

# Motives of Belgian Adolescents for Using Sunscreen: The Role of Action Plans

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## Abstract

The first objective of this study was to analyze the differences between adolescents who use sunscreen frequently and those who do not. The second objective was to explore the importance of specific action plans when planning sunscreen use. Data was gathered among 602 Belgian secondary school students. Frequent and infrequent users of sunscreen were compared on several determinants related with sunscreen use, and a regression analysis on sunscreen use was done. Frequent users of sunscreen measures had significantly higher scores on attitudes, social influence, self-efficacy, some awareness factors, intention, and action plans. The integrated model for exploring motivational and behavioral change (I-Change model) explained 57% of the total variance of

using sunscreen every 2 hours. Frequent sunscreen use was most strongly predicted by action plans, followed by positive intentions to use sunscreen, wearing protective clothing, seeking shade, attitude toward sunscreen use, education, social influence, and exposure to the sun. Our results suggest that skin cancer prevention programs aimed at promoting sunscreen use need to emphasize the advantages of sunscreen to infrequent users and to increase feelings of self-efficacy. Moreover, support by friends and parents should be stimulated. Finally, developing specific action plans for the use of sunscreen should be promoted to more effectively translate general intentions into actual sunscreen use. (Cancer Epidemiol Biomarkers Prev 2006;15(7):1360-6)

## Introduction

In Belgium, as in many other Western countries, melanoma incidence is increasing (1, 2). In 2002, the Belgian age-standardized rates for incidence and mortality were 3.6 and 1.4 for males, and 6.2 and 1.3 for females (2). The majority of melanomas are attributable to excessive UV radiation exposure (3). High sun protection broad-spectrum sunscreens have been recommended as protective measures to decrease the risk of melanoma development (4). Consequently, there is a demand for interventions to limit sun exposure, increase sunscreen use, and improve sunscreen practices.

Late adolescence is a period of increased unprotected sun exposure (5). In a previous study, we analyzed the protection behaviors of Belgian adolescents (6). The results showed that applying sunscreen every 2 hours was the method most commonly used by adolescents to protect themselves, although 70% did not use sunscreen regularly. Female adolescents used sunscreen more regularly than males, and sun bed use was higher among 18-year olds than among 14-year olds. These results are in line with those of other studies, which showed that adolescents are characterized by inadequate sun protection practices, high sunburn prevalence, and high indoor tanning bed use (7-14). Furthermore, the results of our study suggested that respondents with fair skin types were at increased risk of developing skin cancer, because of various high exposure activities accompanied by relatively few protective behaviors. A second risk group that was identified consisted of adolescents with a lower educational level.

Developing effective interventions requires the determinants of sunscreen use to be assessed. Studies have shown that determinants of sunscreen use in adults (7, 15-31) and adolescents (7-10, 15, 19, 20, 22, 25, 28-30, 32-47) are related to attitudes, social influences, and self-efficacy expectations.

Self-efficacy expectations seem not to have been included very often in skin cancer prevention studies.

The present study used the integrated model for exploring motivational and behavioral change (the I-Change model; refs. 48-50). The I-Change model builds on an earlier model (called the Attitude-Social Influence-Self-efficacy model; refs. 18, 51, 52), integrating ideas from various social cognitive models, such as the Theory of Planned Behavior (53), Social Cognitive Theory (54), the Health Belief model (55), the Transtheoretical model (56), the Precaution Adoption model (57), Goal Setting Theory (58), and the Health Action Process Approach model (59-61).

The I-Change model assumes that motivational factors are determined by various distal factors, such as awareness factors (e.g., knowledge, risk perceptions and cues to action; ref. 55), and predisposing factors, such as behavioral factors (e.g., lifestyles), psychological factors (e.g., personality), biological factors (e.g., gender, type of skin), social and cultural factors (e.g., the price of sunscreen, policies), and information factors (the quality of messages, channels, and sources used; ref. 52).

The I-Change model assumes—as do many other social cognitive models—that behavior is the result of intentions and abilities. The main elaborations to the earlier models (including the Attitude-Social Influence-Self-efficacy model), however, involve the addition of premotivational and postmotivational factors. Hence, the I-Change model explicitly makes a distinction between three phases of motivational change and their corresponding determinants.

The premotivational awareness factors are derived from the Health Belief model (55) and the Precaution Adoption Process model (57). In the premotivational phase, people need to become aware of their risk behavior. Important factors in this phase are knowledge, risk perceptions, and cues that prompt people to become aware. In the motivational phase, people need to become motivated to change their behavior; important factors in this phase are attitudes, social influence perceptions such as norms and modeling, and self-efficacy expectations.

In the motivational phase, an intention is formed. In the postmotivational phase—the second elaboration to earlier model—people need to translate intentions into actions, so several preparatory actions to facilitate the actual behaviors need to be planned and executed.

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In the postmotivational phase, a global goal intention is converted into a set of specific intentions: action plans with relevant strategies that will enable them to attain this goal (62). Hence, action plans can also be regarded as very specific intentions to perform specific subbehaviors (e.g., planning to have always sunscreen 15+ with you versus "planning to use sunscreen"). Because the action plans involve specific strategies, the set of relevant action plans is likely to differ from behavior to behavior. Support for the importance of action planning has been provided by several other studies (23, 63-66). However, the identification of effective and ineffective action plans is a relatively underdeveloped area within health behavior research (64-67).

The first goal of this paper is to analyze the differences between adolescents who use sunscreen frequently and those who do not to guide the development of future Belgian educational skin cancer prevention campaigns. A second goal is to explore the importance of specific action plans when planning sunscreen use. We hypothesized that action plans would be the most powerful determinant associated with actual sunscreen use.

## Materials and Methods

**Respondents and Procedure.** A stratified cluster sample was used to select 16 secondary schools from a total of 133 available schools in the study region. Four schools declined to participate because they had already participated in several surveys ( $n = 3$ ) or were not interested in this study ( $n = 1$ ). The adolescents were recruited from the 14- and 18-year grade groups of all three secondary school levels to allow us to detect age differences in sunscreen behavior. The adolescents were informed about the goal of the study and were told that their information would be treated in strict confidence and that they could refuse participation. No students refused participation. A total number of 602 respondents completed the questionnaire in the classroom within 15 to 25 minutes. The questionnaires were anonymous. The questionnaires were collected by the researcher and sealed in an envelope.

**Questionnaire.** The questionnaire included 38 items that were related to attitudes, social influence, self-efficacy, knowledge, risk perception, intentions, and sunscreen behavior. Questionnaire development was guided through several stages. First, salient beliefs about sunscreen use were identified from previous studies on sun protection behavior and adapted for adolescents (18, 68). Second, the questionnaire was piloted with five adolescents to check its readability, comprehensibility, and duration; finally, it was examined by experts of a work committee on malignant melanoma.

**Sun Exposure.** This was assessed by asking "how long are you outside in the sun on sunny days during vacations" (0 = never, 1 = <1 hour, but not zero; 2 = at least 1, but <3 hours; 3 = at least 3, but <6 hours; 4 = as long as possible).

**Sunscreen Use.** This was assessed by two questions on five-point scales, asking the respondents how often they used sunscreen at the beach or swimming pool, and during outdoor activities. Answering categories ranged from never (0) to always (4;  $\alpha = 0.72$ ). A mean sum score was calculated (range 0-4).

**Seeking Shade.** This was measured by asking respondents whether they regularly sought the shade at the beach or pool and when doing outdoor sports or other outdoor activities on a sunny day. Students could choose from five answering categories ranging from never (0) to always (4;  $\alpha = 0.63$ ). A mean score of the two items was calculated (range 0-4).

**Wearing Protective Clothing.** This was assessed on a five-point scale by asking respondents whether they regularly wore protective clothing at the beach or pool, and when doing

outdoor sports or other outdoor activities on a sunny day (0 = never, 4 = always;  $\alpha = 0.56$ ). A combined mean score was calculated (range 0-4).

Other tanning behaviors that were assessed were *frequency of painful sunburns* during the last year (0 = never; 1 = once; 2 = twice; 3 = thrice; 4 = more than thrice) and *frequency of sun bed use* per year (0 = never; 1 = <5 times/yr; 2 = between 6 and 15 times/yr; 3 = between 16 and 25 times/yr; 4 = >25 times/yr).

**Risk Perception.** This was measured with three questions on a five-point scale to estimate (a) the respondents' perceived risk of ever getting skin cancer; (b) their perceived risk of getting skin cancer compared with other adolescents; (c) their perceived risk of getting skin cancer compared with adults (-2 = low risk; +2 = high risk). Two additional questions assessed how serious the respondents perceived sunburns and skin cancer to be (-2 = not serious; +2 = very serious). All these items were used separately in the analysis.

**Response Efficacy Perception.** This was assessed on a five-point scale by one question that asked respondents how much they thought they could do to avoid getting skin cancer (-2 = absolutely nothing; +2 = a lot).

**Cues to action** were assessed by three items. The first item measured whether respondents felt that a skin cancer campaign would be a cue to protect themselves. The second item assessed whether recent sunburns would be a cue to protect themselves. Both items used a five-point scale (-2 = definitely not; +2 = definitely yes). The third item assessed whether they personally knew someone with skin cancer (0 = no; 1 = yes). These items were used separately in the analysis.

**Attitudes.** A five-point likelihood scale was used to assess beliefs about tanning and sunscreen use. *Attitude toward tanning* was measured by three items assessing how healthy (+2)/unhealthy (-2) and how pleasant (+2)/unpleasant (-2) the respondents considered tanning to be, and how important (+2)/unimportant (-2) they considered having a tan to be ( $\alpha = 0.50$ ). The average mean was calculated based on the three items. *Attitude toward sunscreen use* was measured by five items assessing whether they regarded sunscreen as important (+2)/unimportant (-2), easy to apply (+2)/difficult to apply (-2), pleasant (+2)/unpleasant (-2), and whether they thought that using sunscreen would slow down the tanning process very much (-2)/not at all (+2) and would make their skin very greasy (-2)/not greasy at all (+2;  $\alpha = 0.63$ ). The average mean was calculated based on the five items. To measure *anticipated regret*, respondents were asked whether they expected to feel regret after sunburn, and whether they expected to feel regret when having protected themselves poorly, on a five-point scale (-2 = not at all; +2 = very much;  $\alpha = 0.46$ ). An average mean was calculated based on these two items.

**Social Influences.** Social influences with respect to sunscreen use were assessed by six items on a five-point scale. Two of these items assessed social modeling, asking whether parents and friends used sunscreen every 2 hours (-2 = never; +2 = always;  $\alpha = 0.49$ ), whereas two assessed the perceived norms of parents and friends toward sun protection (-2 = not important; +2 = important;  $\alpha = 0.53$ ), and two assessed social support, asking whether parents and friends stimulated them to use sunscreen every 2 hours (-2 = never; +2 = always;  $\alpha = 0.42$ ). The average mean was calculated from these six items ( $\alpha = 0.76$ ). One additional question assessed whether respondents experienced pressure from friends to tan without adequate protection (-2 = never; +2 = always).

**Self-efficacy.** Self-efficacy toward sunscreen use was measured by two questions on a five-point scale. Respondents were asked whether they were sure that they would be able to use sunscreen when tanning (+2 = I'm sure I'll be able to use

sunscreen;  $-2 = I'm$  sure I won't be able to use sunscreen). One question assessed social self-efficacy, asking whether respondents thought they would be able to protect themselves from the sun when their friends would not ( $+2 = I'm$  sure I'll be able to protect myself;  $-2 = I'm$  sure I won't be able to protect myself). These items were used separately in the analysis.

**Intention.** Intention to use sunscreen was measured by one question on a five-point scale. Respondents were asked whether they intended to use sunscreen on sunny days ( $+2 =$  definitely yes;  $-2 =$  definitely no).

**Action Plans.** Action plans were measured by four questions on a five-point scale, with answering options agree ( $+2$ ) and disagree ( $-2$ ;  $\alpha = 0.86$ ), assessing whether adolescents planned to take sunscreen with them when going to the pool or beach this year and to use sunscreen every 2 hours this year when at the pool or beach, when engaging in sports outdoors and when engaging in other outdoor activities (cycling, walking, hiking). The average mean was calculated based on the four items.

**Demographics.** Respondents were asked demographic questions pertaining to their gender, age, and educational level (1 = vocational high school, the easiest track; 2 = technical high school; 3 = general high school, the most difficult track). We also assessed smoking behavior (0 = no/1 = yes) and frequency of alcohol use (0 = never; 4 = very often; refs. 32, 33, 36, 69). Students were also asked to indicate their skin type: (a) burning very quickly and not tanning (type I); (b) burning quickly and tanning slowly (type II); (c) burning rarely and tanning quickly (type III); (d) hardly burning and tanning rapidly (type IV).

The questionnaire also assessed *self-image* (0 = very negative, 4 = very positive) and *confidence to be able to tan responsibly* (0 = not confident at all, 4 = very confident), both on a five-point scale, using single items.

**Statistical Analysis.** Based on the sum of the two sunscreen use items (range 0-4), two groups were created: infrequent sunscreen users (scores 0-2.5) and frequent sunscreen users (scores 3-4).

Data analysis included basic descriptive statistics.  $\chi^2$  Tests examined the statistical association between demographical factors and the sun behavior and frequent or infrequent use of sunscreen. Statistical differences regarding the psychosocial variables between adolescents who applied sunscreen frequently and those who did so infrequently were analyzed using *t* tests. Correlations were used to analyze the associations between the behavior and the I-Change determinants.

A multiple regression analysis was used to assess the predictive value of the I-Change determinants of sun protection behavior in the Belgian adolescents. Four models were used, a strategy derived from expectancy value models such as the Theory of Reasoned Action (70). Model 1 included the demographic variables and relevant other behaviors because they are assumed to precede the development of beliefs (52). For this purpose, the first model included age, gender, education, the number of burns, type of skin, total sun exposure, and the use of the two other protective behaviors. The second model included the variables of model 1 as well as cognitive factors, such as knowledge, response efficacy, risk perception, attitude toward tanning, attitude toward sunscreen use, perceived social influence from parents and friends, and self-efficacy beliefs about sunscreen use. The assumption is that the effect of most demographic variables is mediated through the cognitive factors (52, 71). Model 3 included the variables from model 2 and the intention to use sunscreen because it is assumed that most of the variance of the preceding factors is mediated through intention. The final model included the use of action plans. All analyses were done using SPSS 10; significant differences are reported when  $P < 0.05$ .

## Results

**Characteristics of the Sample.** In total, 602 respondents participated in this study, including significantly more girls ( $n = 358$ ; 59.5%) than boys ( $n = 244$ ; 40.5%);  $\chi^2 (1, n = 602) = 21.588$ ;  $P < 0.001$ . The distribution between the two participating grade groups, second grade (50.2%;  $n = 302$ ; 14-year age group) and sixth grade (49.8%;  $n = 300$ ; 18-year group), did not differ significantly [ $\chi^2 (1, n = 602) = 0.07$ ;  $P > 0.05$ ]. The three school types were represented by similar numbers of students: 33.5% ( $n = 202$ ) attended the general secondary school track; 33.4% ( $n = 201$ ) the technical secondary school, and 33.1% ( $n = 199$ ) attended the vocational secondary school track [ $\chi^2 (1, n = 602) = 0.23$ ;  $P > 0.05$ ]. Of all respondents, 4.2% ( $n = 25$ ) indicated they had skin type I, 24.3% ( $n = 146$ ) classified themselves as having skin type II, 45.2% ( $n = 271$ ) as having skin type III, and 26.7% of the respondents ( $n = 160$ ) classified themselves as having skin type IV. Ninety-three percent of the respondents had the Belgian nationality at birth ( $n = 560$ ); the remaining 7% had the Dutch, German, Turkish, Moroccan, Greek, Spanish, or Italian nationality.

Table 1 shows that girls were more likely than boys to use sunscreen regularly. There were no differences in sunscreen use between 14- and 18-year olds, between respondents in different school types, or between respondents with different skin types.

**Predisposing and Awareness Factors.** Table 2 shows that frequent sunscreen users differed from infrequent users in terms of some of the predisposing factors from the I-Change model. Frequent users reported more smoking and more frequent alcohol consumption. They also reported to be more confident about their ability to tan responsibly.

Table 2 also shows that frequent users of sunscreen reported spending less time in the sun and made more use of other ways to protect themselves from the sun.

Frequent sunscreen users also differed from infrequent users in some of the awareness factors, reporting higher response efficacy by believing more strongly than infrequent users that risks of skin cancer can be influenced by themselves, judging both sunburn and skin cancer to be more serious than infrequent users, and being more likely to consider campaigns about tanning responsibly and sunburns to be cues to action. Frequent users also believed that they were less likely to get skin cancer than others.

**Attitudes, Social Influences, and Self-efficacy.** Table 3 shows that frequent and infrequent users differed in motivational factors. Frequent users were more convinced than infrequent users of the advantages of sunscreen use and found

**Table 1. Demographic characteristics of frequent and infrequent users of sunscreen**

	Frequent users	Infrequent users	Total	$\chi^2$	Sig
Gender					
Male	29	215	244	9.262	0.002
Female	77	281	358		
Age (y)					
14	56	246	302	0.365	NS
18	50	250	300		
Education					
VHS	43	159	202	3.323	NS
THS	29	172	201		
GHS	34	165	199		
Skin type					
Type I-II	33	138	171	0.470	NS
Type III-IV	73	358	431		
Total			602		

Abbreviations: VHS, vocational high school; THS, technical high school; GHS, general high school; NS, not significant.

**Table 2. Differences in means with regard to predisposing factors, tanning behavior, sun behavior, and awareness between frequent (n = 106) and infrequent (n = 496) users of sunscreen**

	Frequent users	Infrequent users	T	P<
Predisposing factors				
Risk behavior: smoking (0;1)	0.89	0.80	2.47	0.034
Risk behavior: alcohol (0;4)	2.50	2.24	2.15	0.032
Self-image(0;4)	2.37	2.37	-0.13	NS
Confidence about tanning responsibly (0;4)	3.03	2.48	5.69	0.001
Tanning behavior				
Exposure to sun (0;4)	2.66	2.99	3.15	0.002
Frequency of painful sunburns (0;4)	1.01	1.02	0.09	NS
Frequency of sun bed use (0;4)	0.84	0.77	-0.55	NS
Sun protection				
Protection by seeking the shade (0;4)	2.34	1.69	6.513	0.000
Protection by clothing (0;4)	1.87	1.26	7.117	0.000
Awareness factors				
Knowledge about sunscreen (0;1)	0.42	0.39	0.57	NS
Response efficacy (-2;2)	0.41	0.03	3.04	0.002
Perception of personal risk (-2;2)	-0.38	-0.38	0.44	NS
Perception of risk to others (-2;2)	-0.38	-0.13	-2.42	0.017
Perception of risk in young people compared with adults (-2;2)	0.52	0.35	1.53	NS
Seriousness of sunburn (-2;2)	0.45	0.08	3.17	0.002
Seriousness of skin cancer (-2;2)	1.69	1.47	2.48	0.014
Cue to action: campaign (-2;2)	1.10	0.29	6.98	0.001
Cue to action: sunburn (-2;2)	1.44	0.95	4.64	0.001
Cue to action: knowing someone with skin cancer (0;1)	0.20	0.17	0.71	NS

using sunscreen more important, easier, and more pleasant, whereas infrequent users were more likely to judge sunscreen to be greasy and to slow down the tanning process. Frequent users also anticipated more regret after getting sunburned or developing skin cancer.

Frequent users reported more positive social influences toward sunscreen use as a result of more social modeling from parents and friends, more social support from parents and friends, and greater positive social norm toward sunscreen use by parents and friends. Frequent users reported higher self-efficacy levels and higher social self-efficacy levels.

**Intentions and Action Plans.** Frequent users were more likely to intend to use sunscreen than infrequent users. Table 4

also shows that frequent users were more likely to indicate that they used action plans related to sunscreen by planning to take sunscreen with them and planning to use sunscreen when at the pool or beach, during sports, and when engaging in outdoor activities.

**Regression Analysis.** The results of the regression analysis are displayed in Table 5. The results of the first model show that being female and attending a higher educational track was associated with the use of sunscreen. Other associated factors were sun exposure, wearing protective clothing to protect oneself from the sun, and seeking shade. In model 2, the factors significantly associated with sunscreen use were gender, education, sun exposure, wearing protective clothing,

**Table 3. Differences in means with regard to attitudes, social modeling and support, and self-efficacy expectations between frequent (n = 106) and infrequent (n = 496) users of sunscreen (ranges between -2 and 2)**

	Frequent users	Infrequent users	T	P<
Attitude				
Total attitude toward sunscreen	0.26	0.24	7.134	0.001
Sunscreen slows down tanning	-0.29	0.06	3.379	0.001
Sunscreen is greasy	0.58	0.87	2.731	0.007
Sunscreen is important	0.88	-0.15	8.171	0.001
Sunscreen is easy	0.42	0.05	3.318	0.001
Sunscreen is pleasant	0.31	-0.16	4.043	0.001
Total attitude toward tanning	-0.67	-0.63	-0.504	NS
Tanning is healthy	-0.15	-0.10	-0.524	NS
Tanning is pleasant	-0.99	-0.89	-0.948	NS
A tan is important	-0.87	-0.92	0.548	NS
Sunscreen regret	0.49	0.11	2.872	0.004
Skin cancer regret	1.61	1.32	3.001	0.003
Social influence				
Social influence for sunscreen	0.77	0.20	7.614	0.001
Modeling sunscreen	0.69	0.07	6.861	0.001
Modeling sunscreen by parents	0.83	0.12	5.698	0.001
Modeling sunscreen by friends	0.55	0.01	5.329	0.001
Social support for sunscreen	0.58	-0.03	6.157	0.001
Social support for sunscreen by parents	1.39	0.63	7.142	0.001
Social support for sunscreen by friends	-0.24	-0.67	3.515	0.001
Total norm score	1.05	0.57	5.652	0.001
Social norm of parents	1.44	0.96	4.688	0.001
Social norm of friends	0.65	0.17	4.547	0.001
Pressure from friends to tan irresponsibly	-0.58	-0.66	-0.688	NS
Self-efficacy				
Self-efficacy about sunscreen	0.73	0.06	4.536	0.001
Social self-efficacy	0.80	0.40	2.960	0.003

**Table 4. Differences in means with regard to beliefs and behaviors between frequent ( $n = 106$ ) and infrequent ( $n = 496$ ) users of sunscreen (range between  $-2$  and  $2$ )**

	Frequent users	Infrequent users	<i>T</i>	<i>P</i> <
Intention				
Intention to use sunscreen	1.06	-0.23	10.80	0.001
Ability factors				
Total score on action plans	1.28	0.15	13.92	0.001
Action plan to bring sunscreen	1.72	0.80	10.07	0.001
Action plan to use sunscreen on beach/at pool	1.26	0.04	11.87	0.001
Action plan to use sunscreen at sports	1.05	-0.13	11.08	0.001
Action plan to use sunscreen at outdoor activities	1.08	-0.10	9.65	0.001

seeking shade, attitude toward tanning, attitude toward sunscreen use, social influence, and self-efficacy. In model 3, intention was most strongly associated with sunscreen use, followed by attitude toward sunscreen use, wearing protective clothing, social influence, and seeking shade. Other factors significantly associated with sunscreen use were gender, education, and sun exposure. In the fourth model, the use of action plans was most strongly associated with sunscreen use, followed by intention, wearing protective clothing, seeking shade, attitude toward sunscreen use, social influence, sun exposure, and education. The fourth model explained 57% of the total variance for sunscreen use.

## Discussion

The first goal of this study was to identify differences between frequent and infrequent users of sunscreen among Belgian adolescents ages 14 to 18 years. With respect to the predisposing and awareness factors, we found that infrequent users had lower levels of response efficacy and were thus less convinced that they could do something to protect themselves against the sun. Frequent users were also more convinced of the seriousness of sunburns and skin cancer. Apparently, the response efficacy of sunscreen may need to be stressed more in interventions, as well as the seriousness of burns and skin cancer. Furthermore, frequent users were more likely to report considering a mass media campaign a cue to action. This is not surprising because people are more willing to respond to a message when it is consistent with what they already believe (72). The extent to which infrequent users indicated that they considered a mass media campaign a cue to action can be

considered satisfactory and gives rise to optimism with regard to this strategy of health promotion. Although knowing someone with skin cancer has been found to be associated with sunscreen use among adults (26, 73), it did not discriminate between frequent and infrequent users of sunscreen in the present study. The reason may be that adolescents believe skin cancer to be a disease of the elderly and that the time frame for getting skin cancer is too large for them to take action (17).

The results of our study confirm findings reported by several other studies, showing sun protection among adolescents to be related to positive attitudes, social influences, and self-efficacy expectations, although the latter factor seems to have been less often included in skin cancer prevention studies (7-10, 15, 19, 20, 22, 25, 29, 30, 32, 33, 35-46, 48, 74).

With respect to the attitudinal beliefs, we found that adolescents who frequently used sunscreen were more convinced of its advantages, and regarded sunscreen as more important, easier to apply, and more pleasant. They also expected more emotional regret after sunburns. Infrequent users, on the other hand, were more convinced of disadvantages, such as sunscreen use being greasy and hampering the development of a nice tan. Consequently, skin cancer programs promoting sunscreen use need to consider emphasizing the advantages of using sunscreen. Furthermore, programs need to indicate that the use of sunscreen may indeed slow down the process of tanning, but also reduces painful burns.

Positive social influences toward sunscreen use among both parents and friends were greater among frequent than infrequent users, which was reflected by more positive modeling, implying that more parents and friends were also

**Table 5. Multiple regression analyses of sunscreen use**

Model	1		2		3		4	
	$\beta$	Sig	$\beta$	Sig	$\beta$	Sig	$\beta$	Sig
Demographic factors and relevant behaviors								
Age								
Gender	0.16	0.000	0.09	0.003	0.08	0.006		
Education	0.09	0.012	0.09	0.004	0.08	0.011	0.07	0.008
Sunburn								
Skin type								
Sun exposure	-0.10	0.009	-0.12	0.000	-0.09	0.004	-0.06	0.038
Protective clothing	0.32	0.000	0.22	0.000	0.16	0.000	0.15	0.000
Seeking the shade	0.19	0.000	0.15	0.000	0.13	0.000	0.11	0.000
Cognitive factors								
Response efficacy								
Risk perception								
Attitude toward tanning			-0.07	0.030				
Attitude toward sunscreen use			0.26	0.000	0.17	0.000	0.10	0.003
Social influence on sunscreen use			0.22	0.000	0.14	0.000	0.06	0.048
Self-efficacy about sunscreen use			0.09	0.003				
Intention								
Intention					0.36	0.000	0.26	0.000
Ability factors								
Action plans							0.32	0.000
Explained variance		0.27		0.45		0.52		0.57

engaging in sunscreen use, as well as more positive support and more positive norms. Consequently, skin cancer programs could use peer modeling to promote more positive norm perceptions in adolescents (see also ref. 75).

With respect to self-efficacy, infrequent users were less convinced that they would be able to use sunscreen when tanning and that they would be able to protect themselves from the sun when their friends would not. This finding suggests that infrequent users may need greater skills to cope with social situations hindering sunscreen use. A limitation of this study, however, was that self-efficacy could only be explored by two items (to avoid the questionnaire becoming too long). More research is needed to identify in greater detail which specific self-efficacy expectations are related to sunscreen use.

The differences in attitudes, social influence, and self-efficacy between frequent and infrequent users suggest that community and mass media initiatives may be needed to change perceptions about tanning and sunscreen use. A well-known example of effective mass media use is the Slip Slop Slap campaign in Australia (76). Several mass media approaches have resulted in effects such as increased awareness and changes in attitudes (76-80). However, their effect may not always be sustained, implying that they should be repeated and supplemented by educational, policy, and environmental strategies (81). Community-wide approaches have the advantage of targeting not only adolescents but also adults (e.g., parents, teachers, sports coaches), but they are more expensive and time consuming. One community-based study found that parents reported fewer sunburns in young children, more sunscreen use on the beach, and improved modeling by parents (82). Furthermore, our findings support earlier findings about the effect of parental influences (29, 47).

The results further confirmed our hypothesis that frequent users would indeed have more action plans than infrequent users pertaining to actions such as carrying sunscreen with them to the beach or pool, using it when at the beach or pool, and using it during sports and other outdoor activities. These findings support the need for clear recommendations in interventions promoting sunscreen use to facilitate the translation of general intentions into the final goal behavior.

The I-Change model explained sunscreen use among Belgian adolescents satisfactorily, with an explained variance of 57.0%, a finding that is comparable with earlier research conducted in the Netherlands (48). As hypothesized, the use of action plans was the strongest predictor of sunscreen use, followed by intention. This has also been reported by others (63, 65). However, the influence of other factors was not entirely mediated by intentions and action plans. Consequently, attitude toward sunscreen use, attending a higher-level school, positive social influences, sun exposure, wearing protective clothing, and seeking shade also made small contributions. These findings support earlier findings of similar models, showing that the so-called end constructs do mediate much but not all variance of factors preceding intentions (31, 48).

Our study was subject to certain limitations, and several recommendations for future research can be formulated. First, our study used a cross-sectional design, thus excluding causal inferences and limiting conclusions to associations. Replication of the findings using a longitudinal study is recommended. Second, the self-reports of adolescents may need to be viewed with some caution. In a study comparing observed and reported sun protection measures, Bennetts et al. (83) found that children who did not protect themselves sufficiently tended to overestimate their sun protective behavior. Furthermore, Milne et al. (84) showed that observation methods for assessing children's sun-protective behaviors during lunch breaks could be implemented successfully. Third, just as in Scandinavian countries and the Netherlands, the Belgian

climate offers an unpredictable number of sunny days. Hence, large amounts of sun exposure may be the result of episodic sunbathing during vacations and sunscreen use may be hindered by the fact that people can be unexpectedly exposed to more sun than predicted (85). Finally, we assessed the respondent's beliefs concerning "cues to action," "anticipated regret," and "social pressure" for sun protection in general. Future research should, however, assess these items within the context of sunscreen use.

Despite these limitations, the results of this study suggest that sunscreen use campaigns should encompass a comprehensive approach by outlining the effectiveness of sunscreen use, the seriousness of burns and skin cancer, the advantages of sunscreen and ways of using it in various situations, and by stimulating the use of clear action plans. Furthermore, sunscreen campaigns should also address the need for a supportive role of friends and parents.

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