors **(Fazel et al., 2023; Symanzik & John, 2022)**.

Significance of the study

Skin cancer is considered one of the most widespread types of cancer worldwide, representing a substantial concern for public health. In 2020 alone, approximately 1.5 million new cases of skin cancer were reported worldwide, including 325,000 cases of malignant melanoma **(Muxunov et al., 2024).**

One of the most crucial known facts about skin cancer is that it can be prevented and effectively managed if detected early. The goal of disease screening is to shorten the interval between the point when a disease is detectable without symptoms and when it is clinically diagnosed, allowing for earlier initiation of treatment **(Rowell et al., 2017).**

Through the implementation of educational interventions, the community health nurse can help lower morbidity and mortality rates while also enhancing access to healthcare services. In the light of what has been mentioned before, the present study assesses the effect of training program on promoting skin self-examination among outdoor workers.

Aim of the study

The study aimed to assess the effects of a training program about skin self-examination on the knowledge, self-reported practices, and attitudes of campus security personnel.

Study Hypothesis

1. Campus security personnel who received a skin self-examination training program exhibit improved mean knowledge scores post-test compared to their mean score pre-test.
2. Campus security personnel who received a skin self-examination training program exhibit improved mean scores of self-reported practice post-test compared to their mean score pre-test.
3. Campus security personnel who received a skin self-examination training program exhibit improved mean attitude score post-test compared to their mean score pre-test.

Subjects and method

Study design

A quasi-experimental design (One-Group Pretest-Posttest Design) was employed in the study.

Study setting

The study was conducted in outdoor spaces of the Mansoura University Campus, including the large courtyards, sports fields, parking lots, and pathways. These areas demand constant monitoring by security personnel and expose the personnel to varying levels of sunlight throughout the day.

Participants

The study included outdoor campus security personnel aged 18 years and above, belonging to both sexes, and able to understand written Arabic. Additionally, those who spent a significant portion of their work outdoors monitoring the entry and exit points, traffic and parking management, and patrolling and surveillance gave consent to participate in the study.

Conversely, those campus security personnel who were unable to understand written Arabic, primarily worked indoors, and refused to give or sign the informed consent form were excluded.

Sample size calculation

The total number of campus security personnel at Mansoura University is about 186 persons on duty. After excluding the night shift security personnel, who are about 30. Thus, the target population is the remaining 156 security personnel (response rate = 86.7%).

Study tools

Tool (I): A structured self-administered questionnaire was developed by the researcher after reviewing related literature and consists of two parts:

Part (1): Socio-demographic & general characteristics of the security personnel, including age, sex, marital status, educational level, years of experience, residence, and monthly income, family history of skin cancer, and sources of skin safety information.

Part (2): Skin health history and sun exposure. It included questions about the history of blistering sunburn, the number of freckles and moles, and Fitzpatrick skin type. The researchers classified workers' skin types using the Fitzpatrick Skin Type Scale **(Fitzpatrick, 1988**). According to the scale, the skin is divided into six categories based on its sensitivity to sunburn, with the risk of developing skin cancer decreasing progressively from skin type 1 to skin type 6. Specifically, skin types 1 and 2 are considered at high risk, types 3 and 4 at moderate risk, and types 5 and 6 at low risk. The assessment of sun protection behaviors included questions about practices such as seeking shade, wearing sunglasses, using hats or caps, wearing long-sleeved clothing or trousers, and applying high-factor sunscreen (sun protection factor).

Tool (II): Knowledge about SSE. It was a structured self-administered questionnaire developed by researchers and contained 9 questions about the definition, importance, and steps of conducting SSE, skin abnormal markings & signs, and the ABCDE “Asymmetry, Border, Color, Diameter, Evolving”

rule. Additionally, questions about the time to perform SSE, and the tools & materials that can be used during SSE. The questions were structured as multiple-choice, allowing for more than one correct answer. The total score for each question was based on the number of correct responses selected. Each correct answer received a score of 1, while incorrect answers were scored as 0. The total score ranges from 0 to 36. Scores < 21.6 are classified as poor knowledge, scores from 21.6 < 28.8 are classified as fair knowledge, and scores ≥ 28.8 and more classified as good knowledge.

Tool III: Self-reported practice about SSE. It was a self-rating scale developed by the researchers and contained 19 questions about preparation for SSE, body parts that should be examined during SSE, and the ABCDE rule**.** Answers to these questions were based on a four-point Likert scale (3=Always, 2=Often, 1=Sometimes, 0=Never). The total score for self-care practices was obtained from the sum of responses and ranged from 0-57 points, with higher scores ≥ 42.75 indicating satisfactory self-care practices.

Part IV: The Skin Self-Examination Attitude Scale (SSEAS), developed by **Djaja et al. (2014),** assesses attitudes towards SSE by measuring outcome expectations and planning for future SSE. The scale consists of 8 items; each rated on a five-point Likert scale ranging from strongly disagree to strongly agree. Scores on the SSEAS can range from 0 to 32, with 0 representing a low level of attitude toward SSE and 32 indicating a high level.

Ethical consideration

Written initial approval was obtained from the research ethics committee of the Faculty of Nursing, Mansoura University (Reference No P.0634). An official letter clarifying the purpose of the study was obtained from the Dean of the Faculty of Nursing, Mansoura University, and submitted to the head of the campus security department for permission to carry out the study. The researchers met with the manager and explained the purpose and procedures of the study, asking them to facilitate participant recruitment, scheduling of training sessions, and ensure that the study did not disrupt regular security operations. Each security personnel was provided with a written informed consent form after being informed about the study's purpose and procedures. They were assured that their participation involved no physical, social, or psychological risks and that they could withdraw from the study at any time during data collection without any penalty.

To maintain confidentiality and anonymity, each participant was assigned a unique code number used only for data analysis. No incentives or rewards were offered to participants for completing the questionnaire.

Validity and reliability

Following a comprehensive literature review to guarantee validity, the researchers developed the questionnaires. These were then evaluated by a panel of five academic experts, three professors in community health nursing and two in public health and preventive medicine, to evaluate content validity. According to the panel's feedback concerning the appropriateness of the material and the clarity of the phrases, only minor revisions were made to the self-administered questionnaire. After that, a translator with expertise in medical texts and research translated the questionnaire into Arabic. Subsequently, the Arabic version was back translated into English to ensure accuracy, and the translation was examined in comparison with the original text by the same team. Any minor discrepancies detected between the original and back-translated versions were resolved through group consensus.

Pilot study

A pilot study was carried out on 16 security personnel (10% of the sample) to evaluate the clarity and completeness of the tools and to estimate the time needed to complete the questionnaire. The results showed that no refinements and modifications were needed, so the subject was included in the actual sample. On average, it took 15-20 minutes to complete the structured questionnaire.

The reliability analysis was done by Cronbach's Alpha coefficient test. Cronbach's Alpha coefficient of the knowledge instrument was 0.853, for self-reported SSE practices was 0.859, and for the SSE attitude scale was 0.80.

Fieldwork

The fieldwork was carried out in 6 months, starting from the beginning of October 2024 to the end of March 2025. The study was carried out through four phases:

Phase I: Assessment phase: Data collection for the study took place over one month, beginning in early October 2024. The researchers visited the study setting three days a week, from 9 AM to 2 PM, throughout the designated period. During these visits, the researcher met with the campus security personnel at their on-site locations, explained the study's purpose and

procedures, and introduced the data collection tools. The security personnel then completed the self-administered questionnaires, self-rating scale, and attitude scale as part of a pre-test assessment of their baseline knowledge, attitudes, and self-reported SSE practices.

Phase II: Planning phase: The researchers developed and prepared the training program contents and learning materials based on the knowledge gaps that were found in the baseline data, reviewing relevant literature, and utilizing the American Cancer Society's recommended training manual, which included SSE videos and other accessible educational resources. The program content was then reviewed by six experts, three in community health nursing, two in public health and preventive medicine, and one from the dermatology department. The final version of the program was developed based on the feedback and recommendations from these experts. It consisted of both theoretical and practical sessions to be implemented over four weeks. Focusing on ensuring that the security personnel understand the key concepts and can confidently perform SSE. The goal of the training program was to educate them on the importance of regular SSE for the early detection of skin cancer.

Phase III: Implementation phase: This phase took three months, starting from the end of November 2024 to the end of February 2025. The researchers implemented a four-week training program in the security staff break rooms. It was carried out through four sessions (one/per week), three theoretical sessions with a duration ranging from 30-45 minutes for each session, and one practical session with a duration ranging from 25-35 minutes. The study participants were divided into 26 subgroups, with 6 security personnel in each subgroup. The researchers attended the study setting for 3 days/ week, starting from 9 AM to 2 PM, and interviewed three subgroups daily until the end of the predetermined period. Each subgroup was interviewed separately during their break time.

The first theoretical session included an orientation about the training program's goal and objectives, with an introduction to skin cancer. The second theoretical session included information about the importance of SSE and understanding skin changes. The third theoretical session focused on sun protection and preventive behaviors, including minimizing environmental UV

exposure, using protective clothing, wearing wide-brimmed hats, protecting the eyes, and applying sunscreen. The fourth session was practical, involving a demonstration and re-demonstration of the steps and methods of SSE. Each session began with a review and feedback on the previous session and an overview of the new session's aim and objectives. At the end of each session, the researchers briefed the security personnel on the objectives of the upcoming session, answered questions, and facilitated a discussion period. Further details of the group training program are provided in Table 1.

During the training sessions, the researchers used different teaching and learning methods and materials, including interactive lectures, group discussion, brainstorming, demonstration, re-demonstration, poster, and PowerPoint presentation. The researchers also gave pictures, brochures, mirrors, and training videos to each participant. The posters and pictures displayed information on the steps for SSE, the risks of skin cancer, and the importance of early detection. The brochure detailed how often SSE should be conducted, who should perform it, and included information on the ABCDE rule. Additionally, a video on SSE was shown to all participants and shared via a brief message sent to their mobile phones. These materials were created based on a guide developed by Friedman, Rigel, and Kopf (1985).

The posters and pictures provided information about the steps for performing SSE, the risks associated with skin cancer, and the importance of early detection. The brochure outlined who should perform SSE, how it should be done, and the recommended frequency, while also including information about the ABCDE rule. Additionally, a video demonstrating SSE was presented to all participants and subsequently shared with them via a short message on their mobile phones. These materials were developed following the guidelines established by **Friedman, Rigel, and Kopf (1985**). The informative posters were put in staff break rooms, the university security administration building, and entrances and exits of campus grounds as a reinforcement for the training program. Following the training, hats were distributed to the security personnel. Additionally, a WhatsApp group was established for the study participants to ensure effective follow-up and reduce dropout rates.

Phase IV: Evaluation phase: This phase was carried out after a month-long follow-up. The researchers

asked the participants to complete the same questionnaire about knowledge, attitude, and SSE self-reported practices used in the pre-test to evaluate the effect of the training program by comparing the difference between pre- and post-test scores.

Table 1: The training program was as follows.

Session	Subject	Time duration (minutes)
1st	Introduction Welcome and introduction: Brief overview of the program and its objectives. Icebreaker activity: Engage participants by asking about their current knowledge or practices regarding skin checks. Understanding skin cancer -Types of skin cancer (basal cell carcinoma, squamous cell carcinoma, melanoma). -Risk factors for skin cancer include prolonged sun exposure, fair skin, and family history. -Importance of early detection in improving survival rates.	30-45
2nd	Importance of skin self-examination -How regular self-examinations can lead to early detection. -The frequency of self-examinations Identifying skin changes -The ABCDEs of melanoma: asymmetry, border, color, diameter, evolving. -Other warning signs: non-healing sores, changes in texture, and new growths.	30-45
3rd	Sun protection and prevention -UV protection: discuss the importance of wearing sunscreen, protective clothing, and seeking shade. -Behavioral changes: encourage adopting sun-safe behaviors, such as avoiding peak sun hours.	30-45
4th	Demonstration of skin self-examination -Instructor-led demonstration: the researchers demonstrate a complete skin self-examination using a volunteer. -Use of mirrors: demonstrate how to use a full-length mirror and a handheld mirror for checking hard-to-see areas. -Checking moles and spots: show participants how to apply the ABCDE criteria in practice.	25-35

Data analysis

The analysis was conducted using SPSS (Statistical Package for the Social Sciences) version 26.0. Descriptive statistics, such as frequencies and percentages, were employed to present the data. For continuous variables, the arithmetic mean ± standard deviation was utilized, while percentages were used for categorical variables. The comparison between two paired groups for quantitative variables involved the use of the Wilcoxon signed rank test for non-normally distributed data and expressed in median (Min-Max). The McNemar test was used for the comparison of categorical variables. Spearman correlation was used to assess the correlation between knowledge, practice, and attitude. The significance level of $P < 0.05$ was considered statistically significant.

Results

Table 2 shows that 82.1% of the security personnel were between 30 to less than 40 years old, with the mean age and SD for them 37.65(10.69) years. It was found that 81.4%, 94.2%, and 84.6% of them were males, married, and living in rural areas, respectively. Regarding their income, 53.8% had enough income. About educational level, 79.5% of them had secondary education. Furthermore, the mean years of experience was 4.71(3.38) years.

Table 3 portrays that 1.28 % of the security personnel had a family history of skin cancer. They also had skin problems such as unusual moles, thin hair, freckles, and sunburn with 7.1%, 22.4%, 9.6%, and 21.8%, respectively. Additionally, 50.3%, 96.2% of them spent midday (11 AM-3 PM) outdoors and had few moles from 0 to 50. Regarding their skin color and type, 59% had bronzed skin, and 54.5% reported that their skin rarely burns and tans profusely to a dark brown. Concerning protective measures used during sun exposure, 84% reported staying in the shade.

Figure 1 illustrates that the source of information related to SSE was primarily the internet (19.9%), followed by family and TV (9.6%). Meanwhile, 60.4% have no information regarding SSE.

Table 4 reveals that in the post-test, there was a statistically significant increase in the median scores of the security personnel's knowledge regarding various aspects of SSE. This increase pertains to the definition and importance of SSE; skin abnormalities and signs found during SSE; tools and materials for SSE; time to perform SSE; the ABCDE rules; and the steps of SSE ($P < 0.001$).

Table 5 shows that in the post-test, there was a statistically significant increase in the median scores of the security personnel's self-reported practices of SSE. This increase pertains to preparation for SSE, body areas examined during SSE, and the ABCDE rule ($P < 0.001$).

Table 6 clarifies that regarding attitudes, 15.4% of security personnel were confident that they could examine their skin even if they had not done so in the past few months during the pre-test, which increased to 82.7% in the post-test. Additionally, 14.7% and 35.3% of participants reported that they could regularly examine their skin without assistance and that they regularly checked their skin to take care of their health in the pre-test, respectively, both increasing to 92.9% in the post-test.

Table 7 indicates that there were statistically significant differences between the pre-test and post-test in the total score levels of knowledge, self-reported practices, and attitudes regarding SSE among the security personnel. It was found that 94.2% of them had a poor total knowledge score level in the pre-test, while 79.5% had a good level in the post-test. In addition, 98.1% of them showed an unsatisfactory level of total self-reported practices in the pre-test, compared to 61.5% who showed a satisfactory level in the post-test. As for total attitudes, 35.3 % of them had high total attitude scores in the pre-test, while 100% had high attitude scores in the post-test.

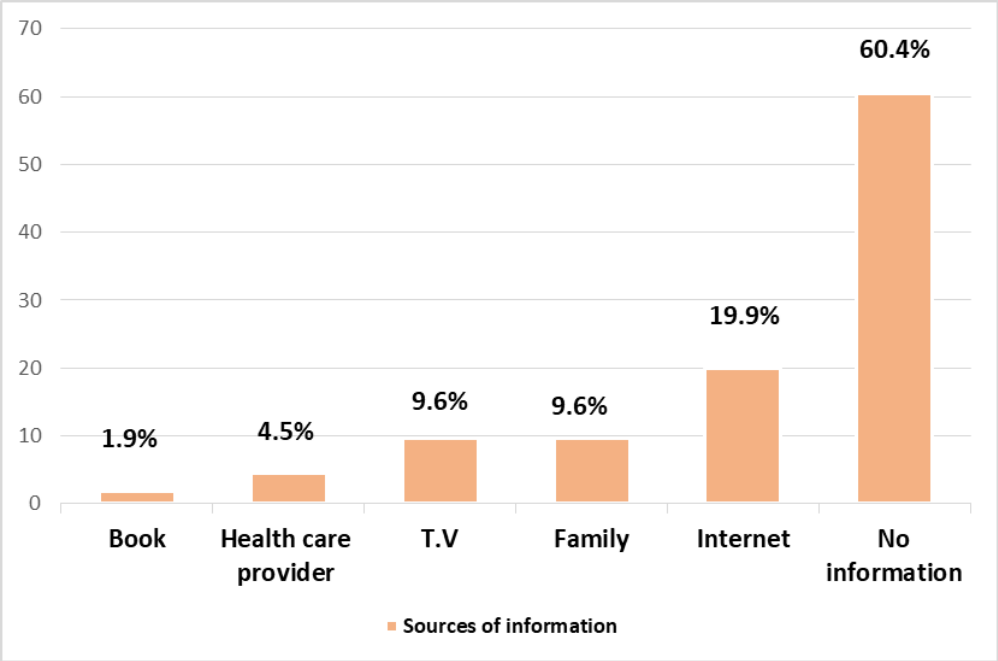
Table 8 shows that there were statistically significant positive correlations between the total knowledge score and total self-reported practices scores as well as between the total knowledge score and total attitudes score in both pre-test ($P<0.001$) and post-test ($P=0.027\&0.014$), respectively. Moreover, statistically significant positive correlations were found between the total self-reported practices score and the total attitudes score in both the pre-test ($P < 0.001$) and post-test ($P = 0.031$).

Table 2. Security personnel's socio-demographic and general characteristics

Item	N (156)	%
Age		
20 > 30	3	1.9
30 > 40	128	82.1
40 > 50	20	12.8
50 and more	5	3.2
Mean *(SD)*	**37.65(10.69)**	
Sex		
Male	127	81.4
Female	29	18.6
Current marital status		
Married	147	94.2
Single	7	4.5
Widow	2	1.3
Residence		
Rural	132	84.6
Urban	24	15.4
Income		
Enough	84	53.8
Not enough	72	46.2
Qualifications		
Illiterate	1	0.6
Primary	1	.0.6
Preparatory	1	0.6
Secondary	124	79.5
University	29	18.6
Years of work experience		
> 5	2	1.3
5 >10	29	18.6
10 >15	112	71.8
15 and more	13	8.3
Mean (SD)	**4.71(3.38)**	

Table 3. Security personnel's skin health history and sun exposure

Item	N (156)	%
Previous skin diseases	22	14.1
Family history of skin cancer	2	1.28
Skin problems		
Thin hair	35	22.4
Sun burn	34	21.8
Freckles	15	9.6
Unusual mole	11	7.1
Time spent outdoors		
Early morning (before 11 AM) and/or late afternoon or evening (after 3 PM)"	53	34
Midday (11 AM - 3 PM)	80	50.3
All day	23	14.7
Mole Numbers		
Few (up to 50)	150	96.2
Moderate (51-100)	6	3.8
Skin color		
Bronzed	92	59
Light	44	28.2
Very light	13	8.3
Dark	7	4.5
Skin type		
Type 1: Always burns, never tans, highly sensitive to UV exposure	4	2.6
Type II: Burns easily and tans minimally	31	19.9
Type III: Burns moderately and tans gradually to a light brown	22	14.1
Type IV: Burns minimally and always tans to a moderately brown color	7	4.5
Type V: Rarely burns, tans profusely to a dark brown	85	54.5
Type VI: Never burns, deeply pigmented, least sensitive to UV exposure	7	4.5
Protective measures during sun exposure		
Staying in the shadow	131	84
Sunglasses	25	16
Hat or Scarf	24	15.4
Clothing over	17	10.9
Sunscreen	13	8.3



*More than answered used

Figure (1): Security personnel's sources of information regarding skin self-examination (n=156)

Table (4). Comparison of the security personnel's score level of knowledge regarding skin self-examination before and one month after the training program (N=156)

Knowledge score level	Pre-test		Post-test		Test of significance	P value*
	N	%	N	%		
Definition of skin self-examination						
Poor	149	95.5	13	8.3	X^2=134.001	<0.001
Good	7	4.5	143	91.7		
Median (Min-Max)	1(0-2)		2(1-2)		Z=4.525	<0.001
Importance of skin self-examination						
Poor	130	83.3	5	3.2	X^2=133	<0.001
Fair	8	5.1	13	8.3		
Good	18	11.6	138	88.5		
Median (Min-Max)	1(0-5)		5(1-5)		Z=10.661	<0.001
Skin abnormalities and signs found during skin self-examination						
Poor	148	94.8	6	3.8	X^2=145	<0.001
Fair	4	2.6	24	15.4		
Good	4	2.6	126	80.8		
Median (Min-Max)	3(0-7)		6(3-7)		Z=10.898	<0.001
Tools and materials for skin self-examination						
Poor	154	98.8	11	7.1	X^2=144	<0.001
Fair	1	0.6	28	17.9		
Good	1	0.6	117	75		
Median (Min-Max)	0(0-4)		4(1-5)		Z=10.922	<0.001
Time to perform skin self-examination						
Poor	145	92.9	33	21.2	X^2=110.009	<0.001
Good	11	7.1	123	78.8		
Median (Min-Max)	0(0-2)		2(0-2)		Z=10.103	<0.001
ABCD rule						
Poor	149	955	8	5.1	Z=11.195	<0.001
Fair	0	0	21	13.5		
Good	7	4.5	127	81.4		
Madian (Min-Max)	0(0-5)		5(1-5)		Z=10.742	<0.001
Steps of performing skin self-examination						
Poor	129	82.7	7	4.5	X^2=136	<0.001
Fair	15	9.6	35	22.4		
Good	12	7.7	114	73.1		
Median (Min-Max)	1(0-10)		9(3-10)		Z=10.646	<0.001

X^2= McNemar's test **Z** = Wilcoxon Signed Rank Test * Significant (p< 0.05)

Table (5). Comparison of the security personnel's self-reported practice score level regarding skin self-examination before and one month after the training program (N=156)

Practice score level	Pre-test		Post-test		Test of significance	P value*
	N	%	N	%		
Preparation for skin self-examination						
Unsatisfactory	118	75.6	29	18.6		
Satisfactory	38	24.4	127	81.4	X^2= 78.222	<0.001
Median (Min-Max)	0(0-12)		10(7-12)		Z=10.105	<0.001
Body areas examined during skin self-examination						
Unsatisfactory	144	92.3	53	34		
Satisfactory	12	7.7	103	66	X^2= 83.505	<0.001
Median (Min-Max)	0(0-30)		24(18-30)		Z=10.634	<0.001
ABCDE rule						
Unsatisfactory	155	99.4	124	79.5		
Satisfactory	1	0.6	32	20.5	X^2= 29.032	<0.001
Median (Min-Max)	0(0-15)		10(5-15)		Z=10.816	<0.001

X^2= McNemar's test **Z** = Wilcoxon Signed Rank Test * Significant (p< 0.05)

Table (6). Comparison of security personnel's attitude regarding skin self-examination before and one month after the training program (N=156)

Items	Pre-test					Post-test				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
	N (%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)	N(%)
It is important to check my skin for skin cancer even if I have no symptoms	2(1.3)	1(0.6)	1(0.6)	9(5.8)	143(91.7)	0	0	1(0.6)	11(7.1)	144(92.3)
Checking my skin regularly is a priority for me	0	6(3.8)	11(7.1)	11(7.1)	128(82.1)	0	2(1.3)	12(7.7)	12(7.7)	130(83.3)
I think I could find something suspicious on my skin if it was there	24(15.4)	5(3.2)	6(3.2)	22(14.1)	99(63.5)	2(1.3)	2(1.3)	8(5.1)	28(17.9)	116(74.4)
If I saw something suspicious on my skin, I'd go to the doctor straight away	2(1.3)	0	0	10(6.4)	144(92.3)	0	0	0	11(7.1)	145(92.9)
I am confident in a doctor's ability to diagnose skin cancer	2(1.3)	3(1.9)	5(3.2)	17(10.9)	129(82.7)	0	0	0	20(12.8)	136(87.2)
I am confident that I can take up examining my own skin again even if I have not looked at my skin in the past few months	86(55.1)	9(5.8)	14(9)	23(14.7)	24(15.4)	0	0	0	27(17.3)	129(82.7)
I am able to keep examining my own skin regularly, even if I have no one to help me	87(55.8)	9(5.8)	14(9)	23(14.7)	23(14.7)	0	0	1(0.6)	10(6.4)	145(92.9)
If I regularly examine my skin, then I am helping to look after my own health	82(52.6)	2(1.3)	2(1.3)	15(9.6)	55(35.3)	0	0	0	11(7.1)	145(92.9)

Table (7). Comparison of security personnel's total score levels of knowledge, self-reported practice, and attitude regarding skin self-examination before and one month after the training program (N=156)

Variables	Pre-test		Post-test		Test of significance	P value*
	N	%	N	%		
Total knowledge score level						
Poor	147	94.2	0	0	Z=11.433	<0.001
Fair	9	5.8	32	20.5		
Good	0	0	124	79.5		
Median (Min-Max)	7(0-26)		31(23-36)		Z=10.839	<0.001
Total practice score level						
Unsatisfactory	153	98.1	60	38.5	X^2=89.095	<0.001
Satisfactory	3	1.9	96	61.5		
Median (Min-Max)	0(0-53)		44(33-55)		Z=10.796	<0.001
Total Attitude score level						
Low	101	64.7	0	0	X^2=108.079	<0.001
High	55	35.3	156	100		
Median (Min-Max)	20(8-32)		32(24-32)		Z=10.616	<0.001

X^2= McNemar's Test **Z** = Wilcoxon Signed Rank Test * Significant (p< 0.05)

Table (8). Correlation between knowledge, self-reported practice, and attitude scores before and one month after the training program (N=156)

Items	Test time	R	p
Knowledge and self-reported practice	Pre-test	0.672	<0.001*
	Post-test	0.177	0.027*
Knowledge and attitude	Pre-test	0.466	<0.001*
	Post-test	0.196	0.014*
Self-reported practice and attitude	Pre-test	0.460	<0.001*
	Post-test	0.172	0.031*

r=Spearman correlation * Significant (p< 0.05)

Discussion

Exposure to ultraviolet (UV) radiation is the primary preventable cause of skin cancer. Skin cancer constitutes a major global health concern, with incidence rates increasing faster than those of any other cancer type. Outdoor workers, as an occupational group, are particularly at high risk for developing skin cancer **(Troya Martín et al., 2023**). Research shows that performing SSE is advantageous for individuals at high risk. Consequently, creating effective target group-oriented interventions aimed at promoting SSE practices among outdoor workers in their workplace is of particular relevance **(Coroiu et al., 2020).** Training programs can play a pivotal role in equipping individuals with the information and skills necessary to drive meaningful behavioral changes. Thus, this study aimed to assess how the knowledge, practices, and attitudes of the outdoor campus security personnel regarding SSE were affected by this educational intervention. Regarding socio-demographic characteristics, it is noted that the age of the majority of the outdoor campus security personnel falls between 30 and 40 years old, and the majority of them are male. This age group and gender have significant criteria that increase susceptibility to skin cancer in Egypt. According to the study of **El-Khalawany et al. (2024**) on skin tumor characteristics at a large tertiary center in Egypt, the age group between 19- 59 years had the highest prevalence of skin tumors, with malignant tumors occurring more frequently in males. Furthermore, the present study found that most security personnel live in rural areas and have between 10 and 15 years of work experience. This is in agreement with **Wu, et al. (2022**), who investigated outdoor activities and sunburn in urban and rural families. They reported that people living in rural areas experience higher rates of melanoma incidence and mortality compared to those in urban settings, which may be attributed to greater exposure to UVR, whether from occupational or other sources. Additionally, **Wittlich et al. (2023),** in their GENESIS-UV study examining UVR exposure across 250 occupations, found that extended work experience as an outdoor worker is directly linked to greater cumulative UV exposure, thereby raising the risk of skin damage and skin cancer.

Concerning the security personnel's skin health history and sun exposure, the findings demonstrated that half of them work outdoors during peak UV hours (midday from 11 AM to 3

PM) when the sun's rays are most intense. This comes in line with **Mohsin & Ali (2022),** who examined the impact of UVR on outdoor workers and found that longer working hours increase UV exposure, making the duration of time spent at work a significant factor in UVR exposure.

The relationship between skin color and skin cancer is well recognized: individuals with less melanin in their skin have a higher risk of developing skin cancer. Melanin plays a crucial protective role, as it not only absorbs UV radiation but also acts as an antioxidant and neutralizes free radicals. It is well documented that people with darker skin tones experience a lower incidence of skin cancer compared to those with lighter skin **(Garbe et al., 2024; LaBerge et al., 2020)**. By skin color, the results of the study reveal that more than one-fourth of security personnel have light skin color. Moreover, less than one-fourth of them identified themselves as skin type I or II (most susceptible to sunburn). This result was consistent with research by **Peters et al. (2016)** on sun protection practices among outdoor workers during both work and leisure time. Similarly, **Troya Martín et al. (2023)** reported comparable results regarding skin type reactivity (I–III) based on the Fitzpatrick classification in their study assessing the risk of occupational skin cancer among outdoor workers.

The findings also showed that an informal source from the internet was the main source of knowledge for security personnel concerning skin safety and SSE. This highlights a significant gap in formal education and training on this topic. This reliance on the internet suggests that structured, credible resources on skin safety and SSE may be either inaccessible or insufficiently promoted to this group. This finding underscores the need for targeted educational interventions, such as structured training programs or easily accessible, authoritative resources, to provide security personnel with reliable, evidence-based knowledge.

The findings demonstrated that the study's hypothesis was accepted. This indicates that following the training program, the security personnel's knowledge, self-reported practices, and attitudes regarding SSE have improved.

After one month of receiving our training program, the security personnel's knowledge of SSE has increased. There were significant changes between the pre-test and post-test in their level of knowledge of the definition and importance of

SSE; skin abnormalities and signs found during SSE; tools and materials for SSE; time to perform SSE; the ABCDE rules; and the steps of SSE. The median for all domains of knowledge increased. This can be attributed to the comprehensive and multifaceted instructional approach employed by the researchers. The use of interactive lectures, group discussions, and brainstorming sessions facilitated active engagement and reinforced learning through varied educational techniques. Supplementary materials, such as posters, pictures, and brochures, provided visual aids, enhancing participants' understanding and recall of SSE steps. The inclusion of visual tools and hands-on resources, tailored to meet different learning styles, likely made the content more relatable and memorable. By integrating diverse methods and materials, the program effectively bridged knowledge gaps and promoted skill acquisition, contributing to the observed improvement in the security personnel's SSE knowledge.

This result is in line with the findings of **Erkin & Aygün (2020)** from their study on the impact of an educational intervention on nursing students' knowledge and attitudes toward SSE and skin cancer risks. They observed significant improvements between pre-test and post-test scores among participants, particularly in their understanding of how frequently SSE should be done, how to properly use a wall and hand mirror during SSE, and the reasons participants gave for not performing SSE. Another study by **Kudubes (2024)** examined the impact of sun protection education on nursing students' knowledge levels. The study showed that receiving this education significantly increased their knowledge about skin cancer and sun protection by a factor of 0.874 ($\beta = 0.874$), with the results being statistically significant ($p < 0.001$).

According to our results, the median of self-reported practices regarding SSE showed a sharp rise in the post-test following the training program. Significant improvements were observed between the pre-test and post-test in self-reported practices related to preparation for SSE, the body areas examined, and application of the ABCDE rule. The median for all domains of self-reported practices increased. Additionally, regarding security personnel's attitudes toward SSE, 35.3% had high attitude scores in the pre-test, which increased to 100% in the post-test. This notable increase in both self-reported practice and

attitudes scores can be attributed to the program's comprehensive and engaging design, which combined interactive and visual educational methods with practical reinforcement strategies. The use of demonstrations and re-demonstrations actively engaged participants and reinforced learning. Supplemental materials, such as mirrors and training videos, provided clear, accessible guidance on SSE steps, frequency, the ABCDE rule for early detection, and the importance of regular self-monitoring. Distributing hats and placing informative posters in key locations served as consistent visual reminders, promoting practice adherence in the participants' work environment. Furthermore, sending the 5-minute training video to participants' mobile phones reinforced the training content, enhancing both accessibility and retention.

This finding is compatible with a study by **Rowell et al. (2017)** on the evaluation of an SSE program. It demonstrated that watching the DVD had a larger and more immediate impact on skin-checking behavior and diagnosis of skin cancer. Another study by **Niu and Heckman (2022)** explored digital educational approaches for teaching SSE. The results demonstrated that participants in the high interactivity and customization group were more effective at correctly identifying abnormal skin lesions and exhibited a stronger intention to perform SSE compared to those in the low interactivity group. Moreover, a study by **Yeşilyurt, & Altunkürek (2024**) on the impact of skin cancer education and SSE. It was found that the rate of performing SSE after training was statistically significant and high in our study. In the pre-test, 20% of parents in the intervention group gave their children SSE, but this percentage climbed to 59.2% in the post-test. Consistent with our results, **Kamyab et al. (2023)** conducted a study on the impact of a series of theory-based educational interventions grounded in the health belief model to promote skin cancer prevention behaviors. They found that three months after the intervention, the experimental group showed significant improvements in knowledge (from 6.22 ± 1.52 to 12.26 ± 1.55), attitude (from 25.51 ± 5.48 to 52.36 ± 5.82), subjective norms (from 20.21 ± 5.20 to 43.32 ± 5.11), perceived behavioral control (from 17.64 ± 4.87 to 40.46 ± 4.58), behavioral intention (from 27.40 ± 5.33 to 61.46 ± 5.68), and skin cancer preventive behaviors (from 5.13 ± 1.35 to 12.84 ± 1.30), with these changes being statistically

significant (paired t-test, $p < 0.05$). In contrast, the control group showed no significant changes.

In this study, correlation analysis was conducted to explore how participants' knowledge, self-reported practices, and attitudes toward SSE were interrelated before and after the training program. A significant positive correlation was observed in the pre-test between the total knowledge score and both the self-reported practices and attitudes scores, suggesting that the security personnel with higher baseline knowledge about SSE were more likely to engage in recommended practices and hold favorable attitudes toward SSE. This implies that knowledge may serve as a foundational component influencing both behavioral and attitudinal readiness. Furthermore, the sustained positive correlation between practices and attitudes scores in both the pre- and post-test indicates a reinforcing relationship, where improved attitudes likely supported better adherence to SSE practices, and vice versa. The persistence of this association after the training program highlights the potential for the training program not only to enhance knowledge but also to foster a positive feedback loop between attitude and practice. This finding aligns with the study by **Baghani et al. (2024),** which evaluated knowledge, attitude, and practice related to skin cancer. Their results showed a positive correlation between knowledge, attitude, and practice concerning skin cancer among medical students and general practitioners.

This study highlights the vital importance of educational interventions in enhancing skin cancer prevention among outdoor campus security personnel, a population particularly vulnerable to sun exposure. The significant improvements observed in participants' knowledge, self-reported SSE practices, and attitudes following the training program demonstrate its effectiveness in fostering early detection behaviors. These findings highlight the critical role of structured health education in promoting preventive practices and empowering individuals to take charge of their skin health.

Conclusion

The present study concluded that the research hypotheses are supported and that training the outdoor campus security personnel about SSE has a positive impact on improving their related knowledge, attitudes, and self-reported practices. Furthermore, in the pre-test, significant positive correlations were found between participants' total knowledge scores

and both self-reported practices and attitudes scores, as well as between practices and attitudes scores in both the pre-test and post-test.

Recommendations

1. Incorporating a periodic SSE training program into the occupational health and safety programs for all outdoor campus security personnel to ensure retention of knowledge and maintenance of positive practices and attitudes toward SSE over time. These behavioral improvements are promising and, if sustained, may lead to a decrease in future skin cancer cases.
2. The university administration should develop and implement policies that promote regular skin health monitoring and provide access to resources, such as brochures, posters, and online tutorials, to reinforce SSE practices.

Funding

No funding was declared.

Conflict of interest

The authors state that there are no conflicts of interest.

Acknowledgments

The authors acknowledge the cooperation of the university security administrative staff and campus security personnel who participated in this study.

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