

# Sun Protective Behaviors in Daytime Outdoor Runners in Thailand

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## ABSTRACT:

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**Background:** Outdoor running has become popular in Thailand. However, performing outdoor activities during the daytime potentially introduces risk of harmful sun ray exposure.

**Objectives:** To explore the characteristics of daytime running activities and sun protective behaviors, including the demographic data of daytime runners, running behaviors, sun protective methods, reasons for not taking sun protective measures, and factors influencing the use of sun protective materials.

**Materials and Methods:** An online, questionnaire-based descriptive study was conducted from 1-31 May 2020 with Thai outdoor runners aged 18 years or older who had performed outdoor activities from 6 A.M. - 6 P.M. at least once during the previous year.

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**Results:** Of all 316 completed questionnaires, 106 (33.54%) were male, 197 (62.34%) were female and 13 (4.11%) were lesbian, gay, bisexual, transgender, or queer (LGBTQs). The average age was  $36\pm 9.68$  years. The average BMI was  $22.62\pm 3.53$  Kg/m<sup>2</sup>. The 44 (13.92%) participants used sunscreen only, whereas 83 (26.26%) participants used various types of sun protective equipment only. Factors that promoted sunscreen application were female ( $p<0.001$ ), LGBTQs ( $p=0.001$ ), and lower BMI ( $p=0.004$ ). The factor that promoted the use of sun protective equipment was older age ( $p=0.02$ ).

**Conclusion:** Less than half of all the Thai outdoor runners took proper sun protective precautions. Some participants never used sun protective materials. Therefore, Thai outdoor runners should be encouraged to increase sun protective behavior by being provided information regarding the harmful effects of sunlight.

**Key words:** Daytime outdoor runners, sun protective behaviors, sunscreen

## Introduction

Nowadays, outdoor running has become popular for the general population since it requires less equipment and movement skills, and because it brings freeness and fresh air throughout the activity. However, performing outdoor running activities during the daytime potentially introduces risk of harmful environmental exposure, such as to sun rays or air pollution, to the runners' bodies. Sun rays consist of multiple types of light, including infrared, visible, and ultraviolet (UV) rays<sup>1</sup>. Previous studies demonstrated that UV rays could damage skin both acutely and chronically<sup>2</sup>. They affect internal structures<sup>3</sup>, cause degeneration to the dermis of skin<sup>4</sup>, and potentially lead to skin cancer<sup>5</sup> (namely the three most common types of skin cancer: basal cell carcinoma, squamous cell carcinoma, and malignant melanoma). Some outdoor

runners suffer from effects of UV after running during the day, such as sunburn or hyper-pigmented skin.

UV rays have a detrimental effect on human skin in a dose-dependent fashion based on intensity and duration of contact<sup>6,7</sup>. For quantitative measurements, an amount of UV rays, measured by UV index (UVI), has been widely applied. UVI is formulated using the spectrum of erythematic action induced by UV radiation on human skin. Previous studies reported that contact with UV rays more than 3 UVI significantly damages the skin<sup>8,9</sup>. Since Thailand is a tropical country and is located close to the equinoctial line, people living in Thailand are susceptible to high UVI. UVI in Thailand is lower than 3 in the early morning and increases to levels higher than 3 by 8 A.M. After reaching the highest level of 12

at noon, UVI decreases and reaches levels lower than 3 again at 4 P.M.

The previous study from temperate climate countries showed that daytime outdoor runners had a greater risk of skin cancers than the general population. This might have resulted from daytime runners' higher and longer exposure to sun rays<sup>10-12</sup>. Therefore, sun protective behaviors are important for outdoor runners to prevent the effects of sun rays on the skin. According to the World Health Organization (WHO)'s recommendation, sun protective behaviors should be applied when the UVI is higher than 3<sup>13</sup>. Sun protective behaviors include applying sunscreen as well as using sun-protective materials such as hats and clothes. The previous study reported that applying sunscreen could protect skin from sun rays in both the short and long term if used properly and practically<sup>14</sup>. Furthermore, it was found that combining sunscreen and sun protective materials could further protect the skin from the sun's effects. Therefore, using sunscreen along with other sun protective materials should be encouraged. Since UVI depends on the geographical property of the measured area, there should be a study specifically investigating the characteristics and the influencing factors of sun protective behaviors in Thai people who are daytime outdoor runners. Thus, the objectives of this study are to explore the characteristics of daytime running activities

and sun protective behaviors, including demographic data, daytime running behaviors and styles, sun protective behaviors and reasons for not taking sun protective measures, as well as factors promoting the use of sun protective materials.

### Materials and Methods

This study was an online, questionnaire-based descriptive study, which was conducted from 1-31 May 2020. It was officially approved by ethics committees, Lamphun Public Health Center, Lamphun, Thailand (REC 2563-09), and was in accordance with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

### Participants

Participants were recruited via face-to-face or social networks (chatting application Line®, Facebook®, Facebook Messenger). The inclusion criteria included Thai citizenship, at least 18 years of age, participation in outdoor running from 6 A.M. - 6 P.M. at least once in the previous year, and able to read and write in Thai.

The representative sample size was calculated based on the study by Duarte and colleagues<sup>15</sup>, which investigated Sun protective behaviors and skin cancer literacy among outdoor runners and reported a prevalence of sun protective behaviors of 23.50%. By using Wayne W.D.'s formula, which

is  $n = \frac{z^2 \cdot \frac{\alpha p(p-1)}{1-\frac{\alpha}{2}}}{d^2}$ . Taking  $p = 0.235$ , Error (d) = 0.05, and Alpha ( $\alpha$ ) = 0.05, the representative sample is 277. To prevent an inadequate sample from incomplete questionnaires, 400 questionnaires were sent to the potential participants.

### Questionnaire

The questionnaire was newly developed in Thai (Appendix 1) and was conducted via Google Form. The questionnaire link was distributed among runners in a group on the chatting application Line®. The questionnaire was adapted from previous studies<sup>16-19</sup>. It contained details regarding personal information (gender, age, education, income, underlying diseases, direct relative family history of skin cancer, and history of skin sensitivity), types of outdoor running activities (overall duration of sun exposure, time, and place), sunscreen regimen details or reasons for not applying it, and details regarding sun protective materials or reasons for not using them. Prior to being sent to the participants, the questionnaire was tested on a group of 20 volunteers in order to improve its accuracy and clearness. In addition, it was also proven and verified by methodological specialists and content-expert dermatologists.

### Statistical analyses

Categorical variables were described using frequency as percentages. Numerical variables were presented using arithmetic means and standard deviations (SD). Differences between the performing and the non-performing sun protective behavior groups were compared using the independent t-test or chi-square test, depending on the type of parameter. Independent influencing factors of performing sun protective behavior were identified using multivariate logistic regression analysis. All statistical analyses were performed using the STATA SE 16 program. A p-value of less than 0.05 was considered statistically significant.

### Results

Of all 400 distributed questionnaires, 339 questionnaires were returned. Among these, 23 questionnaires were incomplete or unreliable (answering incorrectly, for example, by responding that they use sunscreen, but still giving reasons for not using it) and were excluded from the analyses. Table 1 shows the demographic data of the participants. 197 (62.34%) participants of them were female. The mean age was  $36 \pm 9.68$  years. The mean BMI was  $22.62 \pm 3.53$  Kg/m<sup>2</sup>. Regarding level of education, most of the participants had graduated with a bachelor degree (67.09%), followed by those who had completed postgraduate education (22.78%). Regarding monthly income, most of the

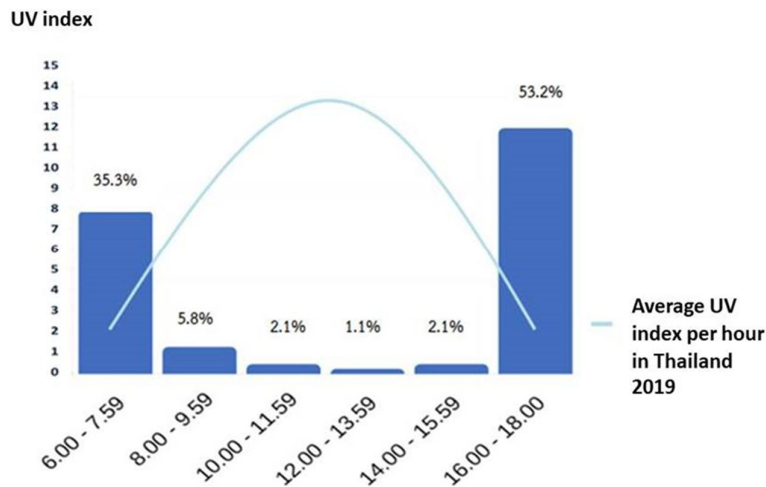
participants earned 15,000 - 49,999 baht per month (61.09%), followed by 50,000 - 99,999 baht per month (22.47%). As for underlying diseases, 55 (17.40%) people had underlying diseases, and 9 (2.85%) people had direct family history of skin cancer.

**Table 1** Demographic data of Thai outdoor runners participating in this study

	Total	n (%)
		<b>316</b>
Sex	Males	106 (33.54)
	Females	197 (62.34)
	LGBTQs	13 (4.11)
	Age (years)	(Mean 36.9, SD $\pm$ 9.68)
Age ranges	18-35	164 (51.90)
	36-55	138 (43.67)
	$\geq$ 56	14 (4.43)
	Body mass index (kg/m <sup>2</sup> )	(Mean 22.62, SD $\pm$ 3.53)
Body mass index ranges	< 18.49	23 (7.28)
	18.50-24.99	234 (74.05)
	25-29.99	47 (14.87)
	>30	12 (3.80)
Education	Primarily education	3 (0.95)
	Secondary education	29 (9.18)
	Bachelor degree	212 (67.09)
	Postgraduate degree	72 (22.78)
Income per month	<15,000 Baht	38 (12.02)
	15,000 – 49,999 Baht	193 (61.09)
	50,000 – 99,999 Baht	71 (22.47)
	$\geq$ 100,000 Baht	14 (4.43)
Underlying disease	Yes	55 (17.40)
	None	261 (82.60)
Direct relative family history of skin cancer	Yes	9 (2.85)
	None	307 (97.16)
History of skin sensitivity	Yes	73 (23.10)
	None	243 (76.90)

**Table 1** Demographic data of Thai outdoor runners participating in this study

	Total	n (%)
		<b>316</b>
Length of daytime running activities	≤6 months	46 (14.56)
	>6 months but < 1 year	47 (14.87)
	≥1 year	223 (70.57)
Average duration of daytime running per day	≤ 30 minutes	28 (8.86)
	> 30-60 minutes	205 (64.87)
	> 1 hour but < 2 hours	73 (23.10)
	≥ 2 hours	10 (3.16)
Frequency of running activities per week	1-2 days	144 (45.57)
	3-4 days	130 (41.14)
	> 5 days	42 (13.29)
Apply sunscreen only		44 (13.92)
Use different kind of sun protective equipment		83 (26.26)
Use sunscreen combined with various types of sun protective equipment		101 (31.96)
Not use sun protective materials		88 (27.85)



**Figure 1** The relation between the average UV index for different time periods in Thailand in 2019 and the frequency of daytime runners in percentage (UVI levels are recorded by satellite, recorded in 18 provinces throughout Thailand.)

Focusing on the characteristics of daytime outdoor running, the times during which participants performed running activities were divided into 2 periods, as shown in Figure 1. Those running during the low UVI period (88.50%) preferred to run from 4 - 6 P.M. and 6 - 7:59 A.M. Those running during the high UVI period (11.50%) preferred to run from 8:00 A.M. to 3:59 P.M. Table 2 shows the use of sunscreen and sun protective equipment for each period of time. During the high UVI period (8.00 A.M. – 3.59 P.M.), 25 (4.90%) used sunscreen, 33 (6.47%) did not use sunscreen while 46 (9.02%) used sun protective equipment and 12 (2.35%) did not use sun protective equipment. For the low UVI period (6.00-7.59 A.M. and 4.00 – 6.00 P.M.), 207 (40.59%) used sunscreen, 245 (48.04%) did not use sunscreen while 274 (53.73%) used sun protective equipment and 178 (34.90%) did not use sun protective equipment. Table 3 shows the distribution of the use of sunscreen and sun protective equipment during the time period that has low UVI level versus high UVI level. We found no significantly different use of sunscreen (comparing use versus not use between high UVI level and low UVI level results in ratios of 1:1.32

and 1:1.18), but there was a markedly different use of sun protective equipment during the high UVI level period (comparing the ratio of use versus not use between high UVI level and low UVI level results in ratios of 3.83:1 and 1.54:1). The length of the daytime running activities was reported, and 46 (14.56%) people had been running for less than 6 months, 47 (14.87%) people had been running for over 6 months but less than a year, and 223 (70.57%) people had been running for over a year. The average duration of daytime running per day was reported, and 28 (8.86%) people ran less than 30 minutes a day, 205 (64.87%) people ran 30-60 minutes a day, 73 (23.10%) people ran 1-2 hours a day, and 10 (3.16%) people ran more than 2 hours a day. Regarding the frequency of running activities per week, 144 (45.57%) people ran 1-2 days a week, 130 (41.14%) people ran 3-4 days a week, and 42 (13.29%) people ran more than 5 days a week. Regarding experiences of skin sensitivity, including wheal, erythema, and skin irritation, during daytime outdoor running, 73 (23.10%) people reported having experienced these issues, and 243 (76.90%) people reported they had not.

**Table 2** The use of sunscreen and sun protective equipment based on time period

Time	Sunscreen		Sun protective equipment	
	n (%)		n (%)	
	510		510	
	Use	Not use	Use	Not use
6.00 A.M. - 7.59 A.M.	87(17.06)	93(18.24)	121(23.72)	59(11.57)
8.00 A.M. - 9.59 A.M.	14(2.74)	15(2.94)	21(4.12)	8(1.57)
10.00 A.M. - 11.59 A.M.	4(0.78)	7(1.37)	11(2.15)	0(0.00)
12.00 A.M. - 1.59 P.M.	3(0.59)	4(0.78)	6(1.18)	1(0.20)
2.00 P.M.- 3.59 P.M.	4(0.78)	7(1.37)	8(1.57)	3(0.59)
4.00 P.M. – 6.00 P.M.	120(23.53)	152(29.80)	153(30.00)	119(23.33)

**Table 3** The use of sunscreen and sun protective equipment during high UVI period compare and low UVI period

Time	Sunscreen			Sun protective equipment		
	n (%)			n (%)		
	510			510		
	Use	Not use	Use: Not use	Use	Not use	Use: Not use
6.00-7.59 A.M. and 4.00-6.00 P.M. (low UVI period)	207 (40.59)	245 (48.04)	1:1.18	274 (53.73)	178 (34.90)	1.54:1
8.00 A.M. - 3.59 P.M. (high UVI period)	25 (4.90)	33 (6.47)	1:1.32	46 (9.02)	12 (2.35)	3.83:1

Regarding sun protective behaviors, 44 (13.92%) people used only sunscreen whereas 83 (26.26%) people used only various types of sun-protective equipment, and 101 (31.96%) people used sunscreen combined with various types of sun protective equipment. Furthermore, there were 88 (27.85%) people who did not use sun protective materials during daytime running. Regarding the application of sunscreen, different participants applied sunscreen to different parts

of the body, such as the face or neck (37.49%), arms and the backs of hands (30.39%), legs (22.23%), and other parts (9.88%), including the body and the backs of ears. It was found that 82.00% of the participants applied sunscreen properly according to the recommendations of the 2010 Clinical Practice Guidelines for Sunscreen by the Dermatological Society of Thailand<sup>16</sup>. Notably, we only focused on the assessment of appropriate amount of sunscreen

applied to the face and neck areas since the surface areas of other body parts could vary widely. Timing for applying sunscreen was reported, with 72.75% applying 15-13 minutes before running outside, 15.64% applying and running immediately, 4.87% applying again after running for 2 hours, and 6.73% applying at other times (such as in the morning as part of a daily routine). In addition to sunscreen, some participants used other sun protective equipment, including brimmed hats (25.00%), arm sleeves (23.80%), jogging pants (16.24%), long sleeved shirts (15.50%), and others such as a cap and sunglasses (19.45%). The frequency of using sunscreen or other sun protective materials was divided into 3 groups, including always (nearly 100%), usually (>50% but <100%), and sometimes (less than 100%). For sunscreen, 35.14% of participants responded that they always apply it, 39.30% responded "usually", and 25.55% responded "sometimes". In terms of other sun protective equipment, 16.30% responded that they always used it, 38.10% responded "usually", and 45.60% responded "sometimes". The reasons for not applying sunscreen were that it was only a short period of time so sun rays would not damage their skin (25.00%), it was uncomfortable and distressing when running (for example, it was uneasy to do makeup) (21.00%), there was still no harmful impact on the body from sunlight even without

sunscreen (19.05%), it reduces the duration of exercise (11.33%), and it is more expensive (23.62%). The reasons for not using sun protective equipment were that it was uncomfortable and distressing when running (32.60%), it was only a short period of time (29.90%), there was still no harmful impact on the body from sunlight even without protective gear (22.40%), sunscreen was enough (7.80%), and it was complicated (7.30%).

Table 4 demonstrates the correlations between applying sunscreen and other factors. By using univariate analyses, chi-square and independent t-test, there were 2 factors significantly correlated with applying sunscreen, including gender ( $p < 0.001$ , by chi-square) and BMI ( $p < 0.001$ , by Independent t-test). When using multivariate logistic regression analysis, gender and BMI were independent influencing factors of applying sunscreen. For instance, by dividing gender into male, female, and LGBTQs, females applied sunscreen more than males with an odds ratio of 7.62 ( $p < 0.001$ , 95% CI 4.03- 14.39), whereas LGBTQs participants applied sunscreen more than males with the odds ratio of 10.03 ( $p = 0.001$ , 95% CI 2.65-37.99). In addition, it was demonstrated that lower BMI correlated with higher chances of using sunscreen. For each increase in BMI of 1  $\text{kg/m}^2$ , the chance of applying sunscreen was decreased by 0.88 times (odds ratio 0.88,  $p = 0.004$ , 95% CI 0.81-0.96) (Table 6).

Table 5 demonstrates the correlation between using sun protective equipment and other factors. By using univariate analyses, chi-square and independent t-test, there were 3 factors significantly correlated with using sun protective equipment, namely gender, age, and BMI. When using multivariate logistic regression

analysis only age was still an independent influencing factor of using sun protective equipment, with the chance of using sun protective equipment increasing by 1.03 times for each increase in age of 1 year (odds ratio 1.03,  $p=0.02$ , 95% CI 1.00-1.06) (Table 7).

**Table 4** Univariate analysis regarding correlations between factors and the use of sunscreen

Factors	Sunscreen		p-value	
	Use n (%)	Not use n (%)		
Sex	Males	16 (11.03)	90 (52.63)	<0.001 <sup>a*</sup>
	Females	120 (82.76)	77 (45.03)	
	LGBTQs	9 (6.21)	4 (2.34)	
Age (years) (Mean ± SD)	36.68 ± 9.66	37.07 ± 9.71	0.719 <sup>b</sup>	
Body mass index (kg/m <sup>2</sup> ) (Mean ± SD)	21.59 ± 2.81	23.49 ± 3.83	<0.001 <sup>b*</sup>	
Education	Primarily education	0 (0.00)	3 (1.75)	0.315 <sup>a</sup>
	Secondary education	11 (7.59)	18 (10.53)	
	Bachelor degree	101 (69.66)	111 (64.91)	
	Postgraduate degree	33 (22.76)	39 (22.81)	
Income per month	<15,000 Baht	15 (10.34)	23 (13.45)	0.427 <sup>a</sup>
	15,000 – 49,999 Baht	95 (65.52)	98 (57.31)	
	50,000 – 99,999 Baht	28 (19.31)	43 (25.15)	
	≥ 100,000 Baht	7 (4.83)	7 (4.09)	
Underlying disease	Yes	22 (15.17)	33 (19.31)	0.335 <sup>a</sup>
	None	123 (84.83)	138 (80.70)	
Direct relative family history of skin cancer	Yes	5 (3.45)	4 (2.34)	0.555 <sup>a</sup>
	None	140 (96.55)	167 (97.66)	
History of skin sensitivity	Yes	36 (24.83)	37 (21.64)	0.503 <sup>a</sup>
	None	109 (75.17)	134 (78.36)	

<sup>a</sup>chi-square test, <sup>b</sup>independent t-test, \*significant at  $p<0.05$

**Table 5** Univariate analysis regarding correlations between factors and the use of sun protective equipment

Factors		Use of sun protective equipment		p-value
		Use n (%)	Not use n (%)	
Sex	Males	53 (28.80)	53 (40.15)	<b>0.006<sup>a</sup></b>
	Females	127 (69.02)	70 (53.03)	
	LGBTQs	4 (2.17)	9 (6.82)	
Age (years) (Mean ± SD)		38.21 ± 9.53	35.06 ± 9.61	<b>0.004<sup>b</sup></b>
Body mass index (kg/m <sup>2</sup> ) (Mean ± SD)		22.18 ± 2.94	23.22 ± 4.15	<b>0.009<sup>b</sup></b>
Education	Primarily education	1 (0.54)	2 (1.52)	0.315 <sup>a</sup>
	Secondary education	18 (9.78)	11 (8.33)	
	Bachelor degree	129 (70.11)	83 (62.88)	
	Postgraduate degree	36 (19.57)	36 (27.27)	
Income per month	<15,000 Baht	20 (10.87)	18 (13.64)	0.221 <sup>a</sup>
	15,000 – 49,999 Baht	121 (65.76)	72 (54.55)	
	50,000 – 99,999 Baht	35 (19.02)	36 (27.27)	
	≥ 100,000 Baht	8 (4.35)	6 (4.55)	
Underlying disease	Yes	35 (19.02)	20 (15.15)	0.371 <sup>a</sup>
	None	149 (80.98)	112 (84.85)	
Direct relative family history of skin cancer	Yes	4 (2.17)	5 (3.79)	0.395 <sup>a</sup>
	None	180 (97.83)	127 (96.21)	
History of skin sensitivity	Yes	48 (26.09)	25 (18.94)	0.137 <sup>a</sup>
	None	136 (73.91)	107 (81.06)	

<sup>a</sup>chi-square test, <sup>b</sup>independent t-test, \*significant at p<0.05

**Table 6** Multivariate logistic regression analysis of correlations between factors and applying sunscreen

Factors		Odd ratio	P-value	95 % CI
Sex compare with males	Females	7.62	< <b>0.001*</b>	4.03 -14.39
	LGBTQs	10.03	<b>0.001*</b>	2.65 – 37.99
Age (years)		0.99	0.30	0.96 – 1.01
Body mass index (Kg/m <sup>2</sup> )		0.88	<b>0.004*</b>	0.81 – 0.96

**Table 6** Multivariate logistic regression analysis of correlations between factors and applying sunscreen

Factors		Odd ratio	P-value	95 % CI
Income compare	15,000- 49,999 baht	1.07	0.88	0.47 – 2.45
with <15,000 baht	50,000 – 99,999 baht	0.92	0.86	0.35 – 2.38
	≥ 100,000 baht	1.77	0.45	0.40 – 7.75
Underlying disease		0.81	0.55	0.40 – 1.62
Direct relative family history of skin cancer		1.66	0.53	0.34 – 8.17
History of skin sensitivity		1.10	0.34	0.60 – 2.01

95 % CI = 95% confidence interval, \*significant at  $p < 0.05$

**Table 7** Multivariate logistic regression analysis of correlations between factors and using sun protective equipment

Factors		Odd ratio	P-value	95 % CI
Sex compare with	Females	1.36	0.25	0.80 – 2.29
males	LGBTQs	0.47	0.25	0.13 – 1.70
Age (years)		1.03	<b>0.02*</b>	1.00 – 1.06
Body mass index (Kg/m <sup>2</sup> )		0.93	0.06	0.87 – 1.00
Income compare	15,000- 49,999 baht	1.24	0.57	0.59- 2.58
with <15,000 baht	50,000 – 99,999 baht	0.66	0.34	0.29 – 1.54
	≥ 100,000 baht	0.96	0.95	0.26 – 3.61
Underlying disease		1.16	0.65	0.60 – 2.23
Direct relative family history of skin cancer		0.54	0.40	0.13 – 2.21
History of skin sensitivity		1.48	0.18	0.84 – 2.63

95 % CI = 95% confidence interval, \*significant at  $p < 0.05$

## Discussion

The major findings of this study are 1) the frequency of applying sunscreen and sun protective equipment for Thai outdoor runners were 13.92% and 26.26%, respectively, and 2) the independent factors that positively influenced application of sunscreen were female and

LGBTQs genders as well as lower BMI, whereas the independent factor that positively influenced use of sun protective equipment was older age. However, before applying these results in clinical practice, some interesting points need to be discussed.

Regarding the frequency and characteristics of applying sunscreen, this study found that there were 44 (13.92%) participants who applied sunscreen only. The most common sites for applying sunscreen were the face, neck, arms, and backs of the hands, respectively. Among participants who applied sunscreen, 72.75% applied sunscreen 15-30 minutes before running, which is proper. On the other hand, 15.64% applied sunscreen and ran immediately, which is improper since the cream is not fully absorbed. In addition, only 4.87% applied sunscreen again after 2 hours of running. In terms of the frequency of using sunscreen, only 35.14% of all participants and a half of the participants who used sunscreen applied sunscreen almost all the time when running outdoors. This improper usage of sunscreen reflects Thai people's inadequate knowledge of using sunscreen. Regarding the prevalence and characteristics of using sun-protective equipment, 83 (26.26%) participants preferred this kind of protection only, which was higher than the use of sunscreen only. This might be because wearing sun protective equipment is easier and more convenient than applying sunscreen, especially in a tropical area such as Thailand. We found a markedly different use of sun protective equipment during the high UVI level period. However, only 16.30% of the participants regularly used them. Moreover, the most common sun protective equipment

reported in this study was a brimmed hat, followed by sleeves, both of which cannot fully protect all parts of the body. All these results indicate that Thai outdoor runners inadequately use sun protective behaviors. Interestingly, the characteristics and frequency of sun protective behaviors reported in this study, namely regarding application of sunscreen and differences between genders, are consistent with those from the study conducted by Catherine M. Olsen and colleagues<sup>20</sup>. Notably, participants in this study reported that they preferred running from 4 - 6 P.M. (53.20%) and from 6 - 7.59 A.M. (35.30%), which are periods with low UVI. During these times, UVI is approximately 2-3, indicating low sunlight. This might be responsible for the relatively low frequency of sun protective behavior since most Thai outdoor runners avoid contact with sunlight by running during the lower sunlight periods.

Regarding the factors associated with application of sunscreen, it was found in this study that being female or LGBTQs were independent influencing factors for application of sunscreen. This result was consistent with the results from previous studies, which demonstrated that female runners used sunscreen more than male runners<sup>20-23</sup>. This might have resulted from the fact that in the general population, females often take good care of their skin, resulting in a higher rate of using sun

protective products than males<sup>24</sup>. No study has clearly elucidated the impact of being LGBTQs on sun protective measures. It is proposed that the mechanism underlying the positive effect demonstrated in our study of being LGBTQs on sunscreen application was similar to that for female participants, which was associated with attention to body image. Regarding the effect of BMI on applying sunscreen, it was found in this study that lower BMI was correlated with a higher rate of applying sunscreen. This might be a coincidence resulting from the fact that people with lower BMI might pay greater attention to their health, causing a higher rate of applying sunscreen when compared to those with higher BMI. Nevertheless, the study of Elizabet Saes da Silva from Brazil<sup>25</sup> found that BMI was not a significant influencing factor for sunscreen use. This inconsistency might have resulted from a lower average age of the representative group of this study when compared with the previous study. In general, it can be assumed that older people pay attention to their body image less than younger people. The effect of age might overwhelm the effect of BMI, resulting in no significant effect of BMI detected in the previous study.

Regarding the associating factors of using sun protective equipment, it was found in this study that only age was an independent influencing factor for use of sun protective equipment.

Outdoor runners with older age used sun protective equipment more than their younger counterparts. Unlike sunscreen, sun protective equipment seems to be less related to body image and more related to older people's familiarity with sun protective gear, resulting in the reciprocal effect of age on applying sunscreen and using sun protective equipment. This result is consistent with the results of a previous study, which demonstrated that people older than 35 years old took sun protective measures more often than those younger than 35 years old, which was associated with concern for their medical condition, especially sun-damaged skin issues such as skin degradation or skin cancer<sup>26</sup>. Notably, in this study, there was no demonstrated effect of education on sun protective behavior. This might be due to the fact that this study's representative group had a relatively high level of education (89.87% had higher or equal to a bachelor's degree). This result is consistent with the results of a previous study that shows no effect of education on the use of sun protective materials and awareness of protecting themselves from the sunlight<sup>15</sup>.

Regarding the reasons for not using sunscreen or sun protective equipment, this study demonstrated that lack of sun protective behavior was due to problems regarding both knowledge and attitude, which is relevant to other research<sup>12</sup>. Some of the study participants

reported that they did not use sunscreen and sun protective equipment (25.00% and 29.90%, respectively) due to lack of knowledge (thinking that it was only a short period of time and/or no harm from sunlight). On the other hand, some participants reported that they did not use sunscreen and sun protective equipment (21.00% and 32.60%, respectively) due to their attitude regarding these measures (thinking that it is inconvenient or wasting time for wearing it). Therefore, runners should be encouraged to increase sun protective behavior by both presenting them with knowledge regarding the harmful effects of sunlight and the benefits of protections, as well as altering their attitude regarding sun protection routines via direct face-to-face meetings with healthcare providers or via media, including social media.

### **Study Limitations**

Some limitations of this study need to be addressed. First, the study design was a descriptive study. Therefore, only correlations without a causative direction could be demonstrated. In addition, the effect of sun protective behaviors on the development of skin disorders in outdoor runners has not been clearly demonstrated. Further prospective longitudinal studies should be conducted to prove the causation of each factor, such as age and BMI, on sun protective behaviors as well as to

demonstrate the effect of sun protective behaviors on the development of skin disorders. Regarding the methodology, conducting questionnaires online brought limitations to some runners who do not normally access the internet. This limitation is confirmed by the representative group in this study, which was relatively young and had a high level of education, which is also another limitation regarding external validity. This should be carefully considered when applying these results to other population groups with different demographic data from the group in this study. Another methodological limitation is the self-administered questionnaire used, which some participants might have incompletely understood and answered incorrectly. Combined online and offline, face-to-face, paper-based questionnaires, which allow participants to recheck their understandings with a reviewer might be conducted to overcome this limitation.

### **Conclusion**

Less than half of Thai outdoor runners had proper sun protective behaviors. Some participants never used sun-protective materials. The reasons for this are lack of both knowledge and positive attitude regarding sun protection. This inadequate use of sun protective behaviors highlights the importance of both introducing knowledge and changing attitudes regarding the harm of sunlight and the benefits of sun

protection measures for Thai outdoor runners to prevent sunlight-related skin disorders.

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## Appendix 1

แบบสอบถามพฤติกรรมกำบังแสงแดดกับนักวิ่งกลางแจ้ง

1) ข้อมูลทั่วไป

1.1 เพศ  ชาย  หญิง  เพศทางเลือก (LGBTQs)

1.2 อายุ \_\_\_\_\_ ปี

1.3 น้ำหนัก \_\_\_\_\_ กิโลกรัม , ส่วนสูง \_\_\_\_\_ เซนติเมตร

1.4 ระดับการศึกษา

ประถมศึกษา  มัธยมศึกษา, ปวช., ปวส.

ปริญญาตรี  สูงกว่าปริญญาตรี

1.5 รายได้เฉลี่ยต่อเดือน

น้อยกว่า 15,000 บาท  15,000 - 49,999 บาท

50,000-99,999 บาท  มากกว่าหรือเท่ากับ 100,000 บาท

1.6 โรคประจำตัว  ไม่มี  มี (โปรดระบุ) \_\_\_\_\_

1.7 ท่านมีญาติสายตรง (บิดา, มารดา, พี่, น้อง, บุตร, หลาน) ป่วยเป็นโรคมะเร็งผิวหนังหรือไม่

มี  ไม่มี

1.8 ท่านเคยมีอาการทางผิวหนังหลังจากการวิ่งกลางแจ้ง (แสบผิว, รอยแดง/ดำ, ผิวลอก, ตุ่มน้ำ) หรือไม่

มี  ไม่มี

2) รูปแบบการวิ่งกลางแจ้งและความถี่

2.1 ช่วงเวลาที่ท่านออกกำลังกายกลางแจ้ง (สามารถตอบได้มากกว่า 1 ช่วง)

6.00 - 7.59 น.  8.00 - 9.59 น.  10.00 - 11.59 น.

12.00 - 13.59 น.  14.00 - 15.59 น.  16.00 - 18.00 น.

2.2 ท่านเริ่มออกกำลังกายกลางแจ้งตั้งแต่เมื่อไหร่

น้อยกว่าหรือเท่ากับ 6 เดือน  มากกว่า 6 เดือน แต่น้อยกว่า 1 ปี  มากกว่าหรือเท่ากับ 1 ปี

2.3 ระยะเวลาที่ใช้ท่านในการวิ่งกลางแจ้งในแต่ละครั้งโดยเฉลี่ย

น้อยกว่าหรือเท่ากับ 30 นาที  มากกว่า 30 นาทีถึง 1 ชั่วโมง  มากกว่า 1 ถึง 2 ชั่วโมง

มากกว่า 2 ชั่วโมง

2.4 ท่านออกกำลังกายด้วยการวิ่งกลางแจ้งบ่อยแค่ไหน

1 ถึง 2 วันต่อสัปดาห์  3 ถึง 4 วันต่อสัปดาห์  มากกว่าหรือเท่ากับ 5 วันต่อสัปดาห์

2.5 สถานที่ท่านออกกำลังกาย (สามารถเลือกตอบได้มากกว่า 1 ข้อ)

สวนสาธารณะ  สนามกีฬา/ลู่วิ่ง  
 ถนนทางหลวง/สถานที่ราชการ  ทางธรรมชาติ/วิบาก

3) ท่านใช้ครีมกันแดด (Sunscreen) ขณะวิ่งกลางแจ้งหรือไม่

3.1  ใช่  ไม่ใช่

(หากเลือก "ใช่" กรุณาตอบต่อข้างล่าง หากตอบ "ไม่ใช่" ข้ามไปทำข้อ 3.2 ต่อ)

3.1.1 บริเวณที่ท่านทา (สามารถเลือกได้มากกว่า 1 บริเวณ)

ใบหน้าหรือลำคอ  
 หลังใบหู  แขนและหลังมือ  ขา  ลำตัว

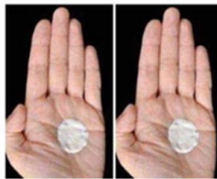
(หากตอบใช้ที่บริเวณ "ใบหน้าหรือลำคอ" กรุณาตอบต่อด้านล่าง)

ปริมาณที่ใช้ต่อใบหน้าที่หรือลำคอ หากเป็นแบบครีมใช้ปริมาณมากกว่าหรือเท่ากับ 2 ข้อนิ้ว หรือเป็นรูปแบบน้ำ ใช้ปริมาณมากกว่าหรือเท่ากับเหรียญสิบ 2 เหรียญ หรือไม่  ใช่  ไม่ใช่

2x fingertip unit  
1 gram (cream)



2x10 baht coin  
1 gram (lotion)



3.1.2 ชนิดของครีมกันแดดที่ท่านใช้ (สามารถเลือกตอบได้มากกว่า 1 ข้อ)

Spf  $\geq$  30  Spf  $\geq$  50  PA  $\geq$  +++  แบบกันน้ำ

3.1.3 วิธีการทาครีมกันแดดของท่าน (สามารถเลือกได้มากกว่า 1 ข้อ)

ทาก่อนออกกำลังกาย 15 - 30 นาที  
 ทาซ้ำหลังวิ่งกลางแจ้งนานกว่า 2 ชั่วโมง  
 ทาแล้วออกกำลังกายทันที

3.1.4 ท่านใช้ครีมกันแดดบ่อยแค่ไหนในการออกกำลังกาย

ใช้บางครั้ง (< 50 %)  ใช้บ่อยๆ (> 50 % แต่ไม่ 100 %)  ใช้ทุกครั้ง (100%)

3.2 หากท่านไม่ได้ใช้ครีมกันแดดเลย เนื่องจากเหตุผล (สามารถตอบได้มากกว่า 1 ข้อ)

- ไม่ได้โดนแดดนาน       ชัดขวาง/รู้สึกไม่สบายในการวิ่ง เช่น เหนียวเหนอะหนะ แต่งหน้ายาก
- สิ้นเปลืองค่าใช้จ่าย       เสียเวลาในการทาออกนอกร่างกาย
- ไม่น่ามีผลกระทบต่อร่างกาย ถ้าหากไม่ใช่       ใช้เครื่องป้องกันอื่นๆ แทน
- เกิดอาการข้างเคียงไม่พึงประสงค์จากการใช้ เช่น เป็นสิ่ว, แสบ, รอยแดง, ผิวลอก เป็นต้น
- อื่นๆ เช่น \_\_\_\_\_

4) ท่านใช้เครื่องป้องกันแดดอื่น ๆ นอกเหนือจากครีมกันแดดหรือไม่

4.1  ใช่       ไม่ใช่

(หากเลือก "ใช่" กรุณาตอบต่อข้างล่าง หากตอบ "ไม่ใช่" ข้ามไปทำข้อ 4.2 ต่อ)

4.1.1 ชนิดของเครื่องป้องกันแดด (สามารถตอบได้มากกว่า 1 ข้อ)

- หมวกปีกกว้าง       เสื้อแขนยาว       กางเกงขายาว
- แว่นตากันแดด       ถุงมือ       ลิปมันกันแดด
- อื่นๆ \_\_\_\_\_

4.1.2 ท่านใช้เครื่องป้องกันแดดบ่อยแค่ไหน

ใช้บางครั้ง (< 50 %)       ใช้บ่อยๆ (> 50 % แต่ไม่ 100 %)       ใช้ทุกครั้ง (100%)

4.2 หากท่านไม่ได้ใช้เครื่องป้องกันแดดเลย เนื่องจากเหตุผล (สามารถตอบได้มากกว่า 1 ข้อ)

- ไม่ได้โดนแดดนาน       ชัดขวาง/รู้สึกไม่สบายในการวิ่ง เช่น อึดอัด เกะกะ
- สิ้นเปลืองค่าใช้จ่าย       คิดว่าไม่น่ามีผลกระทบต่อร่างกาย
- ใช้ครีมกันแดดก็เพียงพอแล้ว       อื่นๆ เช่น \_\_\_\_\_