

# The importance of assessing the readiness to change sun-protection behaviours: a population-based study

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## Abstract

The purpose of this study was to collect information that may be valuable in developing successful skin cancer prevention programmes. A random sample of 6000 adolescents and 4000 adults answered a questionnaire about sun-related issues. The response rate was 68%. Using sunscreen was the main sun-protection behaviour measured. Approximately 40% of adolescents and 30% of adults did not use any sun-protection strategy other than sunscreen. Readiness to change sun-protection behaviour was measured by assessing the stages of change modified from the Transtheoretical Model (TTM). Half of the participants were in the precontemplation stage of giving up sunbathing and avoiding the sun between 11 a.m. and 3 p.m. Attitude had the strongest association with being in the action/maintenance stages for all sun protection behaviours. A large proportion of participants were not ready to change their sun-protection behaviours, which highlights the importance of including motivational strategies when attempting to change sun-protection behaviours.

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## 1. Introduction

The incidence of malignant melanoma, the most dangerous form of skin cancer, has increased rapidly in Sweden as well as in other Western countries during the last 20 years [1–3]. Epidemiological as well as biological evidence has associated sun exposure with all of the major types of skin cancer [4,5]. Studies have shown that sunbathing and sunburn are frequent in the population of Northern Europe and often occur at sunny resorts in lower latitudes [6]. As exposure to ultraviolet radiation (UVR) from the sun is the most important known risk

factor for skin cancer, increasing sun protective behaviours and decreasing sunbathing in the population may reduce the incidence of skin cancer. The World Health Organisation's recommendations include sun-protection behaviours such as wearing protecting clothes, staying in the shade, avoiding the sun in the middle of the day and using a sunscreen [7].

Skin cancer prevention programmes have enhanced the general knowledge of and attitudes about the disadvantages of sun exposure and the benefits of sun protection, but few have succeeded in changing behaviour [8,9]. There is growing agreement among behavioural scientists that successful health promotion should involve both an individual and a social-environmental approach. The importance of multi-level interventions is also stressed [10]. Furthermore, it is suggested that interventions should involve motivational strategies and take

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account of the fact that individuals in a population may differ in their readiness to change their health behaviour [11].

The Transtheoretical Model (TTM) is a general model of behaviour change that has achieved widespread use and acceptance in health research and the development of interventions to change several health behaviours [11]. A limited number of applications in sun-protection behaviour have been published [12–14]. The model presumes that behaviour change is not an event, but a process that involves a movement through a series of stages. Five stages of change have been identified: precontemplation (not thinking of changing), contemplation (considering change), preparation (committed to change), action (having started a change), and maintenance (sustaining the new behaviour) [11]. Individuals use strategies and weigh the pros and cons of a behavioural change differently, depending on which stage they are in [15]. Information on stage distribution in a population gives public health promoters a chance to develop interventions that may reach the whole population, not just those who are ready to change. To our knowledge, only one stage-matched intervention regarding skin cancer prevention has been reported in which the results were positive for both the actual sun-protection behaviours and stage of change progression [12].

One of the strengths of the TTM is that it invites incorporation of variables specific to the behaviour under investigation. One such variable that may be important for sun-protection behaviour is phenotypic characteristics. Demographic and skin cancer risk factors have also been found to be associated with the distribution of the stages of change for sun-protection behaviour [14,15].

The purpose of this study was to collect information that may be valuable in constructing a successful intervention programme for changing sun-protection behaviours in a Swedish population. Specific aims were to assess: (1) The distribution of the predictors of the stages of change for sun-related behaviour i.e., self-assessed skin type, attitude towards sun exposure and knowledge of UVR exposure and sun-protection behaviour. (2) The possible association between these predictors and host characteristics i.e., gender, age and education. (3) The distribution of the endpoints i.e., stages of change for sun-protection behaviour in the general population and to assess the possible association between predictors and host characteristics with endpoints.

## 2. Patients and methods

A random sample of 10 000 individuals registered in Stockholm County was selected from the national census registry. The sample consisted of 6000 adolescents aged 13–19 years and 4000 adults 20–50 years of age.

A questionnaire and a letter informing potential participants about the study were posted in May 1999. A reminder letter was sent to those who had not returned the questionnaire after 10 days and a second reminder along with a new copy of the questionnaire was sent after an additional 10 days. No compensation for participation was offered. The Ethical Committee of the Karolinska Hospital approved the study.

A non-respond study was conducted by telephone in December 1999. There were no statistically significant differences between the answers of the responders and non-responders except that non-responder male adults reported using sunbeds less frequently than responders did. Details of the non-respond study have been described elsewhere in Ref. [6].

### 2.1. Measurement

The questionnaire contained 64 items assessing the sun-protection issue, and background factors. The questions have been used frequently in Swedish surveys and were developed by a multidisciplinary group including specialists in dermatology, oncology, psychology and the social sciences [16–18]. The questions have been validated and reliability-tested [17,19]. Sunbathing was defined in the questionnaire as exposing oneself to the sun, totally or partly undressed, with the intention to tan. In this study, the focus was on readiness to change sun-protection behaviours, attitudes towards sun exposure and knowledge of sun-protection issues. Sunburn experienced during the past 12 months was assessed for two locations i.e., in Sweden and abroad on a sunny seaside resort. Sunburn was defined as redness and smarting pain.

### 2.2. Individual characteristics

Background variables comprised gender, age and education. Phenotypic characteristics were gathered using the self-assessment method of Fitzpatrick, which divides people into skin types according to their tendency to get sunburned and their ability to tan [20]. The level of education was assessed by asking the participants to report their highest education level.

### 2.3. Sun-protection behaviours: readiness to change

Readiness to change sun-protection behaviours was measured by assessing the stages of change modified from the TTM. Readiness to change five different sun-protection behaviours was assessed: (1) Giving up sunbathing, (2) using clothes for sun protection, (3) using the shade for sun protection, (4) avoiding the sun between 11 a.m. and 3 p.m. and (5) using sunscreen.

The stages of change were assessed by the single-item algorithm method without the customary time-frames

Table 1  
Stage-of-change distribution for five sun-protection behaviours across age, gender, skin type, and education in Stockholm County, 1999

Stages of change	Gender		$\chi^2$	Age group (years)		$\chi^2$	Education <sup>a</sup>		$\chi^2$	Weighted, Total (%) <sup>b</sup>
	Females, <i>n</i> (%)	Males, <i>n</i> (%)		13–19, <i>n</i> (%)	20–50, <i>n</i> (%)		University, <i>n</i> (%)	Others, <i>n</i> (%)		
Clothes for protection	<i>N</i> = 3479	<i>N</i> = 3116		<i>N</i> = 3955	<i>N</i> = 2652		<i>N</i> = 1077	<i>N</i> = 1463		<i>N</i> = 6607
Precontemplation	722 (21)	693 (22)	<i>P</i> < 0.001	1069 (27)	347 (13)	<i>P</i> < 0.001	78 (7)	243 (17)	<i>P</i> < 0.001	15
Contemplation	1159 (33)	841 (27)		1305 (33)	698 (26)		256 (24)	408 (28)		27
Preparation	66 (2)	55 (2)		70 (2)	51 (2)		14 (1)	36 (3)		2
Action	460 (13)	321 (10)		331 (8)	450 (17)		217 (20)	217 (15)		16
Maintenance	1072 (31)	1206 (39)		1180 (30)	1106 (42)		512 (48)	559 (38)		40
Avoiding the sun between 11 a.m. and 3 p.m.	<i>N</i> = 3496	<i>N</i> = 3098		<i>N</i> = 3959	<i>N</i> = 2647		<i>N</i> = 1077	<i>N</i> = 1464		<i>N</i> = 6606
Precontemplation	1668 (48)	2027 (65)	<i>P</i> < 0.001	2479 (63)	1224 (46)	<i>P</i> < 0.001	423 (39)	744 (51)	<i>P</i> < 0.001	49
Contemplation	1168 (33)	707 (23)		999 (25)	880 (33)		390 (36)	455 (31)		32
Preparation	119 (3)	54 (2)		106 (3)	67 (3)		31 (3)	35 (2)		3
Action	313 (9)	135 (4)		171 (4)	277 (11)		144 (13)	130 (9)		9
Maintenance	228 (7)	175 (6)		204 (5)	199 (8)		89 (8)	100 (7)		7
Shade for protection	<i>N</i> = 3524	<i>N</i> = 3091		<i>N</i> = 3999	<i>N</i> = 2663		<i>N</i> = 1085	<i>N</i> = 1467		<i>N</i> = 6662
Precontemplation	346 (10)	337 (11)	<i>P</i> < 0.001	541 (14)	178 (7)	<i>P</i> < 0.001	49 (5)	115 (8)	<i>P</i> < 0.001	8
Contemplation	1028 (29)	879 (28)		1214 (30)	698 (26)		238 (22)	421 (29)		27
Preparation	101 (3)	66 (2)		104 (3)	64 (2)		26 (2)	35 (2)		2
Action	554 (16)	333 (11)		422 (11)	465 (18)		214 (20)	243 (17)		16
Maintenance	1495 (42)	1476 (48)		1718 (43)	1258 (47)		558 (51)	653 (45)		47
Using sunscreen	<i>N</i> = 3533	<i>N</i> = 3129		<i>N</i> = 4003	<i>N</i> = 2671		<i>N</i> = 1085	<i>N</i> = 1476		<i>N</i> = 6674
Precontemplation	163 (5)	384 (12)	<i>P</i> < 0.001	354 (9)	195 (7)	<i>P</i> < 0.001	49 (5)	133 (9)	<i>P</i> < 0.001	8
Contemplation	493 (14)	665 (21)		714 (18)	448 (17)		145 (13)	273 (18)		17
Preparation	157 (4)	107 (3)		189 (5)	75 (3)		17 (2)	55 (4)		3
Action	466 (13)	344 (11)		447 (11)	363 (13)		139 (13)	204 (14)		13
Maintenance	2254 (64)	1629 (52)		2299 (57)	1590 (60)		735 (68)	811 (55)		59
Giving up sunbathing	<i>N</i> = 3064	<i>N</i> = 3109		<i>N</i> = 3944	<i>N</i> = 2671		<i>N</i> = 1076	<i>N</i> = 1073		<i>N</i> = 6615
Precontemplation	1935 (56)	1628 (53)	<i>P</i> < 0.001	2277 (58)	1293 (48)	<i>P</i> < 0.001	446 (41)	789 (53)	<i>P</i> < 0.001	50
Contemplation	1189 (34)	889 (29)		1126 (29)	956 (36)		470 (44)	459 (31)		35
Preparation	41 (1)	34 (1)		46 (1)	30 (1)		11 (1)	15 (1)		1
Action	119 (3)	186 (6)		129 (3)	177 (7)		75 (7)	93 (6)		6
Maintenance	205 (6)	327 (11)		366 (9)	215 (8)		71 (7)	123 (8)		8

Note: The number of participants (*N*) varies owing to missing information.

<sup>a</sup> Age 20 to 50 years were only used in this analysis and there were no difference between the genders in how education was associated with stages of change.

<sup>b</sup> Weighted by the population size of the respective age groups.

since sun-protection behaviour is seasonal in Sweden and the summer lasts only 3–4 months. The respondents were asked to mark the one statement that applied best to them. For example, those who marked “I have never thought of giving up sunbathing” were defined as being in the precontemplation stage. “I am thinking of giving up sunbathing” was classified as contemplation. Preparation was defined as “I intend to give up sunbathing”. Action was defined as “I have given up sunbathing”. And maintenance as “I gave up sunbathing a long time ago” or “I have never sunbathed”. This method has been used in several studies and has proved to be sensitive in assessing readiness to change sun-protection behaviours and to have fair to good stability measured by the test–retest method [13,19].

#### 2.4. Attitude and knowledge

Twelve items assessed attitudes towards sun exposure using a Likert-type scale. Response alternatives were “totally agree”, “agree”, “disagree”, and “totally disagree”. An example of an attitude statement is “Being tanned makes me more attractive”. The attitude index was computed by adding the score on each item (range

12–60). The respondents were asked to rate their agreement with each statement. The coefficient alpha value of the index was 0.75. The test–retest reliability of the attitude index was sufficient (Pearson's  $r = 0.80$ ) [19]. The respondents' knowledge of UVR exposure and sun-protection behaviour was assessed by 8 items. Participants were asked to answer each statement by checking one of three response choices (Yes–No–Do not know). The scores were computed by counting the correct responses. An example of a statement is “Wind reduces the effect of sun radiation”.

#### 2.5. Data analyses

Differences in the stage-of-change distribution between genders, age groups and educational levels were conducted using the Chi-square test ( $\chi^2$ ). *T*-tests were conducted to assess differences in attitude and knowledge between genders and age groups. Logistic regression was used to examine the relationship of using sun-protective strategies actively, i.e., being in the action/maintenance stages, to gender, age groups, attitude, knowledge, skin type and education. Both a crude analysis, i.e., no account being taken of the other variables,

Table 2

Skin type, attitude towards sun exposure and knowledge of UVR exposure and sun-protection across gender and age group in Stockholm County, 1999

Variables	Males (13–19 years), <i>n</i> (%)	Females (13–19 years), <i>n</i> (%)	$\chi^{2b}$	Males (20–50 years), <i>n</i> (%)	Females (20–50 years), <i>n</i> (%)	$\chi^2$	Weighted total (%) <sup>a</sup>
Skin type	<i>N</i> = 1881	<i>N</i> = 2092		<i>N</i> = 1235	<i>N</i> = 1429		
I	103 (6)	121 (6)		102 (8)	114 (8)		8
II	375 (20)	613 (29)		300 (24)	369 (26)		25
III	927 (49)	1025 (49)		717 (58)	834 (58)		57
IV	476 (25)	333 (16)		116 (9)	112 (8)		10
			$P < 0.001$			$P = 0.464$	
	Mean (SD)	Mean (SD)		Mean (SD)	Mean (SD)		Mean (SD)
Attitude (12–60) <sup>c</sup>	37.8 (7.5)	37.4 (7.0)	$P = 0.062$	36.3 (7.8)	36.1 (7.7)	$P = 0.581$	36.4 (7.7)
Knowledge (0–8) <sup>c</sup>	5.1 (1.8)	5.4 (1.7)	$P < 0.001$	6.0 (1.6)	6.5 (1.5)	$P < 0.001$	6.4 (1.6)

UVR, ultraviolet radiation; SD, standard deviation.

<sup>a</sup> All totals are weighted by the population size of the respective age group.

<sup>b</sup>  $\chi^2$ , Chi-square test for statistical significance differences between the genders.

<sup>c</sup> *T*-test for the difference between the genders in both age groups.

Table 3

Sun-protection behaviours across age groups and gender

Sun-protection behaviours	Adolescents aged 13–19 years		$\chi^{2a}$	Adults aged 20–50 years		$\chi^2$
	Females, <i>n</i> (%) <i>N</i> = 1852	Males, <i>n</i> (%) <i>N</i> = 1747		Females, <i>n</i> (%) <i>N</i> = 1293	Males, <i>n</i> (%) <i>N</i> = 1140	
Not using any sun protection	728 (39)	661 (38)	$P = 0.012$	360 (28)	278 (24)	$P < 0.001$
Using one of three sun-protection strategies	491 (27)	470 (27)		244 (19)	212 (19)	
Using two of three sun-protection strategies	486 (26)	517 (30)		431 (33)	511 (45)	
Using three of three sun-protection strategies	147 (8)	99 (6)		257 (20)	139 (12)	

Note: The three sun-protection behaviours are using clothes, using shade and avoiding the sun between 11 a.m. and 3 p.m.

<sup>a</sup>  $\chi^2$ , Chi-square test for statistical significance differences between the genders in both age groups.

Table 4  
Factors related to being in the action/maintenance stages of change for five different sun-protection behaviours

	Giving up sunbathing (%)	Odds Ratio <sup>a</sup> (95% CI)	Using clothes for protection (%)	Odds Ratio (95% CI)	Using the shade for protection (%)	Odds Ratio (95% CI)	Avoiding the sun between 11 a.m. and 3 p.m. (%)	Odds Ratio (95% CI)	Sunscreen (%)	Odds Ratio (95% CI)
Gender										
Female (ref.) <sup>b</sup>	9	1.0	45	1.0	60	1.0	16	1.0	81	1.0
Male	18	2.6 (2.2–3.2)	50	1.4 (1.3–1.6)	59	1.1 (1.0–1.2)	10	0.6 (0.5–0.7)	65	0.5 (0.4–0.5)
Age group (years)										
13–19 (ref.)	13	1.0	39	1.0	55	1.0	9	1.0	72	1.0
20–50	15	1.0 (0.8–1.3)	60	1.4 (1.3–1.6)	66	1.2 (1.0–1.4)	18	1.6 (1.3–1.9)	75	1.3 (1.1–1.5)
Skin type										
I (ref.)	23	1.0	61	1.0	70	1.0	20	1.0	83	1.0
II	14	0.7 (0.5–1.0)	55	1.0 (0.7–1.2)	65	0.9 (0.7–1.1)	16	0.8 (0.6–1.1)	80	0.7 (0.5–1.0)
III	10	0.7 (0.5–1.5)	46	0.7 (0.5–0.9)	58	0.7 (0.6–0.9)	11	0.7 (0.5–0.9)	75	0.5 (0.4–0.7)
IV	19	1.5 (1.1–2.2)	33	0.5 (0.4–0.7)	49	0.6 (0.5–0.8)	11	0.8 (0.6–1.0)	52	0.2 (0.2–0.3)
Attitude index										
High (ref.)	2	1.0	32	1.0	45	1.0	7	1.0	68	1.0
Medium	8	4.0 (2.9–5.7)	49	1.9 (1.6–2.2)	62	1.9 (1.7–2.2)	10	1.5 (1.2–1.9)	77	1.4 (1.2–1.6)
Low	30	22.9 (16.6–31.5)	64	3.2 (2.8–3.7)	75	3.3 (2.8–3.8)	24	3.9 (3.1–4.8)	80	1.5 (1.3–1.8)
Knowledge index										
Low (ref.)	16	1.0	41	1.0	56	1.0	11	1.0	67	1.0
High	10	0.7 (0.5–0.8)	56	1.4 (1.2–1.6)	65	1.2 (1.1–1.4)	16	1.1 (0.9–1.3)	82	1.9 (1.6–2.1)
Level of education <sup>c</sup>										
Less than	15	1.0	54	1.0	63	1.0	16	1.0	71	1.0
University degree	14	1.0 (0.8–1.3)	69	1.8 (1.5–2.1)	73	1.6 (1.3–1.9)	22	1.5 (1.2–1.9)	82	1.6 (1.3–2.1)

Percentages and adjusted Odds Ratios with 95% Confidence Intervals (CI) are presented.

<sup>a</sup> Odds Ratio adjusted for all other variables in the model (e.g. gender is adjusted for age, skin type, attitude, knowledge and education).

<sup>b</sup> (ref.) The reference group for the Odds Ratio analysis.

<sup>c</sup> Adolescents were not included in this analysis.

and an adjusted analysis, i.e., each variable is adjusted for all other variables in the model, were performed. For these analyses, the following categorising was done. Attitude scores were dichotomised by dividing participants into three equally sized groups: low score (12–33), medium score (34–39) and high score (40–60). Knowledge scores were dichotomised by dividing the population into two equally sized groups based on the number of correct answers: low score (1–6) and high score (7–8). Skin type was categorised into 4 groups using the self-assessment method of Fitzpatrick [20]. For education, we created two categories, university education versus less than university education. Differences in sunburn experience between sunscreen users and those who did not use sunscreen was conducted using the Chi-square test.

### 3. Results

The response rate in the study was 68% for both adolescents (4078/6000) and adults (2727/4000). Less than 50% of the population reported being in the maintenance stage for all sun-protection behaviours, except sunscreen use, where 59% reported being in the maintenance stage. (Table 1). Approximately half of the participants were in the precontemplation stage for giving up sunbathing and avoiding the sun between 11 a.m. and 3 p.m. A minority, less than 4%, was in the preparation stage for all of the sun-protection behaviours. Adolescents (13–19 year olds) reported being in the precontemplation stage more frequently than adults did (20–50 years of age) for all of the sun-protective behaviours (Table 1).

There was no statistically significant difference in attitudes towards sun exposure between the genders in both age groups (Table 2). Females were more knowledgeable about UVR exposure and sun-protection behaviour than males in both age groups (Table 2). Adults had statistically significant higher mean knowledge scores compared with adolescents, 37.6 and 36.2, respectively, and a less positive attitude towards sun exposure, ( $P < 0.001$ ); this was true for both females and males (data not shown). More than 90% of the participants knew that getting sunburnt increased the risk of getting skin cancer and that the greatest risk of getting sunburnt occurs in the middle of the day (data not shown). Fifty three per cent of the adolescents and 35% of the adults did not know what the sun protective factor (SPF) on sunscreen containers indicated (data not shown). Furthermore, 60% of those in action/maintenance stages for using sunscreen had experienced sunburn during the last 12 months compared with 42% of those in the pre-action stages (data not shown). Finally, 75% of sunbathers use sunscreen compared with 57% of those who do not sunbathe (data not shown). There was a statisti-

cally significant difference between female adolescents and male adolescents and between adolescents and adults, both genders, in how they assessed their skin type (Table 2). The gender difference was not seen in the adult age groups. Approximately 40% of adolescents and 30% of adults were using no other sun-protection than sunscreen (Table 3).

Variables identified as significantly related to being in the action/maintenance stages in the crude analysis comprised gender, age, skin type, attitude, knowledge and educational level (data not shown). These variables were adjusted for in the analysis reported in Table 4. Attitude had the strongest association with being in the action/maintenance stages for all sun-protection behaviours. Those with a least positive attitude towards sun exposure were 23 times more likely to be in the action/maintenance stages for giving up sunbathing. Those with high level of knowledge reported more often that they were in the action/maintenance stage for all behaviours except giving up sunbathing. Individuals in precontemplation stage for all sun-protection behaviours had the lowest knowledge score and the highest attitude score. Sensitive skin and having a university degree were both related to being in the action/maintenance stages for most of the sun-protection behaviours (Table 4).

### 4. Discussion

Approximately 40% of the adolescents and 30% of the adults were not using any sun-protection strategies except sunscreen and only a small percentage reported that they were prepared to change their sun-protection behaviour. Similar results regarding the reluctance to change sun-protection behaviour have been reported from the United States of America (USA) [12].

Seventy three per cent of all participants were in the action/maintenance stages for using sunscreen, which was the most frequent sun-protection method reported. By contrast, more than 80% reported being in the pre-action stages for giving up sunbathing and avoiding the sun between 11 a.m. and 3 p.m. Although 90% of all participants were aware of the increased risk of getting sunburnt between 11 a.m. and 3 p.m. and that getting sunburnt increases the risk of skin cancer, many appear to seek the sun between 11 a.m. and 3 p.m. It is possible that some people may attempt to sunbathe “effectively”, i.e., for attaining suntan, when the UVR from the sun is the strongest. Interestingly, males were significantly more likely to be in the pre-action stages for avoiding the sun between 11 p.m. and 3 a.m. Stage-tailored efforts may be needed to move people through the stages of change in avoiding the midday sun and giving up sunbathing.

As people get older they become more knowledgeable about UVR exposure and sun-protection behaviour and



females possess more knowledge than males in both age groups. However, a high level of knowledge was not associated with being in the action/maintenance stages for giving up sunbathing and only weakly related to sun-protection behaviours. Our results are consistent with the results of other studies showing that the general population has a positive attitude towards sun exposure and that knowledge of the sun-related issues does not necessarily lead to better sun-protection behaviours [21–23].

People in the precontemplation stage were least knowledgeable about UVR exposure and sun-protection behaviour. Intervention for precontemplators should therefore aim to increase knowledge and awareness of the risk of UVR with the goal of getting people to enter the contemplation on stage with regard to sun protection. This is in line with results from other health behaviours and is consistent with the TTM [24]. Attitude had the strongest association to being in the action/maintenance stages and most adolescents and adults were in the pre-action stages of change for most sun-protection behaviours. This calls for motivational efforts to change attitudes towards tanning and sun exposure that in turn may lead to improved sun-protection behaviour.

Only approximately half of all participants knew that the SPF does not indicate how many hours one can stay in the sun. Furthermore, sunscreen users reported both sunburn and intentional tanning more often than those who did not use sunscreen. Other studies have reported an association of sunscreen use with a more positive attitude towards sunbathing and prolonged time spent in the sun, as well as an increased risk for melanoma [13,25–27]. This suggests that recommendations about using sunscreens as sun-protection need to be re-evaluated.

The descriptive analysis of the reported skin type showed that adolescents might underestimate their sun sensitivity. This calls for caution in the interpretation of data involving adolescents where this variable is used and in public health promotions where sun-protection messages are matched with skin type. This phenomenon is reported and discussed in more detail in another paper [28]. Those who reported having skin types III and IV were less likely to be in the action/maintenance stages for all sun-protection behaviours, which is consistent with the results of several studies showing that skin sensitivity is related to sun-protection behaviour [13,29].

Differences according to educational level, age and gender were all associated with being in the action/maintenance stages, which is in accordance with data from other studies [30]. However, educational level was not associated with the readiness to give up sunbathing.

All measures were self-reported and are subject to the bias that is common in such studies. The relatively high response rate, 68% for both adolescents and adults, and the result of the non-response study suggests this study

has a fairly good external validity, and that the results may be representative of the general population [6]. The method used in this study for measuring stages of change is valid and reliable and can be included in population surveys measuring changes in readiness to change sun-protective behaviours in the general population.

## 5. Conclusions

The results of the present study show that several factors, including attitude, skin type, age and gender are associated with sun-protection behaviour. These factors should be kept in mind when designing intervention programmes. Attitude towards sun exposure had the strongest association to being in the action/maintenance stages for all sun-protection behaviours. Motivational efforts to change attitudes towards tanning and sun exposure may lead to improved sun-protection behaviour. Educational efforts to increase knowledge about UVR exposure and sun-protection behaviour might be important to those in the precontemplation stage. It should be emphasised that sunscreen use may be a questionable method to prevent malignant melanoma and should only be used as a compliment to other sun-protection strategies. The results also emphasise the need to match intervention messages to people's readiness to change their behaviour. One way may be to develop interactive interventions in which people in different stages would get feedback that is matched with their readiness to change. Another practical implication of the present results would be to include a variety of messages in skin cancer prevention campaigns that may affect people differently, depending on their readiness to change their sun-protection behaviour.

## Conflict of interest statement

None declared.

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