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ORIGINAL ARTICLE

Exposure to UV Radiation in Lifeguards on Barcelona's Beaches: An Underestimated Occupational Risk

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Lifeguards;
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Skin cancer;
Melanoma

Abstract
Background: The development of skin cancer is closely related to high exposure to UV radiation. Lifeguards are at an increased risk of excessive sun exposure.
Objectives: The main objective of this study was to measure the exposure of Barcelona's beach lifeguards to UV radiation.
Methods: Measurements in the work chair were taken every 30 min on a typical working day from 10:45 am to 19:15 pm. These measurements were carried out on four different days. These data were used to calculate the erythematous doses received during working hours, as well as those potentially received throughout the summer season. Vitamin D production was also estimated for the four days that the radiation received was measured, and the amount generated was calculated for the entire summer season.
Results: Exposure to UV radiation among Barcelona lifeguards far exceeds safety limits. In some locations, the exposure to UVB radiation is more than 16 times the minimum erythematous dose for phototype II skin.
Limitations: This study assessed the radiation received during only four days. However, is a much higher number than most of the published papers.
Conclusion: Although the health risks of excessive exposure to UV radiation are known, Barcelona's beach lifeguards are insufficiently protected.

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PALABRAS CLAVE
Radiación UV;
Socorristas;
Riesgo laboral;
Silla de trabajo;
Cáncer de piel;
Melanoma

Exposición a radiación UV en socorristas de las playas de Barcelona: un riesgo laboral infravalorado

Resumen
Antecedentes: El desarrollo del cáncer de piel está estrechamente relacionado con la alta exposición a la radiación UV. Los socorristas tienen un riesgo aumentado de exposición al sol.
Objetivos: El objetivo principal de este estudio fue medir la exposición de los socorristas de las playas de Barcelona a la radiación UV.
Métodos: Se tomaron mediciones en la silla de trabajo cada 30 min en un día típico de trabajo desde las 10:45 am hasta las 19:15 pm. Estas mediciones se realizaron en 4 días diferentes. Estos datos se utilizaron para calcular las dosis eritematosas recibidas durante las horas de trabajo, así como las potencialmente recibidas a lo largo de la temporada estival. También se estimó la producción de vitamina D durante los 4 días en que se midió la radiación recibida, y se calculó la cantidad generada durante toda la temporada estival.
Resultados: La exposición a la radiación UV de los socorristas de Barcelona supera con creces los límites de seguridad. En algunos lugares, la exposición a la radiación UVB es más de 16 veces superior a la dosis eritematosa mínima para pacientes con fototipo II.
Limitaciones: Este estudio evaluó la radiación recibida durante solo 4 días. Sin embargo, es una cifra muy superior a la de la mayoría de los trabajos publicados.
Conclusión: Aunque se conocen los riesgos para la salud de una exposición excesiva a la radiación UV, los socorristas de las playas de Barcelona no están suficientemente protegidos.

Introduction

UV exposure is associated with the incidence of melanoma and non-melanoma skin cancer.[1,2] It is estimated that 90% of skin cancer can be prevented by using adequate sun protection, wearing hats and protective clothing, and avoiding the sun during peak hours.[1] Certain groups of workers are at a higher risk of exposure to UV radiation, such as airplane pilots, gardeners, and lifeguards, among others.[3–5]

The main objective of this study was to measure the exposure of lifeguards on Barcelona's beaches to UV radiation during a working day. From these data, we then estimated the mean daily UV radiation received by lifeguards during an entire summer season in Barcelona along with the production of vitamin D.

Methods

This study was carried out by dermatologists from the Hospital Clínic and lifeguards from the beaches of the city of Barcelona. Lifeguards from ''Pro Activa Serveis Aquatic'' company participated in our study.

The radiation received by the lifeguards at their workplace was measured. The chair used by the lifeguards was the *Silla de vigilancia look out* manufactured by Esteva® (Fig. 1), with a sunshade on the top. UV radiation measurements were performed using the Solameter 5.0®, which is useful for measuring both UVA (320–380 nm) and UVB (280–320 nm) rays.

Measurements were made by the lifeguards at four different workstations on beaches in the city of Barcelona, every

Figure 1 Lifeguards chair. ''*Silla de vigilancia look out*'' manufactured by Esteva®.

30 min from 10:45 to 19:15, with a total of 18 measurements being recorded. The radiation received was measured on four different days. In addition, they were carried out at six different positions in the lifeguard's chair: left arm, right arm, back, footrest, seat base, and the top rung of the chair. General direct radiation from the sun as well as at 90° to the sun was measured.

The orientation of the chair was determined by compass. The maximum temperature of the day was recorded. The weather assessment at each measurement was sunny, slightly cloudy, or partially cloudy.

From the measurement data and considering the corresponding maximum UV index value for that day under clear sky conditions, the radiation doses needed for the development of erythema and vitamin D production at each of the measurement points in each workstation were calculated, and mean values were recorded.

The levels of UV light exposure, the minimum erythematous dose (MED), and also the potential for vitamin D formation were determined from the UV radiation received.

MED is the dose of UV radiation needed to cause a minimum erythematous skin response within 24 h of exposure and varies according to the skin type set out in the Fitzpatrick scale.[6]

The total dose that a worker would receive at different working hours and the total MED received during the working day were calculated. The potential MED during the April–October period was also determined assuming that sun exposure had been continuous during working hours.

The data were analyzed by an expert photobiologist from the University of Malaga. All analyses were carried out using SPSS.

Results

Two lifeguards recorded the radiation doses received at four different workstations, on four different days.

Table 1 shows the radiation received at different points of the lifeguard's chair, every 30 min, for the full working day over four different days. In Table 2, the MED and vitamin D production are shown at each of the measuring points in each workstation, representing the mean values. For example, lifeguards in Station 3 with phototype II received 16.39 times more radiation than necessary to produce erythema on the right arm. Furthermore, it can be observed that, according to the UV radiation of that day, direct exposure to the sun (outside the work chair) caused the lifeguards with phototype II to receive 22.8 times the radiation needed to produce erythema.

The total dose that a worker would receive during one working hour in the different periods of the year were calculated as well as the total MED received during the entire work period, as is shown in Table 3. These calculations were made from the average values estimated in the various positions at each of the measurement points. We can observe that in the period July–August, a phototype II lifeguard will receive 0.92 times the MED in one working hour. Additionally, they will receive 415.71 times the MED during all hours worked from March to September.

Fig. 2 shows the daily UV index cycles on the 15th of each month, between April and October, on the Barcelona coast.

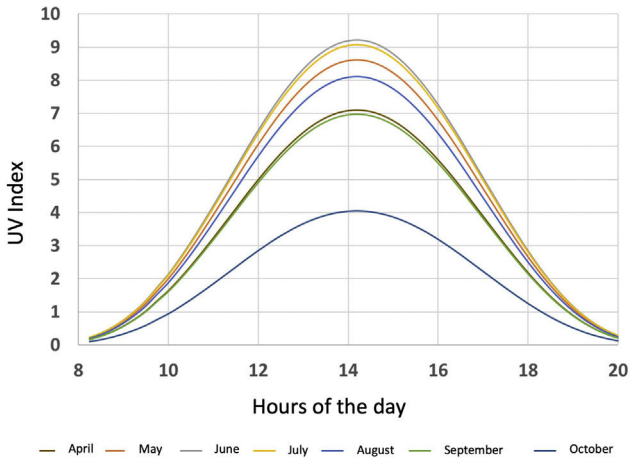

Figure 2 Daily UV index cycles on the 15th of each month between April and October on the Barcelona coast. The maximum values always correspond to 14.15 approximately.

The maximum values always correspond approximately to the time 2.15 pm on each day.

Table 4 shows the different daily cycles of erythematous sun exposure and analyzes the potential exposure data for the different time slots and the average cumulative total on the 15th day of each month.

The minutes needed to produce MED and vitamin D in each month are shown in phototypes II and III, as well as the MED received per hour according to the month of the year and the phototype. For example, in July, phototype III lifeguards take 25.9 min to reach MED and 6.5 min to produce vitamin D.

Table 5 shows the MED values for phototype II lifeguards. Values are listed for each hour in each month, when exposure to the sun was direct in clear sky conditions. The lowest value was observed at 2 pm in June and July when the MED was reached in 18 min.

Discussion

Excessive exposure to UV radiation suffered by outdoor workers continues to be an occupational health problem.[1] UV radiation is the leading cause of malignant skin tumors and photoaging as well. In fair-skinned people, it is responsible for 50%–70% of squamous cell carcinomas and 50%–90% of basal cell carcinomas.[7] A strong positive association with the development of melanoma has also been found in outdoor workers who receive high exposure to UV radiation.[8]

The optimal use of sunscreen routinely applied was associated with a decreased risk of melanoma.[9,10] However, the use of measures to reduce exposure to UV radiation for lifeguards, such as hats, specific clothing, sunscreens, and sunglasses, is not universally accepted and is used irregularly, depending on the employer.

Most lifeguards are at an increased risk of excessive sun exposure and sunburn and receive levels of UV radiation that exceed the occupational guidelines proposed by the International Commission on Non-Ionizing Radiation Protection.[11]

We frequently see that lifeguards on the beaches of Spain do not use bathing suits that cover most of the body, glasses,

Table 1 UV radiation measurements at different points of the lifeguard's chair every 30 min during a full working day over four different working days.

Date: June 27th 2018		Beach: Barceloneta		Surveillance post: Chair 21			Orientation: 92°		
Location: 41°21′40.8″N 2°11′32″E		Solar protection of the post: Awning		Maximum temperature: 29 °C			Wind: moderate		
Time		Level of UV radiation							
		Left armrest	Right armrest	Backrest	Footrest	Seat base	Top rung	Direct to the sun	Direct to the sky 90°
10:45 am	Clear	1.4	1.5	0.5	2.2	2.3	1.4	–	–
11:15 am	Clear	0.8	1.9	0.4	3	3.3	2.3	–	–
11:45 am	Partially cloudy	0.7	1.2	0.4	1.9	3.8	2.7	–	–
12:15 pm	Partially cloudy	0.8	2.7	0.4	4.4	3.8	3	–	–
12:45 pm	Partially cloudy	0.8	3	0.4	3.3	3.8	3.3	–	–
13:15 pm	Clear	0.9	4.2	0.6	4.6	1.3	0.7	–	–
13:45 pm	Clear	0.9	4.4	0.4	4.5	1	0.6	–	–
14:15 pm	Clear	0.9	4.4	0.5	4.3	0.9	0.4	–	–
14:45 pm	Clear	0.8	4.1	0.8	2.7	0.9	0.4	–	–
15:15 pm	Clear	0.8	4	0.4	1.1	0.6	0.4	–	–
15:45 pm	Clear	0.8	3.7	0.7	1	0.7	0.3	–	–
16:15 pm	Clear	0.7	3.1	0.5	0.9	0.7	0.2	–	–
16:45 pm	Partially cloudy	0.7	2.5	2.5	0.9	0.8	0.2	–	–
17:15 pm	Partially cloudy	0.7	1.5	1.9	0.8	0.6	0.2	–	–
17:45 pm	Partially cloudy	0.8	1.2	1.6	0.8	0.5	0.2	–	–
18:15 pm	Partially cloudy	0.6	0.5	1	0.7	0.5	0.2	–	–
18:45 pm	Partially cloudy	0.4	0.4	0.4	0.5	0.3	0.3	–	–
19:15 pm	Partially cloudy	–	–	–	–	–	–	–	–
Date: June 29th 2018		Beach: Sant Sebastià		Surveillance post: Chair 11			Orientation: 100°		
Location: 41°22′18.5″N 2°11′21.4″E		Solar protection of the post: Awning		Maximum temperature: 27 °C			Wind: light		
Time		Level of UV radiation							
		Left armrest	Right armrest	Backrest	Footrest	Seat base	Top rung	Direct to the sun	Direct to the sky 90°
10:45 am	Clear	2.7	3.5	0.3	2.9	3.5	1.7	3.8	–
11:15 am	Clear	3.3	3.1	0.2	3.3	3	2.5	4.3	–
11:45 am	Clear	0.8	3.1	0.2	3.5	3.2	2.6	4.5	–
12:15 pm	Clear	1	3	0.2	4.1	1	3	4.7	–
12:45 pm	Clear	1	3.1	0.3	4.2	1.2	3.2	4.8	–
13:15 pm	Clear	0.9	4	0.4	4.3	1	0.7	4.9	–
13:45 pm	Clear	0.8	3.4	0.4	4.3	0.9	0.6	5	–
14:15 pm	Partially cloudy	0.8	2.4	0.4	2.8	1	0.6	2.6	–
14:45 pm	Partially cloudy	1	3.1	0.5	3.1	1.1	0.7	4.6	–
15:15 pm	Partially cloudy	0.9	3.1	0.4	1.3	1.1	0.6	5	–
15:45 pm	Clear	0.8	2.7	0.4	1	0.6	0.5	4.8	–

Table 1 (*Continued*)

Date: June 29th 2018		Beach: Sant Sebastià		Surveillance post: Chair 11			Orientation: 100°		
Location: 41°22′18.5″N 2°11′21.4″E		Solar protection of the post: Awning		Maximum temperature: 27 °C			Wind: light		
Time		Level of UV radiation							
		Left armrest	Right armrest	Backrest	Footrest	Seat base	Top rung	Direct to the sun	Direct to the sky 90°
16:15 pm	Clear	0.7	2.5	0.5	1	0.8	0.5	4.6	–
16:45 pm	Clear	0.7	2.5	2.2	0.9	0.6	0.4	4.2	–
17:15 pm	Partially cloudy	0.8	2.5	2.1	0.9	0.7	0.4	3.9	–
17:45 pm	Partially cloudy	1.2	1.3	1.4	1.4	0.6	0.3	3.1	–
18:15 pm	Clear	1	1.1	0.4	0.4	1.4	0.2	2.7	–
18:45 pm	Clear	0.6	0.6	0.5	0.5	0.4	0.2	2	–
19:15 pm	Clear	0.4	0.4	0.3	0.3	0.4	0.3	1.6	–
Date: July 4th 2018		Beach: Sant Sebastià		Surveillance post: Chair 11			Orientation: 100°		
Location: 41°22′18.5″N 2°11′21.4″E		Solar protection of the post: Awning		Maximum temperature: 27 °C			Wind: light (morning); moderate (afternoon)		
Time		Level of UV radiation							
		Left armrest	Right armrest	Backrest	Footrest	Seat base	Top rung	Direct to the sun	Direct to the sky 90°
10:45 am	Clear	2.4	2.6	0.4	3	3.6	2	4.3	3
11:15 am	Clear	2.9	2.8	0.4	3.2	3.4	2.6	4.8	3.2
11:45 am	Clear	0.8	3.6	0.2	3.6	3.8	3.2	5	3.9
12:15 pm	Clear	0.8	4	0.2	4	4	3.6	5	4.1
12:45 pm	Clear	0.8	4.1	0.2	4.3	0.9	3.8	5.2	4.6
13:15 pm	Clear	0.8	4.4	0.3	4.6	0.8	0.6	5.2	4.8
13:45 pm	Clear	0.8	4.3	0.3	4.6	0.8	0.5	5.2	4.8
14:15 pm	Clear	0.7	4.1	0.3	4.5	0.7	0.5	5.2	4.9
14:45 pm	Clear	0.7	4.1	0.3	1.2	0.7	0.5	5.1	4.6
15:15 pm	Clear	0.7	3.8	0.3	1.2	0.8	0.5	5.3	4.6
15:45 pm	Clear	0.8	3.7	0.5	1.1	0.8	0.4	4.9	4.1
16:15 pm	Clear	0.7	3.1	0.5	1	0.7	0.4	4.6	3.6
16:45 pm	Clear	0.7	2.7	0.3	0.9	0.6	0.4	4.6	3.2
17:15 pm	Clear	0.6	2.2	1.6	0.7	0.5	0.3	4.1	2.9
17:45 pm	Clear	0.7	1.5	1.9	0.6	0.5	0.3	3.7	2.2
18:15 pm	Clear	1.3	1.3	1.5	0.6	0.4	0.2	3.2	1.6
18:45 pm	Clear	0.5	0.5	0.4	0.5	0.5	0.2	2.6	1.1
19:15 pm	Clear	0.3	0.4	0.3	0.2	0.4	0.2	2	0.7

Table 1 (*Continued*)

Date: July 5th 2018		Beach: Sant Sebastià		Surveillance post: Chair 11			Orientation: 100°		
Location: 41°22′18.5″N 2°11′21.4″E		Solar protection of the post: Awning		Maximum temperature: 28 °C			Wind: light (morning); moderate (afternoon)		
Time		Level of UV radiation							
		Left armrest	Right armrest	Backrest	Footrest	Seat base	Top rung	Direct to the sun	Direct to the sky 90°
10:45 am	Clear	2.4	0.3	0.6	2.2	2.6	2.6	4	2.8
11:15 am	Clear	3	0.4	0.7	2.7	0.8	2.3	4.4	3.2
11:45 am	Clear	1.3	0.6	0.8	3.7	1	2.6	4.9	3.9
12:15 pm	Clear	1.1	0.7	0.7	3.7	0.8	0.2	4.8	4.1
12:45 pm	Clear	1	0.7	0.8	3.9	0.6	0.6	4.9	4.2
13:15 pm	Clear	0.7	0.6	0.8	3.9	0.7	0.5	4.9	4.4
13:45 pm	Clear	0.8	0.5	0.9	0.9	0.6	0.4	5	4.6
14:15 pm	Clear	0.8	0.5	0.9	0.9	0.7	0.4	5	4.6
14:45 pm	Clear	0.8	0.4	2.5	0.9	0.6	0.4	5	4.6
15:15 pm	Clear	0.8	0.4	3.9	0.8	0.6	0.3	4.9	4.3
15:45 pm	Clear	0.8	0.5	3.8	0.7	0.6	0.3	4.8	3.9
16:15 pm	Clear	3	0.5	2.9	0.6	0.5	0.3	4.5	3.7
16:45 pm	Clear	2.7	2.5	3.1	0.6	2.3	0.3	4.4	3.4
17:15 pm	Clear	2.8	2.9	2.4	0.6	0.6	0.3	3.9	2.6
17:45 pm	–	–	–	–	–	–	–	–	–
18:15 pm	Cloudy	0.7	0.6	0.8	0.7	0.6	0.3	1.2	1
18:45 pm	Cloudy	0.7	0.4	0.7	0.6	0.5	0.3	1.1	0.9
19:15 pm	Cloudy	0.5	0.3	0.4	0.4	0.4	0.2	0.7	0.6

Table 2 Total doses for erythema and vitamin D production.

	Station 1	Station 2	Station 3	Station 4	Average	Standard deviation
Left armrest						
Erythematous total dose	109.4	157.14	118.26	174.2	139.7	30.9
DEMs phototype II	4.4	6.29	4.73	7.0	5.6	1.2
DEMs phototype III	3.1	4.49	3.38	5.0	4.0	0.9
DoVitD phototype II	17.5	25.14	18.92	27.9	22.4	5.0
DoVitD phototype III	12.5	17.96	13.52	19.9	16.0	3.5
Right armrest						
Erythematous total dose	358.8	367.74	409.86	101.3	309.4	140.6
DEMs phototype II	14.4	14.71	16.39	4.1	12.4	5.6
DEMs phototype III	10.3	10.51	11.71	2.9	8.8	4.0
DoVitD phototype II	57.4	58.84	65.58	16.2	49.5	22.5
DoVitD phototype III	41.0	42.03	46.84	11.6	35.4	16.1
Backrest						
Erythematous total dose	108.5	89.91	76.95	211.4	121.7	61.2
DEMs phototype II	4.3	3.60	3.08	8.5	4.9	2.4
DEMs phototype III	3.1	2.57	2.20	6.0	3.5	1.7
DoVitD phototype II	17.4	14.39	12.31	33.8	19.5	9.8
DoVitD phototype III	12.4	10.28	8.79	24.2	13.9	7.0
Footrest						
Erythematous total dose	304.6	325.62	298.08	207.4	283.9	52.4
DEMs phototype II	12.2	13.02	11.92	8.3	11.4	2.1
DEMs phototype III	8.7	9.30	8.52	5.9	8.1	1.5
DoVitD phototype II	48.7	52.10	47.69	33.2	45.4	8.4
DoVitD phototype III	34.8	37.21	34.07	23.7	32.4	6.0
Seat base						
Erythematous total dose	209.0	182.25	164.43	96.4	163.0	48.0
DEMs phototype II	8.4	7.29	6.58	3.9	6.5	1.9
DEMs phototype III	6.0	5.21	4.70	2.8	4.7	1.4
DoVitD phototype II	33.4	29.16	26.31	15.4	26.1	7.7
DoVitD phototype III	23.9	20.83	18.79	11.0	18.6	5.5
Top rung						
Erythematous total dose	136.1	153.90	147.42	78.6	129.0	34.4
DEMs phototype II	5.4	6.16	5.90	3.1	5.2	1.4
DEMs phototype III	3.9	4.40	4.21	2.2	3.7	1.0
DoVitD phototype II	21.8	24.62	23.59	12.6	20.6	5.5
DoVitD phototype III	15.6	17.59	16.85	9.0	14.7	3.9
Direct to the sun						
Erythematous total dose		575.91	613.17	521.6	570.2	46.0
DEMs phototype II		23.04	24.53	20.9	22.8	1.8
DEMs phototype III		16.45	17.52	14.9	16.3	1.3
DoVitD phototype II		92.15	98.11	83.5	91.2	7.4
DoVitD phototype III		65.82	70.08	59.6	65.2	5.3
Direct to the sky 90°						
Erythematous total dose			477.09	437.4	457.2	28.1
DEMs phototype II			19.08	17.5	18.3	1.1
DEMs phototype III			13.63	12.5	13.1	0.8
DoVitD phototype II			76.33	70.0	73.2	4.5
DoVitD phototype III			54.52	50.0	52.3	3.2

MED: minimal erythematous dosages; DoVitD: minimum dose of vitamin D.

or protective caps. As a result, lifeguards receive high levels of UV radiation exposure in the workplace.[4] Several authors have described this increased exposure of lifeguards to UV radiation.[3,11]

In this work, we specifically analyzed the UV radiation received by lifeguards of Barcelona in their work chairs. The chair is chosen by the company employing the lifeguards and is specially selected to reduce the risk of work-related ill-

Table 3 MEDs that a lifeguard would receive for each working hour performed for the different working periods.

Season level	Months	Total working hours	Surveillance hours	Average MED phototype II	Average MED phototype III	Total MED phototype II	Total MED phototype III
Low level 1	March–September	1000	500	0.83	0.57	415.71	287.14
Low level 2	May–September	900	450	0.89	0.62	402.55	278.05
Medium	June–September	750	375	0.89	0.61	333.44	230.31
High level 1	June 9–September 9	550	275	0.93	0.65	256.87	177.43
High level 2	July–August	380	190	0.92	0.63	174.06	120.23

MED: minimal erythematous dosages.

Table 4 Maximum UV index levels. Maximum total potential erythematous dose if exposure is direct to the sun.

Months	UV index	Erythematous irradiance ($mJ\,cm^{-2}$)	Minutes for MED in phototype II	Minutes for MED in phototype III	Minutes for vitamin D production in phototype II	Minutes for vitamin D production in phototype III	MED/hour in phototype II	MED/hour in phototype III
January	2	0.01	83.3	116.7	20.8	29.2	0.22	0.15
February	3.5	0.01	47.6	66.7	11.9	16.7	0.38	0.26
March	5.5	0.01	30.3	42.4	7.6	10.6	0.59	0.41
April	7	0.02	23.8	33.3	6.0	8.3	0.75	0.52
May	8.5	0.02	19.6	27.5	4.9	6.9	0.92	0.63
June	9	0.02	18.5	25.9	4.6	6.5	0.97	0.67
July	9	0.02	18.5	25.9	4.6	6.5	0.97	0.67
August	8	0.02	20.8	29.2	5.2	7.3	0.86	0.60
September	7	0.02	23.8	33.3	6.0	8.3	0.75	0.52
October	4	0.01	41.7	58.3	10.4	14.6	0.43	0.30
November	2.1	0.01	79.4	111.1	19.8	27.8	0.23	0.16
December	1.8	0.00	92.6	129.6	23.1	32.4	0.19	0.13

MED: minimal erythematous dosages.

Table 5 Minutes for MED in phototype II, in a direct sun exposure.

Time	Minutes for an erythematous dose for phototype II											
	January	February	March	April	May	June	July	August	September	October	November	December
11	180	103	65	51	42	40	40	45	52	90	171	200
12	117	67	42	33	27	26	26	29	34	58	111	130
13	91	52	33	26	21	20	20	23	26	45	86	101
14	82	47	30	24	19	18	18	21	24	41	78	91
15	86	49	31	25	20	19	19	22	25	43	82	96
16	104	60	38	30	25	23	23	26	30	52	99	116
17	150	86	55	43	35	33	34	38	44	75	143	167
18	267	153	97	76	63	59	60	67	78	134	255	297
19	652	373	237	186	153	144	146	163	190	326	621	725
20	2709	1548	985	774	637	596	606	677	787	1354	2580	3010

MED: minimal erythematous dosages.

nesses. Among the most important factor to be considered is protection from UV radiation, thus decreasing the incidence of skin cancer. However, many of the lifeguards' chairs have areas totally exposed to the sun at different times of the day.

In 2009, Gies et al. reported the exposure to UV radiation received by lifeguards working at swimming pools. They observed that more than 74% received UV radiation above the recommended values for occupational exposure. Thirty-nine percent were exposed to more than four times

the limit, and 65% of this exposure was sufficient to induce sunburn.[11] In this study, they did not analyze the exposure in the work chair.

The idea that ''people are more attractive if they tan'' persists.[2] Lifeguard surveys have confirmed this conception of beauty.[12] Another concept that many workers are not clear about is that to achieve healthy vitamin D production levels, about one-third of the exposure time needed to produce MED is required.[3] In this respect, there is much that dermatologists can contribute to the training of outdoor workers.

To encourage the implementation of these preventive measures, studies assessing exposure to UV radiation in lifeguards are necessary.[13]

In our study, we found that exposure to UV radiation among Barcelona lifeguards far exceeds safety limits. These workers, then, have a high risk of developing different types of skin cancer, both non-melanoma, and melanoma.[4]

Our results are relevant because these high values of exposure to UV radiation were taken in the lifeguard's work chair, thus demonstrating the insufficient protection that they provide. It is the responsibility of the employer to carry out training programs and provide work elements that are aimed at reducing exposure to UV radiation to safe levels. On the basis of these results, we believe that it is essential to inform employers about the need to use work chairs that are safe for the health of lifeguards.

The lack of adequate photo-protection has been described by many outdoor workers, including, in addition to lifeguards, landscapers, farmers, fishermen, and mountain guides, among others.[14] Sanlorenzo et al. demonstrated that airline pilots and cabin crew have high radiation exposure. They observed that the windscreen of the plane blocked UVB rays but not UVA rays.[5]

However, there is still a need for studies to establish recommendations on UV dose limits as related to occupation. These studies should include more accurate workplace measurements.

Based on our results, we suggest prioritizing the two following aspects: the lifeguard's chair should be optimized; and the use of photo-protective measures, i.e., hat, clothes sunscreen, should be promoted and/or made obligatory.

We believe that better UV protection at lifeguard workstations is necessary to provide a safe working environment. We strongly recommend the use of appropriate clothing, sunscreens, and periodic skin checks for lifeguards. We hope that work chairs will improve photo-protective conditions for these vulnerable groups of workers. We think that more research is needed in this field to improve photo-protective measures in the workplace.

Limitations

This study assessed the radiation received during only one working day. However, 72 measurements of UV radiation were made, which is a much higher number than most of the published papers. Only four workstations were assessed, however, describing the UV radiation received in the work chair provides unpublished data that can improve the health of workers.

Conclusions

Although the risks of UV radiation are known, many outdoor workers now receive doses thar are harmful to their health. The work chair used by many lifeguards is chosen for study by people trained in occupational health. In spite of this, we were able to demonstrate the insufficient protection that they have from UV radiation.

Conflict of interests

The authors declare that they have no conflict of interest.

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