

# Investigation on the Awareness and Behavior of Primary School Students on Sunscreen Use in Beijing

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**Objective:** This study aims to understand primary school students' behavior and awareness of sun exposure and sunscreen in Beijing, China.

**Methods:** A questionnaire survey was conducted of 232 students in grades 4–6 at a public primary school in Beijing, including 129 boys (55.6%) and 103 girls (44.4%). The contents of the questionnaire included awareness about ultraviolet rays, sun exposure, sunscreen habits, and the understanding and use of sunscreen.

**Results:** The majority of the subjects (75.0%) said they had never been sunburned, and 26.3% had never been tanned. Only 7.3% of the primary school students had a comprehensive and correct understanding that sunlight will burn, cause cancer, tan, and age the skin. Sunscreen (47.8%), sunshades (47.4%), sun hats (44.4%), avoiding going out at noon (37.5%), and sunglasses (30.2%) were the most frequently used sunscreen means. Furthermore, 47.8% of primary school students used topical sunscreen for light protection, higher than other measures. The proportion of girls using sunscreen at least once a day was more than boys.

**Conclusion:** Primary school students in Beijing, China, do not have a comprehensive understanding of ultraviolet rays, and there are deficiencies in protective behavior. Their awareness and use of sunscreen need to be improved.

**Keywords:** ultraviolet, sunscreen, awareness, behavior, primary school students

## Introduction

Excessive ultraviolet (UV) radiation may cause a series of skin injuries, including sunburn, tanning, photoaging, and tumors. UV radiation in sunlight and severe sunburn are important risk factors for melanoma and other skin cancers.<sup>1–5</sup> Under normal circumstances, children receive three times as much sunlight as adults every year; most sun exposure in life occurs in childhood.<sup>6</sup> Compared with adults, children are more likely to participate in outdoor activities, which increases the risk of sunburn caused by added UV radiation.<sup>7</sup> About half of adults' cumulative UV exposure occurs before the age of 20.<sup>8,9</sup> Sunburn and excessive sunlight exposure in childhood increase the risk of melanoma.<sup>10–12</sup> One or two sunburns in childhood can increase the risk of basal cell carcinoma.<sup>13,14</sup> Many studies have pointed out that children can be protected from UV rays through the use of sunscreen, sunshades, wide-brimmed sunhats, long-sleeved tops and sunglasses.<sup>15,16</sup> Because of the strong sunlight and high incidence of skin cancer in Australia and other Western countries, many awareness-raising programs related to sun harm have been launched and geared toward teenagers, such as “SunSmart” and “Play Safe in the Sun.” Since 2005, China has held a skincare day on May 25 every year, aiming to educate people about scientific skincare and sunscreen.<sup>17</sup> These activities help educate young people on sun exposure and reduce the incidence of sunburn and skin cancer. Educating primary school students on the correct information about sunscreen and establishing the concept of using sunscreen from an early age is the first step to preventing UV damage to the skin. In order to understand the level of knowledge and behavior of Chinese primary school students regarding sunscreen, we conducted this survey.

Beijing is the capital of China, located in a temperate zone with four seasons and high temperatures in the summer. The skin types of Beijing residents are typical Chinese skin types, and types 3 and 4 accounts for the majority. These skin types tan easier

than Westerners, do not get sunburned easily, and have a low incidence of tumors.<sup>18,19</sup> The prevalence of cutaneous melanoma in China is 0.49/100,000, ranking 24th among all malignant tumors, and at a low level in the world. The incidence rate of cutaneous melanoma in urban areas is 0.54/100,000, while that in rural areas is 0.44/100,000.<sup>20</sup> Chinese people's awareness of and behavior regarding sunscreen may be very different from those in the West. Understanding the awareness levels of sun exposure and sunscreen and the behavior of primary school students in China is necessary. This study surveyed students in grades 4 through 6 of a public primary school in Beijing about their sunscreen knowledge to realize their understanding and behavior regarding sunscreen. These findings highlight the importance of instructing primary school students to take correct sun protection, which may eventually reduce the incidence of skin cancer in the population.

## Information and Methods

### General Information

From June 2013 to September 2013, 232 questionnaire forms were distributed to students in grades 4–6 of a public primary school in urban Beijing, and 232 valid questionnaires were recovered. The Ethics Committee of Beijing Chuiyangliu Hospital approved this study.

### Methods

A questionnaire was formulated referring to previous sun exposure and studies according to the characteristics of Chinese primary school students. The teachers organized the students to carry out the survey. All participating students used the simple random sampling survey method to respond to the questionnaire. The questionnaire was completed anonymously. The contents included the subject's gender, age, skin color, sunburn and tanning history, awareness of UV rays, sun exposure, sunscreen habits, and the awareness and use of sunscreen.

The questionnaire covered the following: Part I: age, gender, and skin color of the subjects. Part II: awareness of the harm of excessive sunlight to human skin health (sunburn, tanning) and the degree of understanding of UV rays. Part III: daily sunscreen measures: the use of sunshades, wide-brimmed hat, long-sleeved tops, sunglasses, and topical sunscreen, as well as the awareness and use of sunscreen. Part IV: the source of their knowledge about sun damage and protection, including TV, books, teachers, and parents.

Three questions were designed to ascertain the skin color of primary school students and their sun exposure in summer. 1. Your usual skin color (exposed parts, such as upper arm). 2. Does your skin easily burn in summer? 3. Does your skin easily tan in summer?

We designed six questions to study the general knowledge of primary school students about sun exposure, skin damage, and sunscreen use after sun exposure. 4. What kind of sunlight do you think can harm the skin? 5. What damage will the sun cause to the human body? 6. Do you like the sun? 7. Has your skin been sunburned this summer? 8. Has your skin been tanned by the sun this summer? 9. What sunscreen measures do you usually take when you are outdoors in summer?

We designed four questions to study sunscreen knowledge and the use of sunscreen in primary school students. 10. How old were you when you started to use sunscreen? 11. How often do you use sunscreen every day? 12. Where did you learn about sunscreen? 13. Do your parents use sunscreen?

### Statistical Analysis

Data were analyzed using SPSS 11.5 statistical software. Countable data were expressed as frequency and percentage, and compared using chi-square test or exact test. Two-sided  $P < 0.05$  was considered a statistically significant difference.

## Results

### Demographics

Among the 232 primary school students in grades 4–6 that returned the questionnaires, 129 were boys (55.6%), and 103 were girls (44.4%), their ages ranged between 9–13 years old, with an average age of  $10.65 \pm 1.06$  years old. There were 61 students in the fourth grade, including 37 boys and 24 girls, 79 students in the fifth grade, 44 boys and 35 girls, and 92 students in the sixth grade, 48 boys and 44 girls.

## Sunburn

The majority (174, 75.0%) of the subjects said they had never been sunburned, including 96 boys (74.4%) and 78 girls (75.7%). Seven (3.0%) said they easily or very easily get sunburned, four boys (5.17%) and three girls (2.9%; [Table 1](#)). Twenty-four were sunburned (10.3%) this summer, 17 boys (15.6%) and seven girls (6.8%), and 57 (24.6%) had a history of sunburn before the survey, 33 boys (25.6%) and 25 girls (24.3%).

## Tanning

Sixty-one subjects (26.3%) said they had never been tan, including 40 boys (31.0%) and 21 girls (20.4%). Thirteen (5.6%) said they easily or very easily tanned, four boys (3.0%) and nine girls (8.7%; [Table 2](#)), and 111 (47.8%) were tanned this summer, 53 boys (41.1%) and 58 girls (56.3%).

## Participants' Understanding of Ultraviolet Rays and Sunscreen

One hundred sixty-nine (72.8%) of the subjects understood that UV rays could harm the skin, including 92 boys (71.3%) and 77 girls (74.8%; [Table 3](#)). One hundred sixty-seven (72.0%) understood that sun exposure could cause sunburn, 88 boys (68.2%) and 79 girls (76.7%). Fifty-eight (25.0%) understood that sun exposure might cause skin cancer, 27 boys

**Table 1** Has Your Skin Been Easily Sunburned in Summer?

	Male	Female	Total	p
	N=129	N=103	N=232	
Very vulnerable to sunburn	1 (0.8%)	0 (0%)	1 (0.4%)	0.7796
Vulnerable to sunburn	3 (2.3%)	3 (2.9%)	6 (2.6%)	0.3705
I am easy to get sunburned after a long time of sun exposure	8 (6.2%)	4 (3.9%)	12 (5.2%)	0.4283
Occasional sunburn	9 (7.0%)	8 (7.8%)	17 (7.3%)	0.8185
Only sunburned once or twice	12 (9.3%)	10 (9.7%)	22 (9.5%)	0.9091
I have never had a sunburn	96 (74.4%)	78 (75.7%)	174 (75%)	0.819

**Table 2** Has Your Skin Been Easily Tanned in Summer?

	Male	Female	Total	p
	N=129	N=103	N=232	
Never get tanned	40 (31.0%)	21 (20.4%)	61 (26.3%)	0.0679
Occasionally tanned	26 (20.2%)	42 (40.8%)	68 (29.3%)	0.0006
Get tanned after prolonged sun exposure	22 (17.1%)	29 (28.2%)	51 (22.0%)	0.0425
Easily get tanned	3 (2.3%)	9 (8.7%)	12 (5.2%)	0.003
Must get tanned after very short time of sun exposure	1 (0.7%)	0 (0%)	1 (0.4%)	0.3705
I am tan without sun exposure. I am already very tan.	4 (3.1%)	2 (1.9%)	6 (2.6%)	0.5815

**Table 3** What Kind of Sunlight Do You Think Can Do Harm to the Skin?

	Male	Female	Total	p
	N=129	N=103	N=232	
Infrared rays	102 (79.1%)	51 (49.5%)	153 (65.9%)	0.0001
Visible light	18(14.0%)	19(18.4%)	37 (15.9%)	0.353
Ultraviolet rays	92 (71.3%)	77 (74.8%)	169 (72.8%)	0.5584
Do not know	4 (3.1%)	12 (11.7%)	16 (6.9%)	0.0107

(20.9%) and 31 girls (30.1%). One hundred forty-three (61.6%) understood that sun exposure could cause a tan, 73 boys (56.6%) and 70 girls (68.0%). Fifty-six (24.1%) understood that sun exposure could age the skin, 32 boys (24.8%) and 24 girls (7.0%; Table 4).

The source of the subjects' knowledge about sun exposure and protection. The top three sources of knowledge were learning from their parents (48 boys, 37.2%; 54 girls, 52.4%), reading by themselves (27 boys, 20.9%; 25 girls, 24.3%), and watching TV (22 boys, 17.1%; 14 girls, 13.6%; Table 5).

## Sunscreen Behavior

In terms of sunscreen used by the subjects during outdoor activities in summer, 111 (47.8%) use sunscreen, including 44 boys (34.1%) and 67 girls (65.0%;  $\chi^2 = 21.97$ ,  $P < 0.01$ ). Thirty-nine (16.8%) wear long-sleeved clothes, 26 boys (20.2%) and 13 girls (12.6%). One hundred three (44.4%) wear sun hats, 60 boys (46.5%) and 43 girls (41.7%). One hundred ten (47.4%) wear sunshades, 55 boys (42.6%) and 55 girls (32.0%). Seventy (30.2%) wear sunglasses, 37 boys (28.7%) and 33 girls (14.2%). Eighty-seven (37.5%) avoid going out at noon, 41 boys (31.8%) and 46 girls (44.7%;  $\chi^2 = 4.1$ ,  $P < 0.05$ ). And 52 (22.4%) try to walk in the shade, 31 boys (24.0%) and 21 girls (20.4%; Table 6).

**Table 4** What Damage Will Sun Exposure Cause to the Human Body?

	Male	Female	Total	p
	N=129	N=103	N=232	
Skin sunburn	88 (68.2%)	79 (76.7%)	167 (72.0%)	0.1529
Possible skin cancer	27 (20.9%)	31 (30.1%)	58 (25.0%)	0.1091
Tanned skin	13 (10.1%)	70 (68.0%)	83 (35.8%)	0.9075
It will age the skin	32 (24.8%)	24 (7.0%)	56 (24.1%)	0.79
Do not know	1 (0.8%)	6 (5.8%)	7 (3.0%)	0.0255

**Table 5** Where Do You Learn Sunscreen Knowledge?

	Male	Female	Total	p
	N=129	N=103	N=232	
The teacher taught it	13 (10.1%)	1 (1.0%)	14 (6.0%)	0.0038
I learned from my parents	48 (37.2%)	54 (52.4%)	102 (44.0%)	0.0203
I read by myself	27 (20.9%)	25 (24.3%)	52 (22.4%)	0.6649
I learned from the media	22 (17.1%)	14 (13.6%)	36 (15.5%)	0.4693
Others	27 (20.9%)	15 (14.6%)	42 (18.1%)	0.2108

**Table 6** What Sunscreen Measures Do You Usually Take When You are Outdoors in Summer?

	Male	Female	Total	p
	N=129	N=103	N=232	
Sunscreen cream	44 (34.1%)	67 (65.0%)	111 (47.8%)	0.0001
Long sleeved clothes	26 (20.2%)	13 (12.6%)	39 (16.8%)	0.1274
Sun hat	60 (46.5%)	43 (41.7%)	103 (44.4%)	0.4682
Sunshade	55 (42.6%)	55 (53.4%)	110 (47.4%)	0.1029
Sun glasses	37 (28.7%)	33 (32.0%)	70 (30.2%)	0.5802
Try to avoid going out at noon	41 (31.8%)	46 (44.7%)	87 (37.5%)	0.0441
Try to walk in the shadow	31 (24.0%)	21 (20.4%)	52 (22.4%)	0.5086
No protective measures have been taken	12 (9.3%)	3 (2.9%)	15 (2.9%)	0.0492

## Knowledge and Use of Sunscreen

Seventy-nine of the subjects (34.1%) use sunscreen at least once a day, including 25 boys (19.4%) and 54 girls (52.4%;  $\chi^2 = 27.9$ ,  $P < 0.01$ ). One hundred (43.1%) said they had never used sunscreen, 72 boys (55.0%) and 28 girls (27.2%;  $\chi^2 = 19.1$ ,  $P < 0.01$ , Table 7). The earliest age that the boys reported using sunscreen was one year old, and the average age was  $6.52 \pm 2.32$  years old. The earliest age the girls started using sunscreen was one year old, and the average age was  $6.73 \pm 2.55$  years old. The number of subjects whose parents often use sunscreen was 88 (37.9%), including 42 boys (32.6%) and 46 girls (44.7%), and the number of subjects whose parents had never used sunscreen was 27 (11.6%), 17 boys (13.2%) and 10 girls (9.7%; Table 8).

## Discussion

Excessive sun exposure may cause sunburn, tanning, and photosensitive skin reactions in the short term, and photoaging and even tumors in the long term. Evidence suggests that sunlight exposure in children and adolescents plays a vital role in skin cancer in adulthood. In this study, the understanding of harmful sun exposure on skin health of some primary school students in Beijing was investigated, and the results revealed that the level of awareness about excessive sun exposure and protection measures is still relatively low.

Our previous sunscreen surveys in Beijing demonstrated that the proper understanding of skin damage caused by sun exposure was as high as 63.1% for college students, 25% for high school students, and approximately 10% for junior middle school students,<sup>21</sup> suggesting that with increased age and knowledge, teenagers' awareness of sunburn injury gradually increases. This awareness significantly increases after entering college, suggesting that college students pay more attention to sun exposure damage, while primary school students have a low awareness of the damage caused by sun exposure. The reason may be related to the lack of relevant information and awareness-raising education. Understanding UV and sun exposure is the premise of preventing UV damage to the skin. Primary school students' awareness of UV is only a perceptual knowledge, and they do not know enough about the basics of UV.

In this study, the survey results of the sunscreen measures taken during outdoor activities were relatively satisfactory; 97.1% of primary school students believe it is necessary to take sunscreen measures during outdoor activities. A study of sunscreen behavior among fourth-graders in Florida, United States, revealed that the utilization rate of sunscreen was 32.8%, wearing sunglasses was 32.3%, sun hats were 16.4%, and wearing long-sleeved clothes was 15%.<sup>22</sup> A study of sunscreen behavior among adolescents aged 11–18 across the United States revealed that the utilization rate of sunscreen was 31.4%, wearing sunglasses was 32.2%, walking in the shadows was 22%, wearing long-sleeved clothes was 21%,

**Table 7** How Often Do You Use Sunscreen Every Day?

	Male	Female	Total	p
	N=129	N=103	N=232	
Once every day	25 (19.4%)	54 (52.4%)	79 (34.1%)	0.0001
Many times a day	3 (2.3%)	4 (3.9%)	7 (3.0%)	0.4907
Only when I remember it	29 (22.5%)	17 (16.5%)	46 (19.8%)	0.2567
Never	72 (55.0%)	28 (27.2%)	100 (43.1%)	0.0001

**Table 8** Do Your Parents Use Sunscreen?

	Male	Female	Total	p
	N=129	N=103	N=232	
Often	42 (32.6%)	46 (44.7%)	88 (37.9%)	0.9625
Occasionally	50 (38.8%)	41 (39.8%)	91 (39.2%)	0.8712
Never	17 (13.2%)	10 (9.7%)	27 (11.6%)	0.4129
Do not know	20 (15.5%)	6 (5.8%)	26 (11.2%)	0.0202

and wearing sun hats was 16.4%.<sup>23</sup> Our study involving volunteers from the 2008 Beijing Olympic Games in China revealed that the five most commonly used sunscreen methods were creams (58.8%), long-sleeved clothes and trousers (49.3%), sunshades (45.4%), sunglasses (45.3%), and sun hats (42.2%).<sup>17</sup> Because of the high temperatures and humidity in summer in Beijing, primary school students are more inclined to use cooler sunscreen methods such as creams, hats, and sunshades.

As an effective form of sunscreen, cream has gradually become the primary means of protection, which may be related to increasing sun protection education and substantial business promotion. Our 2012 survey on sunscreen knowledge and behavior in northern China revealed that 53% of adult women in Beijing often use sunscreen cream.<sup>24</sup> Our study involving volunteers from the 2008 Beijing Olympic Games in China revealed that 58.8% often used sunscreen cream,<sup>17</sup> suggesting that adults' awareness is higher than primary school students. With the rapid development of China's economy, more Chinese people accept and use sunscreen cream. A series of surveys conducted in Shanghai, China, about 20 years ago revealed that only 23.1% of college students, 13.1% of middle school students, and 7.7% of primary school students used sunscreen cream,<sup>20</sup> suggesting that the use of sunscreen is also restricted by financial ability. A study on sun exposure of fourth-graders at a primary school in Florida revealed that the utilization rate of sunscreen cream was 32.8%.<sup>22</sup> Another survey on sun exposure among primary school students in third to fifth grades in Florida revealed that 53.1% of NHW primary school students often use sunscreen cream, which is higher than Beijing primary school students, while 35.3% Hispanic and 13.4% NHB primary school students often use creams, which is lower than Beijing primary school students.<sup>25</sup> The use of sunscreen cream is influenced by race and skin color. In summary, the use of sunscreen cream is affected by gender, age, race, and economy. Economic and cultural background may be the main influencing factors.

Learning from parents (44%) was the main source for primary school students in the Beijing region to acquire knowledge about UV hazards and their protection. The proportion of information sources from other channels, such as reading and network media, is still low. A study of sunscreen behavior among adolescents aged 11–18 across the United States revealed that one in two youths received information about sun protection from friends and family.<sup>23</sup> Our 2012 survey on sunscreen knowledge and behavior of adult women in northern China revealed that the top three sources of knowledge in the Beijing region were television (31%), reading (21.1%), and parents (7%).<sup>24</sup> There are great differences in the sources of sunscreen knowledge between adults and children. Similar to other studies, the present study revealed that parents were the primary source of sunscreen information for children, and parents' behavior and attitudes about sunscreen had a great impact on children.<sup>26</sup> Schools also need to strengthen the publicity and education of young students on the hazards of sun exposure and their protection knowledge.

This survey revealed that primary school students in Beijing, China, do not have a comprehensive understanding of UV, and there are deficiencies in protective behavior; their awareness and use of sunscreen need to be improved. Like all sun exposure studies, this survey was organized by teachers for primary school students, and the self-report questionnaire was adopted to investigate their knowledge and behavior of sunscreen. There was a deviation in survey results; it was affected by individual recall errors. Students make errors in evaluating their behavior to please teachers by filling in the more conducive results.<sup>27–29</sup> In this study, data were collected from a public primary school in downtown Beijing. Although the population, race, and economic conditions in the urban area of Beijing are evenly distributed, a single school can only be representative to the general population to a certain extent. Future studies with a larger sample size need to be performed in schools from different areas of Beijing to validate the current findings.

In conclusion, this study shows that primary school students in Beijing have insufficient understanding of the damage that sun exposure may cause to the skin, and even have some misunderstandings. This may lead to lack of adequate sun protection measures and correct sun protection behavior. It is important to instruct primary school students to take correct sun protection, including the correct use of sunscreen, the use of sunshades, sun hats, avoiding going out at noon, wearing sunglasses, walking in the shade as much as possible, and wearing long-sleeved clothes. Changing sun protection habits of primary school students may ultimately reduce the incidence of skin cancer in the population.

## Consent for Publication

Participants under the age of 16 have obtained written informed consent from their parents.



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## Disclosure

The authors declare that they have no competing interests in this work.

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