

Original

Prevalence and correlates of skin cancer risk behaviors in Madrid (Spain)

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ABSTRACT

Objective: To estimate the prevalence and correlates of skin cancer-related behaviors in a representative sample of the population of the region of Madrid (Spain).**Methods:** We performed a cross-sectional study based on a telephone survey. A total of 2,007 participants aged 18–64 years completed a questionnaire that included items on knowledge about the risk of skin cancer, sun exposure, the use of ultraviolet (UV) lamps and sunburn during the previous year. Logistic regression models were constructed, adjusted for gender, age, educational level and employment status.**Results:** Sun exposure as a risk factor for skin cancer was identified by 92.3% of participants and artificial tanning by 73.6%. Knowledge of risk factors was greater among university graduates and women ($P < .001$). A total of 14.6% were usually exposed to the sun in the summer during the hours of maximum UV radiation, while 4.3% had used UV lamps during the previous year; the use of these lamps was more frequent among women ($P < .001$) and young people ($P < .05$). The prevalence of sunburn was 13.2% and was lower among women: odds ratio (OR) 0.68 (95% CI: 0.51–0.90); this prevalence declined with greater age (p linear trend < 0.001) and was higher among students: OR 1.60 (95% CI: 1.07–2.40).**Conclusions:** Numerous sociodemographic factors are related to UV radiation exposure and sunburn, with young people at highest risk. UV exposure is more frequent among women, whereas sunburn is more common among men.

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Prevalencia y factores relacionados con las conductas de riesgo de cáncer de piel en Madrid (España)

RESUMEN

Objetivo: Estimar la prevalencia y los factores asociados a las conductas relacionadas con el cáncer de piel en una muestra representativa de la Comunidad de Madrid (España).**Métodos:** Estudio transversal basado en encuesta telefónica. Un total de 2.007 personas de 18–64 años completaron un cuestionario sobre conocimiento de riesgos del cáncer de piel, la exposición al sol, el uso de aparatos de bronceado artificial y quemaduras solares durante el último año. Se elaboraron modelos de regresión logística, ajustando por sexo, edad, nivel educativo y situación laboral.**Resultados:** Un 92,3% identificaron la exposición al sol como un factor de riesgo para el cáncer de piel, disminuyendo al 73,6% para el bronceado artificial. Este conocimiento es mayor entre las personas con educación superior y en las mujeres ($p < 0,001$). El 14,6% estuvieron expuestos al sol en verano durante las horas de máxima radiación ultravioleta (UV), y el 4,3% utilizaron lámparas UV en el último año, siendo más frecuente en las mujeres ($p < 0,001$) y jóvenes ($p < 0,05$). La prevalencia de quemaduras solares fue del 13,2%, siendo menor en las mujeres (odds ratio [OR] de 0,68; IC95%: 0,51–0,90), disminuyendo a medida que aumenta la edad (p de tendencia lineal $< 0,001$) y más alta entre los estudiantes (OR de 1,60; IC95%: 1,07–2,40).**Conclusiones:** Se detectan numerosos factores sociodemográficos asociados a la exposición a la radiación UV y las quemaduras solares, siendo la población más joven la de mayor riesgo. La exposición a radiación UV es más frecuente entre las mujeres, mientras que las quemaduras solares son más comunes en los hombres.

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Introduction

Ultraviolet (UV) radiation has various effects on health. Some are positive, such as the production of vitamin D₃, essential forbone mineralization.¹ A protective effect, mediated by vitamin D₃, has also been suggested against multiple sclerosis² and the development of prostate cancer,³ although the evidence is still not conclusive.⁴ Other effects are negative, acting as a risk factor for skin cancer, immunosuppression and cataracts.⁵

Malignant skin tumours, basal cell carcinoma and spinocellular carcinoma as well as melanoma, are a growing problem in Spain due to their steady increase in recent decades. Annual increases in

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Table 1
Knowledge of the effects of exposure to ultraviolet radiation and skin cancer, according to sociodemographic variables

	n	Knowledge that prolonged sun exposure is a risk factor for skin cancer			Knowledge that prolonged exposure to ultraviolet ray lamps is a risk factor for skin cancer		
		%	OR ^a (95% CI)	P value	%	OR ^a (95% CI)	P value
<i>Total</i>	2,007	92.3			73.6		
<i>Gender</i>							
Men	984	89.3	1		68.3	1	
Women	1,023	95.1	2.90 (1.92-4.38)	<.001	78.7	1.83 (1.47-2.28)	<.001
<i>Age</i>							
18-29	540	93.7	1		78.3	1	
30-44	768	93.9	1.02 (0.61-1.71)	.938	74.6	0.76 (0.56-1.03)	.076
45-64	699	89.4	0.71 (0.43-1.17)	.181	68.8	0.65 (0.47-0.88)	.006
<i>p linear trend</i>				.115			.007
<i>Educational level</i>							
University	615	94.8	1		77.1	1	
Higher secondary education	697	94.1	0.88 (0.54-1.44)	.610	74.9	0.87 (0.67-1.13)	.292
Lower secondary education	473	89.9	0.50 (0.31-0.81)	.005	72.3	0.78 (0.59-1.03)	.081
Primary education or below	222	84.7	0.33 (0.19-0.58)	<.001	62.6	0.51 (0.36-0.74)	<.001
<i>p linear trend</i>				<.001			<.001
<i>Employment status</i>							
Employed	1,470	92.7	1		74.0	1	
Students	181	94.5	0.99 (0.45-2.17)	.987	77.3	0.89 (0.57-1.38)	.599
Houseworkers	205	91.2	0.66 (0.35-1.26)	.211	73.7	0.93 (0.64-1.36)	.716
Unemployed/retired	151	86.8	0.72 (0.42-1.25)	.246	65.6	0.80 (0.55-1.17)	.254

^a Odds ratios adjusted for the rest of the variables in the table.

mortality of 2% have been recorded for melanoma, and the incidence of this neoplasm ranges between 4 to 9/100,000 for men and 3 to 10/100,000 for women.⁶ Despite this increase, similar to that seen in other countries in southern Europe like Portugal and Greece, the mortality rate from melanoma in Spain is still one of the lowest in Europe, probably because of the characteristics of the cutaneous pigmentation of the population. Nevertheless, the increase in this disease could reflect changes in the sun exposure habits of the Spanish population.⁶

There is strong evidence that solar radiation is the main environmental risk factor for the three main types of skin cancer,⁷ with the effect increasing as the intensity of exposure rises.⁷ There are variations in the relationship between the types of cancer and their localization regarding the time and type of sun exposure,⁸ but this association is seen even for short-term intermittent exposures and basal cell carcinoma or melanoma.⁹ Scientific evidence also supports the relationship between exposure to artificial sources of UV radiation and certain types of skin cancer, increasing the risk of melanoma, squamous cell carcinoma¹⁰ and basal cell carcinoma.¹¹

In the summer, UV radiation in the Madrid region reaches very high values on the UV index,¹² but until now there have been no studies describing the patterns of exposure and its distribution among the population of this region. The estimation of these parameters, using information from self-reported questionnaires, would be very useful for the more efficient planning of skin cancer prevention interventions within the framework of the Regional Plan for the Prevention and Control of Cancer, and could serve as a reference for other countries in southern Europe with high levels of insolation.

Methods

Study design and population

A cross-sectional study carried out in 2007 as part of the *Sistema de Vigilancia de Factores de Riesgo de Enfermedades No Transmisibles* (SIVFRENT) [Behavioural Risk Factor Surveillance System for non-communicable diseases] of the Madrid region, which continually monitors the health habits and preventive practices of the

non-institutionalised population aged 18-64 years.¹³ A total of 2,007 participants were selected in a representative way from the household directory for fixed line telephone services (covering 92% of all households), by stratified sampling with proportional allocation of the population structure according to gender, age and geographical area. The interviews were conducted using a Computer Assisted Telephone Interviewing (CATI) system, for one week each month, except for August.

Study variables

The questionnaire was drawn up from questions normally used with an adult population¹⁴ and structured into four sections: 1) Knowledge: Do you think that prolonged exposure to the sun is a risk factor for skin cancer? (Yes, No, Not sure); Do you think that prolonged exposure to UV ray lamps is a risk factor for skin cancer? (Yes, No, Not sure); 2) Protective measures: Do you use protection against the sun in summer? (Always, Nearly always, Sometimes, Never), which of the following do you use?: clothing (cap, T-shirt); sun protection creams; sunglasses; 3) Exposure variables: Do you sunbathe in the summer for sun tanning between 12 midday and 4 in the afternoon? (Always, Nearly always, Sometimes, Never); Have you used UV ray lamps for tanning during the last year? (Yes, No); and 4) Effects: Have you suffered sunburn during the last 12 months, including any occasion when an area of skin, even only a small one, was red for more than 12 hours? (Yes, No).

Data analysis

Logistic regression models were constructed differentiated for each indicator, simultaneously introducing the following analysis variables: gender, age (18-29, 30-44 and 45-64 years of age), educational level (university, higher secondary education, lower secondary education, primary education or below), and employment status (employed persons, students, houseworkers, unemployed persons/retired). Prevalence odds ratios (OR) were calculated with their corresponding 95% confidence intervals (95%CI). The first-order interactions between gender, age, educational level and employment status were also calculated in each

Table 2
Use of protective measures for avoiding sun exposure in summer, according to sociodemographic variables

	n	Normally use ^b clothing as sun protection			Normally use ^b sun protection creams			Normally use ^b sunglasses with protective lenses against ultraviolet radiation		
		%	ORa ^a (95% CI)	pP value	%	ORa (95% CI)	P value	%	ORa (95% CI)	P value
<i>Total</i>	2,007	60.1			78.2			60.8		
<i>Gender</i>										
Men	984	67.9	1		65.5	1		57.0	1	
Women	1,023	52.7	0.47 (0.39-0.58)	<.001	90.5	5.13 (3.91-6.73)	<.001	64.4	1.46 (1.21-1.78)	<.001
<i>Age</i>										
18-29	540	50.7	1		77.6	1		56.7	1	
30-44	768	59.0	1.37 (1.07-1.77)	.014	82.3	1.42 (1.03-1.96)	.032	65.9	1.25 (0.96-1.62)	.091
45-64	699	68.7	2.06 (1.56-2.71)	<.001	74.3	0.87 (0.63-1.21)	.420	58.4	1.05 (0.80-1.38)	.722
<i>p linear trend</i>				<.001			.195			.937
<i>Educational level</i>										
University	615	59.8	1		83.4	1		65.9	1	
Higher secondary education	697	57.0	0.92 (0.73-1.16)	.483	76.5	0.61 (0.45-0.82)	.001	61.1	0.93 (0.73-1.17)	.532
Lower secondary education	473	62.6	1.07 (0.83-1.38)	.612	77.8	0.66 (0.48-0.91)	.012	58.8	0.78 (0.60-1.00)	.054
Primary education or below	222	65.8	1.04 (0.74-1.48)	.812	70.3	0.37 (0.25-0.56)	<.001	50.0	0.55 (0.39-0.76)	<.001
<i>p linear trend</i>				.612			<.001			<.001
<i>Employment status</i>										
Employed	1,470	60.2	1		76.9	1		63.3	1	
Students	181	50.3	1.01 (0.70-1.46)	.970	81.2	1.54 (0.96-2.48)	.076	49.2	0.59 (0.41-0.85)	.005
Houseworkers	205	64.4	1.40 (0.99-1.97)	.056	90.7	1.47 (0.84-2.56)	.173	58.5	0.80 (0.57-1.13)	.204
Unemployed/retired	151	65.6	1.02 (0.71-1.48)	.900	70.9	0.98 (0.65-1.49)	.939	53.6	0.77 (0.54-1.09)	.142

^a Odds ratios adjusted for the rest of the variables in the table.

^b Normally use: always or nearly always.

one of the models. P-value for linear trend was estimated for the variables age and educational level.

The level of statistical significance was set at $p < 0.05$. The statistical analyses were carried out using Stata v.10 (StataCorp, College Station, 2008).

Results

The response rate (completed interviews as a percentage of the total sum of completed, partially completed and incomplete/refused interviews) was 65.1%. The sample studied was similar in structure in terms of age and gender to the population between 18 and 64 years of age in the Madrid region.

Regarding knowledge of risk factors, 92.3% [95% CI: 91.0-93.4] knew that prolonged sun exposure is a risk factor for skin cancer and 73.6% [95% CI: 71.6-75.5] knew about the association of skin cancer with prolonged exposure to UV ray lamps. Table 1 shows the odds ratio (OR) adjusted for gender, age, educational level and employment status. Knowledge of these risk factors was higher among women than among men. For age, no differences were observed for the risk of sun exposure, while knowledge about the effect of artificial UV exposure declined as age increased (p linear trend = 0.007). Knowledge of the effects of both kinds of exposure, natural and artificial, fell in a direct relationship with the reduction of educational level (p linear trend <0.001). Although the frequency with which unemployed people and pensioners stated that they knew of these risk factors was lower, after adjustment there were no statistically significant differences for employment status.

For the use of protective measures to avoid sun exposure in summer, 60.1% of the population interviewed stated that they normally used clothing as sun protection, 78.2% used sun creams and 60.8% sunglasses with protective lenses against UV radiation (Table 2). Women more frequently used sun creams and sunglasses than men, but less frequently used clothing as sun protection. The use of clothing as a protective measure increased with age (p linear trend <0.001). The use of creams was higher among those of 30-44 years of age than among those of 18-29 years of age, estimating an OR of 1.42 [95% CI: 1.03-1.96], whereas there were no age

differences for the use of sunglasses. There was less use of creams and sunglasses as the educational level decreased (p linear trend <0.001), but no differences were seen for the use of clothing as a protective measure. For employment status, statistically significant differences were only detected in the adjusted model, with a lower use of sunglasses among students.

Finally, Table 3 shows the prevalence and risk of exposure to UV radiation and sunburn in the last year. Some 14.6% stated that they sunbathed always or nearly always between 12 midday and 4 in the afternoon for tanning, 4.3% used UV ray lamps in the last 12 months and 13.2% suffered sunburn in the last 12 months. The habit of sunbathing in the summer between 12 midday and 4 in the afternoon for tanning was seen more frequently among women and young people. No clear pattern was seen for educational level or employment status. The use of UV ray lamps for tanning was also higher among women. No differences were seen for the use of UV tanning equipment by educational level after adjustment for the rest of the sociodemographic variables. Regarding employment status, a lower use of such equipment was recorded for students. Women reported suffering less sunburn throughout the last year than men, OR of 0.68 [95% CI: 0.51-0.90]. In addition, as age increased the probability of sunburn decreased (p linear trend <0.001). By educational level, those with lower secondary education suffered less frequently from sunburn in the last year (OR of 0.58; 95% CI: 0.39-0.87). By employment status, students were the group that most frequently reported sunburn in the last year, estimating an OR of 1.60 [95% CI: 1.07-2.40].

No statistically significant interactions were found between the variables studied.

Discussion

The main results of this study suggest that most of the population, especially among people of a higher educational level and women in general, knows the relationship between exposure to UV radiation and skin cancer. The most commonly used protection was sun cream, and a variable distribution was seen by gender, age and educational level, according to the types of measures employed.

Table 3

Prevalence and risk of exposure to ultraviolet radiation and sunburn in the last year, according to sociodemographic variables

	n	Sunbathing in summer for tanning between 12 midday and 4 in the afternoon ^b			Used ultraviolet ray lamps for tanning during the last 12 months			Suffered sunburn in the last 12 months		
		%	ORa ^a (95% CI)	P value	%	ORa (95% CI)	P value	%	ORa (95% CI)	P value
<i>Total</i>	2,007	14.6			4.3			13.2		
<i>Gender</i>										
Men	984	11.5	1		1.9	1		15.8	1	
Women	1,023	17.5	1.72 (1.32-2.24)	<.001	6.6	4.05 (2.39-6.86)	<.001	10.8	0.68 (0.51-0.90)	.008
<i>Age</i>										
18-29	540	20.0	1		8.0	1		30.4	1	
30-44	768	13.0	0.66 (0.47-0.93)	.017	3.7	0.35 (0.21-0.59)	<.001	10.4	0.31 (0.22-0.43)	<.001
45-64	699	12.0	0.64 (0.44-0.93)	.019	2.2	0.24 (0.12-0.46)	<.001	3.0	0.09 (0.05-0.15)	<.001
<i>p linear trend</i>				.025			<.001			<.001
<i>Educational level</i>										
University	615	13.8	1		4.7	1		14.3	1	
Higher secondary education	697	16.8	1.14 (0.83-1.57)	.407	4.7	1.09 (0.64-1.86)	.754	16.9	0.82 (0.58-1.14)	.238
Lower secondary education	473	13.3	0.98 (0.68-1.40)	.905	4.0	0.95 (0.52-1.76)	.880	9.5	0.58 (0.39-0.87)	.009
Primary education or below	222	12.2	0.94 (0.57-1.55)	.809	2.3	0.69 (0.25-1.90)	.469	6.3	0.82 (0.43-1.55)	.537
<i>p linear trend</i>				.773			.586			.031
<i>Employment status</i>										
Employed	1,470	14.1	1		4.8	1		12.3	1	
Students	181	23.2	1.25 (0.80-1.97)	.323	3.9	0.33 (0.14-0.79)	.012	37.0	1.60 (1.07-2.40)	.022
Houseworkers	205	13.7	0.84 (0.53-1.35)	.481	2.4	0.49 (0.18-1.31)	.153	2.4	0.49 (0.19-1.25)	.136
Unemployed/retired	151	9.3	0.67 (0.37-1.20)	.174	2.0	0.52 (0.16-1.71)	.280	7.9	1.06 (0.55-2.03)	.870

^a Odds ratios adjusted for the rest of the variables in the table.^b Frequency: always or nearly always.

Some 13.2% suffered sunburn during the last year, with a greater risk detected for men, young people and students.

Knowledge that sun exposure is a risk factor for skin cancer is very high in this population (92.3%), but is lower for artificial UV exposure, with one in four people unaware of the risk. Indeed, this latter estimate is lower compared to that of a recent study in Denmark, where 88% identified artificial UV exposure as a risk factor for cancer and skin alterations,¹⁵ or to that shown in the United Kingdom (UK) (82%).¹⁶ Nevertheless, the distribution of this knowledge, greater among people of a higher educational level and women in general, is consistent with the pattern detected by Miles et al in the UK.¹⁶

The relatively high level of knowledge about the risk of exposure to UV radiation contrasts with the level of use of protective measures. For example, only 60.1% of those interviewed used clothing as sun protection. Although the way of posing the question and of evaluating the replies differs between studies, this prevalence can be compared to that found in Melbourne¹⁷ (66%), a city that also has a very high exposure to UV radiation. In other geographical areas, such as the UK¹⁶ (38%), the USA^{18,19} (23%) or Israel²⁰ (11%), the prevalence is very low. In our study, we found that women and young people adopt this protective measure less frequently, a result previously obtained by some authors,^{18,19,21,22} although others have not detected gender differences.^{16,23} In contrast to that found in some other areas regarding use of protective measures, in the Madrid region, people with a higher educational level did not use clothing more frequently as sun protection, something that has also been reported for the USA¹⁹ and the UK.¹⁶

As observed by other authors,²² the use of sun creams is the preferred method for sun protection, probably because, although it is less safe,²⁴⁻²⁶ it is compatible with sun tanning. The percentage using creams in Madrid (78%) is much higher than in the USA¹⁸ (49%) and the UK¹⁶ (37%), although in these studies only those using creams with a sun protection factor of 15 or above were considered to be adequately protected. The Madrid percentage is also higher than the estimates for Israel²⁰ (37%) and Melbourne¹⁷ (27%). Sun creams were the most commonly used method by women, who were precisely the group least using clothing for sun protection.

Regarding age and educational level, creams were most used by interviewees of 30-44 years of age and those with the highest educational level. These results are compatible with those observed in other countries.^{16,18,19,22} For the use of sunglasses, 61% used sunglasses with protective lenses against UV radiation, a percentage considerably higher than that in Israel (28%).²⁰

As already described in the literature,²¹ there is a discrepancy between the knowledge that the population has about the risk of sun exposure and the level of protective measures taken to avoid its effects. Our results also show this discrepancy, which is probably due to a certain level of skin tanning still being socially considered to be attractive and an indicator of good health.^{16,21,27}

Exposure to solar radiation in the peak afternoon hours is low (15%), much lower than that recorded in Israel²⁰ (63%). Again, it is associated with women and with young people, as in the UK.²⁸ Similarly, the prevalence of artificial UV exposure is very low in our region (4.3%), at least when compared with countries with limited sun exposure, such as Denmark, with a prevalence of 29%.¹⁵ This prevalence is also lower than that in the USA (15%).²⁹ In our study, artificial UV exposure is higher among women and young people, which is consistent with the findings of previous studies.^{15,27,29,30} Our data do not reflect an association with educational level, in contrast to other studies that have found associations in different directions, in some cases being linked to a lower educational level¹⁵ and, in others, to a higher educational level.²⁹

In our study, the prevalence of sunburn in the last year (13.2%) is much lower than that seen in the Anglo-Saxon countries, using the same or a very similar question: 34-39% in the USA,^{25,31,32} 39% in the UK,²⁸ 56% in Canada²⁴ or 51-70% in Australia.^{33,34} In Europe, specifically in Stockholm, a prevalence of 55% has been estimated for the population of 13-50 years of age.³⁰ Factors that could contribute to these differences are that, as previously mentioned, the population of the Madrid region more frequently uses sun protection measures, but also that the dominant skin phototype of the population is more resistant to sun exposure. Hence, for example, when only people of Latin origin were included in the interviews conducted in the USA, the percentage of sunburn was reduced to 20% for men and 17.2% for women.³¹ Yet in Melbourne, with a less

resistant skin phototype, a study published in 2008 showed how the percentage of people suffering sunburn was 9.1% due to the influence of strong prevention campaigns.¹⁷

Although women sunbathe more often, they suffer less sunburn than men, a finding consistent with those of other authors.^{24,25,27,28,31–34} It is possible that the greater use of protective sun creams by women may have influenced these results, although the difference could also be due to variations in total sun exposure times, as in general men spend more time outdoors than women.³⁵ According to our results, the youngest people in the study, who also have a higher sun exposure, have a higher incidence of skin lesions, as indicated in other studies.^{18,24,25,27,28,32,33,36} Irrespective of age, students have a greater probability of suffering sunburn, as seen in previous reports.^{32,36} However, no clear association was found between sunburn and educational level, a relationship that has contradictory information in the literature. Although some studies have found no relationship,^{25,27,28} others have found a greater probability of sunburn for people with the highest educational level,^{32,36} or for those with a low educational level.³³ Finally, there did not appear to be a higher risk of sunburn for employed people, which could suggest that its occurrence is linked to leisure-time sun exposure, looking for a tan.²⁸

There are certain methodological limitations in our study that should be pointed out, in order to obtain a better interpretation of the results. Data have not been obtained for those over 64 years of age, among whom there are many cases of skin cancer, or for those under 18 years of age, where prevention is very important. The general way of measuring the variables has not allowed the gathering of detailed information, for example, about the level of protection of sun creams or the frequency of application, the inclusion of which would be useful in subsequent surveys. Although subject to the classic memory bias of this type of measurement, self-reported information from questionnaires has demonstrated an acceptable validity.^{37,38} Another limitation is related to the differences in the questions and response categories used in questionnaires, which make comparison between studies difficult, leading to a recent proposal for standardized measurements.¹⁴

This study is based on a broad representative sample (in terms of age and gender) of a region that has 13.5% of the population of Spain. Nevertheless, it is possible that people with a low educational level could be underestimated.³⁹ The telephone questionnaire of SIVFRENT (a Behavioural Risk Factor Surveillance System for non-communicable diseases in the Madrid region), in which the section about sun exposure was included, has shown a good reproducibility⁴⁰ and convergent validity as compared to home surveys.³⁹ Moreover, the distribution of the interviews throughout all the months of the year avoids estimates being influenced by seasonal variability. For example, a higher prevalence of sunburn has been described by those interviewed in the summer.³²

In summary, most of the population, especially people with a high level of education and women in general, know the relationship between exposure to UV radiation and skin cancer, even if a discrepancy was seen between this level of knowledge and the use of protective measures and sun exposure habits. The use of sun creams is the most frequently used protective measure, and one in seven people normally sunbathe during the summer in the peak afternoon hours, with this habit being more frequent among women and young people. Some 13.2% of the sample population suffered sunburn in the last year, with a higher risk among men, young people and students. These results indicate the need to maintain preventive strategies to continue improving knowledge about the risk of exposure to UV radiation and reduce risk behaviour to exposure, as well as strengthening environmental protection measures, such as guaranteeing that public recreational spaces have abundant shady areas for protection against direct exposure to the sun.

Author's contributions

I. Galán and E. Cámara designed the study. I. Galán performed statistical analysis. I. Galán, A. Rodríguez, L. Díez and E. Cámara significantly contributed to the interpretation of the data and to the article writing. All authors read and approved the final manuscript.

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Conflict of interest

None declared.

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References

1. Wolpowitz D, Gilchrist BA. The vitamin D questions: how much do you need and how should you get it? *J Am Acad Dermatol.* 2006;54:301–17.
2. Van Amerongen BM, Dijkstra CD, Lips P, et al. Multiple sclerosis and vitamin D: an update. *Eur J Clin Nutr.* 2004;58:1095–109.
3. John EM, Koo J, Schwartz GG. Sun exposure and prostate cancer risk: evidence for a protective effect of early-life exposure. *Cancer Epidemiol Biomarkers Prev.* 2007;16:1283–6.
4. Gilbert R, Metcalfe C, Oliver SE, et al. Life course sun exposure and risk of prostate cancer: population-based nested case-control study and meta-analysis. *Int J Cancer.* 2009;125:1414–23.
5. Gallagher RP, Lee TK. Adverse effects of ultraviolet radiation: a brief review. *Prog Biophys Mol Biol.* 2006;92:119–31.
6. López-Abente G, Pollán M, Aragonés N, et al. La situación del cáncer en España Madrid: Ministerio de Sanidad y Política Social; 2005. [Accessed on 2 January 2010.] Available at: <http://www.msps.es/ciudadanos/enflesiones/enfNoTransmisibles/docs/situacionCancer.pdf>.
7. Armstrong BK, Kricke A. The epidemiology of UV induced skin cancer. *J Photochem Photobiol.* 2001;63:8–18.
8. Chang YM, Barrett JH, Bishop DT, et al. Sun exposure and melanoma risk at different latitudes: a pooled analysis of 5700 cases and 7216 controls. *Int J Epidemiol.* 2009;38:814–30.
9. Gandini S, Sera F, Cattaruzza MS, et al. Meta-analysis of risk factors for cutaneous melanoma: II. Sun exposure. *Eur J Cancer.* 2005;41:45–60.
10. International Agency for Research on Cancer Working Group on artificial ultraviolet (UV) light and skin cancer. The association of use of sunbeds with cutaneous malignant melanoma and other skin cancers: a systematic review. *Int J Cancer.* 2007;120:1116–22.
11. Boyd AS, Shyr Y, King Jr LE. Basal cell carcinoma in young women: an evaluation of the association of tanning bed use and smoking. *J Am Acad Dermatol.* 2002;46:706–9.
12. Agencia Estatal de Meteorología. Observación de radiación ultravioleta. [Accessed on 2 January 2010.] Available at: <http://www.aemet.es/es/eltiempo/observacion/radiacionuv/estaciones/graf?uri=/web/eltiempo/observacion/radiacionuv/graficos/uvi/madrid.uvi>.
13. Galán I, Rodríguez-Artalejo F, Tobías A, et al. Risk factors surveillance for non-communicable disease through telephone survey. Results in the Autonomous Community of Madrid from 1995–2003. *Gac Sanit.* 2005;19:193–205.
14. Glanz K, Yaroch AL, Dancel M, et al. Measures of sun exposure and sun protection practices for behavioral and epidemiologic research. *Arch Dermatol.* 2008;144:217–22.
15. Koster B, Thorgaard C, Clemmensen IH, et al. Sunbed use in the Danish population in 2007: a cross-sectional study. *Prev Med.* 2009;48:288–90.
16. Miles A, Waller J, Hiom S, et al. SunSmart? Skin cancer knowledge and preventive behaviour in a British population representative sample. *Health Educ Res.* 2005;20:579–85.
17. Dobbins SJ, Wakefield MA, Jansen KM, et al. Weekend sun protection and sunburn in Australia trends (1987–2002) and association with SunSmart television advertising. *Am J Prev Med.* 2008;34:94–101.
18. Coups EJ, Manne SL, Heckman CJ. Multiple skin cancer risk behaviors in the U.S. population. *Am J Prev Med.* 2008;34:87–93.
19. Santmyre BR, Feldman SR, Fleischer Jr AB. Lifestyle high-risk behaviors and demographics may predict the level of participation in sun-protection behaviors and skin cancer primary prevention in the United States: results of the 1998 National Health Interview Survey. *Cancer.* 2001;92:1315–24.
20. Tamir D, Tamir J, Dayan I, et al. Positive changes in sun-related behavior in Israel (1994–1998). *Prev Med.* 2002;35:369–75.

21. Arthey S, Clarke VA. Suntanning and sun protection: a review of the psychological literature. *Soc Sci Med*. 1995;40:265–74.
22. Stanton WR, Janda M, Baade PD, et al. Primary prevention of skin cancer: a review of sun protection in Australia and internationally. *Health Promot Int*. 2004;19:369–78.
23. Hall HI, May DS, Lew RA, et al. Sun protection behaviors of the U.S. white population. *Prev Med*. 1997;26:401–7.
24. Purdue MP, Marrett LD, Peters L, et al. Predictors of sunburn among Canadian adults. *Prev Med*. 2001;33:305–12.
25. Hall HI, Saraiya M, Thompson T, et al. Correlates of sunburn experiences among U.S. adults: results of the 2000 National Health Interview Survey. *Public Health Rep*. 2003;118:540–9.
26. Livingston PM, White V, Hayman J, et al. Sun exposure and sun protection behaviours among Australian adolescents: trends over time. *Prev Med*. 2003;37:577–84.
27. Robinson JK, Rigel DS, Amonette RA. Trends in sun exposure knowledge, attitudes, and behaviors: 1986 to 1996. *J Am Acad Dermatol*. 1997;37:179–86.
28. Stott MA. Tanning and sunburn: knowledge, attitudes and behaviour of people in Great Britain. *J Public Health Med*. 1999;21:377–84.
29. Heckman CJ, Coups EJ, Manne SL. Prevalence and correlates of indoor tanning among US adults. *J Am Acad Dermatol*. 2008;58:769–80.
30. Boldeman C, Branstrom R, Dal H, et al. Tanning habits and sunburn in a Swedish population age 13–50 years. *Eur J Cancer*. 2001;37:2441–8.
31. Sunburn prevalence among adults—United States, 1999, 2003, and 2004. *MMWR*. 2007;56:524–28.
32. Brown TT, Quain RD, Troxel AB, et al. The epidemiology of sunburn in the US population in 2003. *J Am Acad Dermatol*. 2006;55:577–83.
33. Raasch BA, Buettner PG. Knowledge and perceptions about sunburn and solar keratoses in Australia. *Australas J Dermatol*. 2008;49:142–7.
34. Disipio T, Rogers C, Newman B, et al. The Queensland Cancer Risk Study: behavioural risk factor results. *Aust N Z J Public Health*. 2006;30:375–82.
35. Gurrea G, Cañada J. Study of UV radiation dose received by the Spanish population. *Photochem Photobiol*. 2007;83:1364–70.
36. Saraiya M, Hall HI, Uhler RJ. Sunburn prevalence among adults in the United States, 1999. *Am J Prev Med*. 2002;23:91–7.
37. O’Riordan DL, Lunde KB, Steffen AD, et al. Validity of beachgoers’ self-report of their sun habits. *Arch Dermatol*. 2006;142:1304–11.
38. Oh SS, Mayer JA, Lewis EC, et al. Validating outdoor workers’ self-report of sun protection. *Prev Med*. 2004;39:798–803.
39. Galán I, Rodríguez-Artalejo F, Zorrilla B. Telephone versus face-to-face household interviews in the assessment of health behaviors and preventive practices. *Gac Sanit*. 2004;18:440–50.
40. Galán I, Rodríguez-Artalejo F, Zorrilla B. Reproducibility of a telephone questionnaire on risk factors associated with behavior and preventive practices. *Gac Sanit*. 2004;18:118–28.