


SUPPLEMENT ARTICLE

Sunbed use legislation in Europe: assessment of current status

M.I. Longo,^{1,*} J.L. Bulliard,² O. Correia,³ H. Maier,⁴ S.M. Magnússon,⁵ P. Konno,⁶ N. Goad,⁷ A.F. Duarte,³ J. Oláh,⁸ L.T.N. Nilsen,⁹ K. Peris,¹⁰ R. Karls,¹¹ A.M. Forsea,¹²  V. del Marmol¹³

¹Department of Dermatology, University of Florida College of Medicine, Gainesville, FL, USA

²Institute of Social and Preventive Medicine (IUMSP), Lausanne University Hospital, Lausanne, Switzerland

³Centro Dermatologia Epidermis, Instituto CUF, Porto, Portugal

⁴Department of Dermatology, Medical University of Vienna, Vienna, Austria

⁵Icelandic Radiation Safety Authority, Reykjavík, Iceland

⁶Department of Dermatology, East Tallinn Central Hospital, Tallinn, Estonia

⁷British Association of Dermatologists, London, UK

⁸Department of Dermatology and Allergology, University of Szeged, Szeged, Hungary

⁹Norwegian Radiation Protection Authority, Østerås, Norway

¹⁰Department of Dermatology, Catholic University of the Sacred Heart, Milano, Italy

¹¹Department of Infectology and Dermatology, Riga Stradins University, Riga, Latvia

¹²Department of Dermatology, Elias University Hospital, Carol Davila University of Medicine and Pharmacy, Bucharest, Romania

¹³Department of Dermatology, Hôpital Erasme, Université Libre de Bruxelles, Brussels, Belgium

*Correspondence: M. I. Longo. E-mail: mlongo@ufl.edu

Abstract

Background The use of UV-emitting tanning devices for cosmetic purposes is associated with an increased risk of melanoma and non-melanoma skin cancer. Young women are the most frequent users, therefore, there is an increasing concern about the regulation of sunbed use.

Objective The primary objective is to assess the current legislation on sunbed use among European countries.

Methods We developed a 30-item questionnaire to gather the most relevant information about sunbed use legislation. The questionnaire was sent to Euromelanoma coordinators and to designated coordinators out of the Euromelanoma network.

Results We obtained a response rate of 64%. More than 25% of the countries did not report any specific legislation. Roughly one-third of the countries does not have a restriction for minors. Even in countries with a specific legislation, a lack or insufficient enforcement of age limit was observed in up to 100% of the inspections based on the PROSAFE report from 2012. Self-tanning devices were reported in 50%, and almost 40% of countries do not require supervision of use. Although a warning display is required in 77% of cases, a signed informed consent is not required in 80%. In the vast majority of cases, the number of licensed or closed tanning centres is unknown.

Conclusions Despite the evidence of its harmful effects, and its frequent use by young people, many of whom are at high risk of skin cancer because of fair skin, a significant number of European countries lack a specific legislation on tanning devices. In order to limit the access of young people to sunbeds, a more strictly enforced regulation is needed, as well as regulation regarding advertisement, and location of tanning centres, in addition to health promotion campaigns that target the vulnerable population of young women seeking its use for improved cosmesis.

Received: 9 May 2018; Accepted: 20 September 2018

Conflicts of interest

None.

Funding sources

None.

Introduction

The use of sunbeds has dramatically increased since it became popular in the 1980's. Current evidence clearly supports a causal association between sunbed use and melanoma, that is independent of sun exposure, sun sensitivity and other known risk factors such as the presence of multiple or dysplastic nevi or family history of melanoma^{1–3}

In 2009, the International Agency for Research on Cancer (IARC), based on a meta-analysis (IARC Working Group),⁴ categorized UV-emitting tanning devices as carcinogenic to humans (for cutaneous and ocular melanoma).⁵ Several meta-analyses have not only substantiated that sunbed users are at increased risk of melanoma^{6,7} but have also evidenced significant increases in non-melanoma skin cancer (basal cell carcinoma and squamous cell carcinoma).⁸ The risk of melanoma appears to be stronger for young women, who are the most frequent users, and increases with initial use at an early age (less than 35 years) and number of sunbed sessions.⁹ Although most of the evidence supporting an association between sunbed use and melanoma is of poor quality given the type of studies (primarily case-control studies) as highlighted in a recent systematic review,¹⁰ there is also strong evidence from high-quality studies such as the one recently published by Ghiasvand and colleagues.¹¹ They found an increased melanoma risk with increased cumulative number of tanning sessions, and initiation before the age of 30 was associated with a higher risk compared to never use. Their study comprised a large population-based cohort (Norwegian Women and Cancer Center) where more than 140 000 women were followed for a mean duration of 13.7 years. Inference based on the concomitant fast rises in melanoma incidence and sunbed use in some populations further supports the growing body of evidence on the harms of indoor tanning.¹² Initially, practised predominantly in Northern Europe and the United States, the spread of indoor tanning since 2000 to sunny environments like Australia and Southern Europe is of particular concern. The last review about international sunbed use showed that 'ever use' of indoor tanning was 35.7% for adults, 55% for university students and 19.3% for adolescents.¹³ The prevalence in women compared to men doubled or almost tripled for university students, and adolescents.

There has been generalized criticism of the regulatory measures relating to sunbed use adopted in Europe¹⁴ compared to other countries like the United States where their administration strongly battles for banning access to teenagers and levies taxes on tanning sessions.¹⁵

The primary objective of this study is to assess the current legislation on sunbed use across Europe; additional objectives include the assessment of available data on the number of sunbeds, and on educational campaigns about the hazards of sunbed use. Finally, we compare legal requirements with the outcome of inspections performed in several European countries

in a joint action co-funded by the European Commission (PROSAFE).¹⁶

Materials and methods

We compiled a questionnaire aimed at covering the most relevant aspects of sunbed legislation. It was developed by IL, in conjunction with expert epidemiologist JLB and VM, and later approved by all participating Euromelanoma Chairs and collaborators (pretest survey). The questionnaire comprised 30 questions (Fig. 1), most with dichotomous answers. It was sent to all coordinators participating in the Euromelanoma network and also to European countries that do not belong to this network. For each country, coordinators were asked to complete the survey or refer it to an appropriate contact able to provide the information. The completed questionnaires were received between April and December 2012. An update on current legislation was performed at the end of 2017. Data from the PROSAFE report are based on inspections performed from March 2010 until November 2011. The majority of countries that provided information for the PROSAFE report also answered our questionnaire (Cyprus, Czech Republic, Denmark, France, Germany, Hungary, Latvia, Norway, Portugal, The Netherlands, United Kingdom).

Results

We received data from 23 out of 36 invited countries, giving a response rate of 64% (Fig. 2). A total of 26 questionnaires were analysed (UK returned one questionnaire for each territory: England, Northern Ireland, Scotland and Wales). Some countries could not complete the questionnaire due to lack of knowledge of a specific legislation (Greece) or due to an absence of sunbeds (Malta). The results pertaining to the main issues addressed in the questionnaire are summarised in Table 1. The items in the table do not match the order of questions, they have been grouped to facilitate reading. Twenty-seven per cent of the countries did not report any specific legislation. The year of the first issued legislation varied from 1983 to 2014 with 23% of existing legislation being developed between 2008 and 2011.

We were able to compare the outcome of the inspections performed during the joint action with the current legislation in eight countries (Denmark, France, Germany, Hungary, Latvia, Norway, Portugal and United Kingdom). The issues analysed relate to the safe use of sunbeds, namely UV irradiance, enforcement of age limit, staff supervision, self-tanning devices, personal advice on potential hazards, warning displays and use of protective eyewear. Ultraviolet irradiance above the threshold limit (0.3 W/m^2) was observed in more than 55% of inspected centres, in some countries the rate was above 90%. Lack of warning displays and insufficient eye protection were observed in up to 45% and 75% of centres, respectively. Rates varied widely from 0% to 100% for the rest of addressed issues.¹⁶

Questionnaire for updating information regarding current legislation of sunbed use in Europe		
Country:		
1. When was issued the first legislation regarding sunbed use in your country?	Year	
2. Does your legislation include centers that use UV-emitting devices for medical purposes?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
3. Is there any specification on allowed wavelength and irradiance?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
If yes		
a. Wavelength allowed:		
b. Maximum irradiance allowed:		
4. Is tanning equipment professionally tested and certified?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(please specify the standard applied:)		
5. Is there a restriction related to age?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Under what age sunbed use is not permitted ?		
6. Is there any restriction regarding its use during		
a. Pregnancy		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(please specify):		
b. Intake of medication		
	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(please specify):		
7. Do users need to sign a consent form (where risks are specifically addressed) before using the tanning device?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
If yes, what are the specific risks addressed? Select all that apply		
a. Have a personal or family history of skin cancer	<input type="checkbox"/>	
b. Have large number of moles	<input type="checkbox"/>	
c. Tendency to freckle	<input type="checkbox"/>	
d. Have a history of frequent childhood sunburn	<input type="checkbox"/>	
e. Have sun-damaged skin	<input type="checkbox"/>	
f. Have difficulty in getting tanned (skin easily turns red when sun exposed)	<input type="checkbox"/>	
g. Have red hair	<input type="checkbox"/>	
h. Have green or blue eyes	<input type="checkbox"/>	
i. Going on vacation to sunny places	<input type="checkbox"/>	
j. Other (please specify:		
8. Do tanning salons are required to keep a record of signed consent forms?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
9. Do clients receive a copy of their signed consent?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
10. Is there any specific training for the tanning salon staff?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(please specify):		
11. Is trained staff required to attend an update training course periodically?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(please specify how often		
12. Are tanning salon operators required to supervise the use of tanning devices?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
13. Is there a safety device to prevent accidental excessive exposures?	<input type="checkbox"/> Yes	<input type="checkbox"/> No

Figure 1 Euromelanoma questionnaire on sunbed use legislation.

Discussion

A recent document from the World Health Organization released in June 2017 (Artificial tanning devices: Public health interventions to manage sunbeds) states that ‘the evidence is clear that artificial tanning is responsible for a portion of skin

cancers and therefore offers an excellent opportunity for primary prevention’.¹⁷ Worldwide, only Brazil and Australia (all six states) have completely banned sunbed use for cosmetic purposes since 2009 and 2016, respectively. In the present study, we have analysed the current legislation on sunbed use in Europe.

14. Is there a usual official surveillance of tanning centers in your country?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
15. Is a technical inspection of the devices mandatory?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	(please specify how often)	
16. Do tanning centers need to provide protective eyewear?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
17. Is there a specific regulation of hygiene measures for sunbed use?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
18. Do tanning centers need to record the number and duration of exposures as well as specific recommendations for each user?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
19. Is advertisement specifically regulated?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
20. Is it required to display information notices (warnings) about sunbed use on visible sites in the salons?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
21. Is it required to display staff training certificates on visible sites in the salons?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
22. Do you have self-service tanning salons?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
23. Do tanning salons promote the use of tanning accelerators?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	If yes, please specify	
	<input type="checkbox"/> Oral <input type="checkbox"/> Antioxidants/vitamins <input type="checkbox"/> Methoxsalen <input type="checkbox"/> Other, please specify	
	<input type="checkbox"/> Topical (please specify):	
24. What is the approximate number of sunbeds/inhabitants (main cities)?	
25. How many tanning centers have been licensed in your country in the last three years?	<input type="checkbox"/> I don't know	<input type="checkbox"/> Number:
26. How many tanning centers have been closed in your country in the last three years?	<input type="checkbox"/> I don't know	<input type="checkbox"/> Number:
27. Do you usually have national sensitization meetings for teachers about the harm of sunbed?	<input type="checkbox"/> I don't know	<input type="checkbox"/> Number:
28. Do you usually have national sensitization meetings for pharmacists about the harm of sunbed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	(please specify):	
29. Do you usually have national sensitization meetings for primary care physicians about the harm of sunbed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	(please specify):	
30. Do you usually have public national warnings about the harm of sunbed?	<input type="checkbox"/> Yes	<input type="checkbox"/> No
	for how many years?	
	how (please select all that apply) <input type="checkbox"/> TV <input type="checkbox"/> Radio <input type="checkbox"/> Newspaper	
31. Comments:	

Figure 1 Continued

Roughly three quarters of the surveyed countries do have specific legislation on sunbed use. Countries that do not have it are presumed to follow the European Standard on safety for household and similar electrical appliances with particular requirements for appliances for skin exposure to ultraviolet and

infrared radiation (EN 60335-2-27) of the European Committee for Electrotechnical Standardization (CENELEC for the French acronym).¹⁸ The standard is a recommendation, not compulsory compliance. It establishes a series of statements that shall be included in the instructions for UV appliances (Table 2), and a

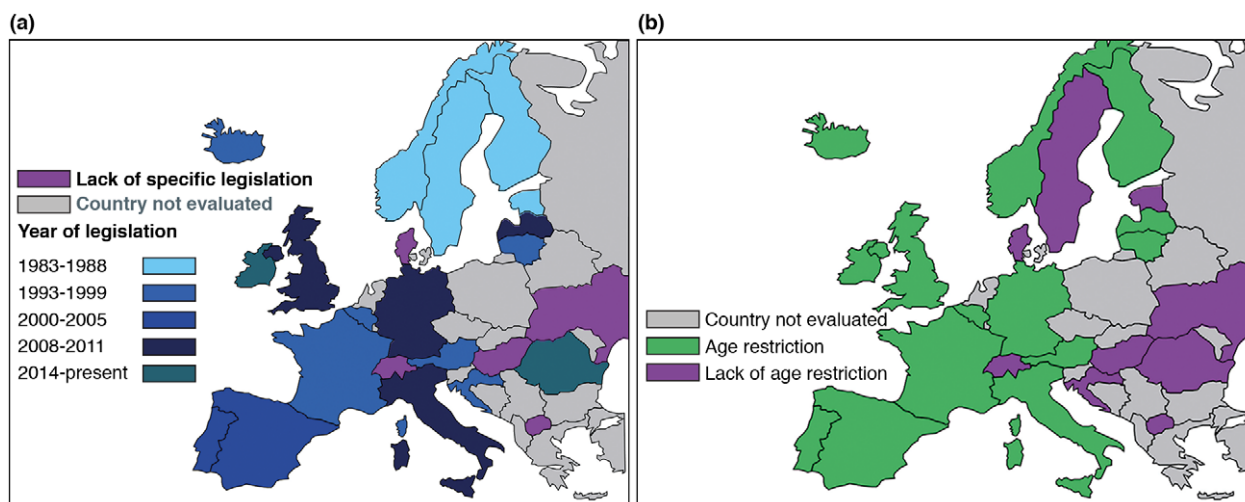


Figure 2 Countries that submitted a complete questionnaire. (a) Reported legislation; (b) Age restriction to youth under 18 years.

maximum total effective irradiance threshold (0.3 W/m^2) that corresponds to the level of ambient irradiance at midday in summer in Southern Europe (0.27 W/m^2), for which public health messages advise staying out of the sun as the UV index is superior to 11 (extreme exposure level).¹⁹

Although 85% of the countries report a specification on wavelength and irradiance, the limit of the erythemally effective irradiance was exceeded, frequently by two or three times, in two-thirds of inspected sunbeds during the PROSAFE Joint Action.¹⁶ A study carried out in England that measured the UV spectra from 400 tanning devices found that in 90% it almost doubled the compliance level²⁰ with a mean erythemal irradiance of 0.56 W/m^2 . Recently, the Health and Food Safety Directorate of the European Commission stated that there is no safe level of exposure.²¹

Although the majority of laws (80%) do not include centres that use UV-emitting devices for medical purposes, it is not uncommon to find type 3 and 4 UV machines (high-output devices not intended for cosmetic sunbed use) in tanning centres. A study in Northern Ireland showed that five and 15.6% of tanning centres reported the use of type 3 and 4 UV devices, respectively, in addition to finding that UV emission typing of sunbeds was unknown in 71%.²² Therefore, the hazardous UV exposure might also be facilitated by the lack of professional testing and certification of the devices and the lack of a mandatory technical inspection in 35% and 42% of the countries, respectively.

Roughly one-third of the countries do not have a restriction for people aged under 18 years. This is of special concern considering that overall 50% have self-tanning devices that can be indiscriminately used by teenagers even in countries with restriction on age. In Denmark, which lacks a specific regulation on age limit, 13% of users are aged 12–14 years,²³ while in UK,

which has a restriction on age, this percentage is 1.8 for a similar age group (11–14 years).²⁴ Restriction for those under 18 years has increased worldwide from two countries in 2003 to 14 countries in 2016,²⁵ and this parallels the development of laws which peaked after 2005. Although there is a trend towards better compliance with age limit in countries that have a regulation, and it has been shown to be more effective than parental consent,²⁶ insufficient enforcement of the legislation hinders its effectiveness.

Staff supervision is of utmost importance for compliance with restrictions, keeping a record of exposures and providing adequate recommendations to each user. Nonetheless, in 38% of the countries there is no requirement to supervise the use of tanning devices. The information and advice that the user receives strongly depend on the training received by the staff which is lacking in 50% of cases. Staff training is mainly provided by the industry as shown in a study from Northern Ireland where the most common provider was the owner or manager (in 41%).²² Topics covered in over 95% of cases were the duration of use and equipment operation, while risk assessment was addressed in only 16% of cases.²⁰ Although the majority of sunbed users tans easily (phototypes III or higher),^{3,27,28} the increased melanoma incidence is mostly observed in groups with known risk factors for melanoma (fair skin, history of sunburns, red hair, more than 50 moles or dysplastic nevi, family history of melanoma).^{2,29–31} In 58% of countries we surveyed, there was no requirement to record the number and duration of exposures, or to give specific recommendations to each user.

Other than some studies on prevalence of sunbed use, especially among high-risk groups like minors, there is scant information about the real picture of compliance with regulatory measures. A population-based study (2011–2012) from

Table 1 Results of the questionnaire on sunbed use legislation (*n* = 26)

General specifications of devices and centres	Yes (%)	No (%)	NA (%)
Regulates use for medical purposes	19	81	0
Specification on wavelength and irradiance	88	12	0
Equipment professionally tested and certified	65	35	0
Mandatory technical inspection of devices	58	42	0
Official surveillance of centres	85	15	0
Type of restriction			
Younger than 18 years	69	31	0
Pregnancy	27	73	0
Drugs	54	42	4
Staff training and supervision			
Required training for staff	50	50	0
Update training	50	50	0
Training certificate display	15	85	0
Required supervision of use	62	38	0
Self-tanning devices	50	50	0
Health advice about sunbed use			
Signed informed consent	19	81	0
Copy of signed consent for client	50	50	0
Keep record of signed consents	80	20	0
Warning display	77	23	0
Record exposures and specific recommendations	42	58	0
Safety measures			
Protective eyewear	92	8	0
Hygiene	62	38	0
Safety device	58	23	19
Advertisement			
Specific regulation	38	62	0
Promotion of tanning accelerators	50	23	27
Registry of tanning centres			
Known number of sunbeds per inhabitants	42	0	58
Known number of licensed tanning centres	8	0	92
Known number of closed tanning centres	15	0	85
Sensitization campaigns			
For teachers	8	88	4
For pharmacists	4	96	0
For primary care physicians	12	88	0
National	77	23	0

NA, not answered.

Germany³² showed a high rate of non-compliance with safety measures: 40% of sunbed users were never advised to use goggles (in one-third, goggles were not provided in the last visit) and had never received advice on skin type, one-third reported that there were no supervising personnel during their last visit. Overall, 75% were not informed about the potential health risks of sunbed use and did not receive an individual plan suitable to

Table 2 European standard recommendation on restrictions for sunbed use (GENELEC-EN 60335-2-27)

Age	Under 18 years
Sun sensitivity	Tendency to freckle, natural red hair colour, suffer or had suffer from sunburns, not able to tan at all or not able to tan without burning when exposed to the sun, burn easily when exposed to the sun, photosensitivity diseases, photosensitizing medications
Nevi	More than 16 moles (2 mm or more in diameter) on the body, any atypical moles
Skin cancer	Suffer from or previously suffering from skin cancer or predisposed to skin cancer, first-degree relative with melanoma
Other	Abnormal discoloured patches on the skin

their skin type, and 70% were not asked about skin-related medications, skin care products or skin disorders.³² The PROSAFE report observed insufficient or lack of personal advice in 46% (including Portugal where compliance of inspected centres was 100%).¹⁶

A mainstay for the sunbed industry is advertising, which is not specifically regulated in more than 60% of the countries. The reported health benefits on vitamin D production, reduced sun sensitivity and improved mental well-being are not accurate, misleading the users who believe sunbed use is safer than sun exposure. Indeed, the belief that tanning beds are safe has been positively correlated with sunbed use.^{33,34} Additionally, the industry enhances sunbed use by offering discounts and unlimited tanning packages, and by promoting tanning accelerators.³⁵ Price incentives are especially attractive to the young, and several studies from the United States have shown that advertisements are more commonly found in collegiate (36%), high school (48%) and entertainment (53%) newspapers compared with other press types.³⁶ Promotion of tanning accelerators was reported in 50% of countries in our study, with roughly a third of the total being oral and two-thirds topical. In a study from Northern Ireland, tanning accelerator creams were available in 86% of tanning salons.²²

It has been shown that regulation of sunbed use, even in countries with a low prevalence of use, improves compliance with skin cancer awareness and restriction for high-risk groups and people under 18 years, although strict enforcement must follow to reach optimal levels.³⁷ In this respect, the sanctions placed after inspections in the PROSAFE report globally ranged from warnings (23%) to fines (30%) or official reports which are rather low considering the observed high rate of non-compliance with many requirements. Only Portugal carried out severe sanctions in response to non-compliance.

For many countries, there is no legal requirement to licence tanning equipment, which hinders appropriate surveillance and inspections. As many sunbeds are located in facilities not exclusive to tanning, like gyms, spas and hair or beauty salons, a registry of sunbed equipment would facilitate inspections and the monitoring of the effects of educational campaigns.

The role of educational campaigns must be carefully evaluated. In most countries, information about the health hazards of sunbed use is given in the setting of sun protection campaigns. Very few countries address the use of sunbeds separately, focusing on selected groups such as teachers, pharmacists and primary care physicians that can reach more efficiently the target population, especially the youth with lower education grades and behavioural problems (addiction conduct and low self-esteem). From the studied countries, only Portugal has a long tradition of year-round, focused campaigns and, in the PROSAFE report, it is the country with the highest compliance with restriction under 18's, personal advice, warning displays and lack of self-tanning salons (from 32 inspected centres). A favourable impact of public health campaigns has also been suggested in countries with a high prevalence of use. In Iceland, where a melanoma epidemic was observed in young women, possibly influenced by the use of sunbeds around 2002, melanoma incidence lowered thereafter and that coincided with decreased sunbed use following a health campaign focused on teenage girls.¹² In Denmark, sunbed use decreased from over 50% in 2007 to 44% in 2008 among 15–19 year-olds, after a campaign against sunbed use was launched in 2007.³⁸

Health campaigns should specifically address the age groups most susceptible of using sunbeds in order to antagonise the clever advertising of the tanning industry. Although skin cancer prevention is a strong argument, young age groups may be more concerned with cosmetic appearance, and a greater emphasis on accelerated skin ageing induced by sunbed use might prove to be a more effective strategy.

Additional measures, mainly aimed at discouraging sunbed use by adolescents, include taxing sunbed use and restricting the locations of tanning salons (far from schools and residential areas).²⁵ In 2010, the United States implemented a 10% tax on tanning services. Although the impact of this measure on decreasing sunbed use is to be evaluated, a similar measure on tobacco products decreased smoking by at least 4%.³⁹

It is difficult to independently assess the impact of strict regulation and education on sunbed use. In countries that have strength on both, like Portugal, we observe the lowest rate of use and the highest rate of compliance with legislation.

In summary, although the majority of countries do have a specific legislation on sunbed use, surveillance market inspections reveal that compliance is poor for the most critical issues such as limit of UV irradiance, restriction to youth under 18 years and personal advice about potential hazards. Based on our survey findings and our evidence-based review of the literature, several efficient measures could be implemented (Table 3): ban access to minors and use of self-operating devices, regulate advertising, require staff training by independent authorities, document health advice, register tanning equipment, strictly enforce regulations (sanctions upon non-compliance) and tailor

Table 3 Summary of proposed measures to restrict sunbed use among minors

1. Enforcement of legislation banning access to the youth under 18 years
2. Regulation of advertisement
3. Taxing sunbed use
4. Location restriction of tanning centres
5. Health promotion campaigns

public health education campaigns for the most susceptible population.

References

- 1 Swerdlow AJ, Weinstock MA. Do tanning lamps cause melanoma? An epidemiologic assessment. *J Am Acad Dermatol* 1998; **38**: 89–98.
- 2 Lazovich D, Vogel RI, Berwick M *et al*. Indoor tanning and risk of melanoma: a case-control study in a highly exposed population. *Cancer Epidemiol Biomarkers Prev* 2010; **19**: 1557–1568.
- 3 Fears TR, Sagebiel RW, Halpern A *et al*. Sunbeds and sunlamps: who used them and their risk for melanoma. *Pigment Cell Melanoma Res* 2011; **24**: 574–581.
- 4 The 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* 2006; **120**: 1116–1122.
- 5 El Ghissassi F, Baan R, Straif K *et al*. A review of human carcinogens-Part D: radiation. *Lancet Oncol* 2009; **10**: 751–752.
- 6 Boniol M, Autier P, Boyle P, Gandini S. Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis. *BMJ* 2012; **345**: e4757.
- 7 Colantonio S, Bracken MB, Beecker J. The association of indoor tanning and melanoma in adults: systematic review and meta-analysis. *J Am Acad Dermatol* 2014; **70**: 847–857.
- 8 Wehner MR, Shive ML, Chren MM *et al*. Indoor tanning and non-melanoma skin cancer: systematic review and meta-analysis. *Br Med J* 2012; **345**: e5909.
- 9 Cust AE, Armstrong BK, Goumas C *et al*. Sunbed use during adolescence and early adulthood is associated with increased risk of early-onset melanoma. *Int J Cancer* 2011; **128**: 2425–2435.
- 10 Burgard B, Schöpe J, Holzschuh I *et al*. Solarium use and risk for malignant melanoma: Meta-analysis and evidence-based medicine systematic review. *Anticancer Res* 2018; **38**: 1187–1199.
- 11 Ghiasvand R, Rueegg CS, Weiderpass E, Green AC, Lund E, Veierød MB. Indoor tanning and melanoma risk: Long-term evidence from a prospective population-based cohort study. *Am J Epidemiol* 2017; **185**: 147–156.
- 12 Héry C, Tryggvadóttir L, Sigurdsson T *et al*. A melanoma epidemic in Iceland: possible influence of sunbed use. *Am J Epidemiol* 2010; **172**: 762–767.
- 13 Wehner MR, Chren MM, Nameth D *et al*. International prevalence of indoor tanning: a systematic review and meta-analysis. *JAMA Dermatol* 2014; **150**: 390–400.
- 14 Autier P, Doré JF, Breitbart E, Greinert R, Pasterk M, Boniol M. The indoor tanning industry's double game. *Lancet* 2011; **377**: 1299–1301.
- 15 Lim HW, James WD, Rigel DS, Maloney ME, Spencer JM, Bhusan R. Adverse effects of ultraviolet radiation from the use of indoor tanning equipment: time to ban the tan. *J Am Acad Dermatol* 2011; **64**: e51–e60.
- 16 Joint Market Surveillance Action on Sunbeds and Solarium Services. Part 2. PROSAFE Joint Actions Best Practice. July 3, 2012. URL http://www.prosafe.org/index.php/library/knowledgebase/item/sunbeds-solarium-services-final-report-ii?category_id=154 (last accessed: April 2018).
- 17 World Health Organization. Artificial tanning devices: public health interventions to manage sunbeds. June 2017. URL <http://apps.who.int/>

- iris/bitstream/handle/10665/255695/9789241512596-eng.pdf?sequence=1 (last accessed 13 April 2018).
- 18 European Committee for Electrotechnical Standardization. Household and similar electrical appliances-Safety-Part 2-27: Particular requirements for appliances for skin exposure to ultraviolet and infrared radiation. EN 60335-2-27. June 2010.
 - 19 World Health Organization. *Ultraviolet radiation and human health*. December 2009. URL http://www.who.int/uv/health/uv_health2/en/index1.html (last accessed March 2018).
 - 20 Tierney P, Ferguson J, Ibbotson S et al. Nine out of 10 sunbeds in England emit ultraviolet radiation levels that exceed current safety limits. *Br J Dermatol* 2013; **168**: 602–608.
 - 21 Scientific Committee on Emerging and Newly Identified Health Risks, European Commission. Preliminary Opinion on Biological Effects of Ultraviolet Radiation Relevant to Health with Particular Reference to Sunbeds for Cosmetic Purposes. Brussels, Belgium: European Commission; 2015. http://ec.europa.eu/health/scientific_committees/emerging/docs/scenih_r_o_052.pdf.
 - 22 Gavin A, Donnelly C, Devlin A et al. Public at risk: a survey of sunbed parlour operating practices in Northern Ireland. *Br J Dermatol* 2010; **162**: 627–632.
 - 23 Krarup AF, Køster B, Thorgaard C et al. Sunbed use by children aged 8–18 years in Denmark in 2008: a cross-sectional study. *Br J Dermatol* 2011; **165**: 214–216.
 - 24 Thomson CS, Woolnough S, Wickenden M, Hiom S, Twelves CJ. Sunbed use in children aged 11–17 in England: face to face quota sampling surveys in the National Prevalence Study and Six Cities Study. *BMJ* 2010; **340**: c877.
 - 25 Pawlak MT, Bui M, Amir M et al. Legislation restricting access to indoor tanning throughout the world. *Arch Dermatol* 2012; **148**: 1006–1012.
 - 26 Mayer JA, Woodruff SI, Slymen DJ et al. Adolescents' use of indoor tanning: a large-scale evaluation of psychosocial, environmental, and policy-level correlates. *Am J Public Health* 2011; **101**: 930–938.
 - 27 Ezzedine K, Malvy D, Mauger E et al. Artificial and natural ultraviolet radiation exposure: beliefs and behaviour of 7200 French adults. *J Eur Acad Dermatol Venereol* 2008; **22**: 186–194.
 - 28 Schneider S, Krämer H. Who uses sunbeds? A systematic literature review of risk groups in developed countries. *J Eur Acad Dermatol Venereol* 2010; **24**: 639–648.
 - 29 Veierød MB, Weiderpass E, Thörn M et al. A prospective study of pigmentation, sun exposure, and risk of cutaneous malignant melanoma in women. *J Natl Cancer Inst* 2003; **95**: 1530–1538.
 - 30 Coelho SG, Hearing VJ. UVA tanning is involved in the increased incidence of skin cancers in fair-skinned young women. *Pigment Cell Melanoma Res* 2010; **23**: 57–63.
 - 31 Nielsen K, Mäsback A, Olsson H, Ingvar C. A prospective, population-based study of 40 000 women regarding host factors, UV exposure and sunbed use in relation to risk and anatomic site of cutaneous melanoma. *Int J Cancer* 2012; **131**: 706–715.
 - 32 Schneider S, Diehl K, Bock C et al. Sunbed use, user characteristics, and motivations for tanning: results from the German population-based SUN-Study 2012. *JAMA Dermatol* 2013; **149**: 43–49.
 - 33 Knight JM, Kirincich AN, Farmer ER, Hood AF. Awareness of the risks of tanning lamps does not influence behavior among college students. *Arch Dermatol* 2002; **138**: 1311–1315.
 - 34 Hoerster KD, Mayer JA, Woodruff SI et al. The influence of parents and peers on adolescent indoor tanning behavior: findings from a multi-city sample. *J Am Acad Dermatol* 2007; **57**: 990–997.
 - 35 Kwon HT, Mayer JA, Walker KK et al. Promotion of frequent tanning sessions by indoor tanning facilities: two studies. *J Am Acad Dermatol* 2002; **46**: 700–705.
 - 36 Freeman S, Francis S, Lundahl K et al. UV tanning advertisements in high school newspapers. *Arch Dermatol* 2006; **142**: 460–462.
 - 37 Makin JK, Hearne K, Dobbins SJ. Compliance with age and skin type restrictions following the introduction of indoor tanning legislation in Melbourne, Australia. *Photodermatol Photoimmunol Photomed* 2011; **27**: 286–293.
 - 38 Køster B, Thorgaard C, Philip A, Clemmensen I. Sunbed use and campaign initiatives in the Danish population, 2007–2009: a cross-sectional study. *J Eur Acad Dermatol Venereol* 2011; **25**: 1351–1355.
 - 39 Jha P, Chaloupka FJ. The economics of global tobacco control. *BMJ* 2000; **321**: 358–361.