



UV exposure at work and skin cancer

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Abstract

Background and Purpose: It is well known that exposure to UV radiation can be harmful for human health. UV exposure is often related to professional occupation.

Methods and Materials: Data from Croatian Referral Center for melanoma were analyzed to find out whether the incidence of melanoma was related to the occupation.

Results: Our results show almost the same incidence of melanoma between people with university diploma and people with high school diploma even though results are insufficient and certain conclusion cannot be made.

Conclusions: Cumulative UVR known as a main environmental agent has not yet been proven as a role in developing melanoma.

INTRODUCTION

Sun is a source of life on the Earth providing us a feeling of well being and good vitality. Contrariwise it is well known that exposure to ultraviolet radiation (UVR) from sun can be harmful to human health, in particular for eyes, skin and immune system (1, 2). UVR is a spectrum of electromagnetic waves with frequencies range 10–400 nm (3). The Earth's ozone layer blocks 97–99% of UVR from penetrating through the atmosphere. 95–98% of the UVR that reaches the Earth's surface is UVA (400–320 nm). UVA penetrates the epidermis and spreads in dermis but is poorly absorbed by DNA. Recently UVA was divided into UVA-I (340–400) and UVA-II (320–340) because of mechanistically similar biological effect of UVA-II and UVB. Only 2–5% of the UVB (290–320 nm) undergoes ozone layer, penetrates the epidermis and is then absorbed by DNA causing mutations. UVC radiation (290–200 nm) can be lethal for human being and does not pass the ozone layer. The earth's atmosphere shields us from harmful UVC and most of UVB radiation, therefore decreasing of stratospheric ozone layer since 1980 due to high concentration of chlorofluorocarbon agents must be restrained. UV exposure is considered to be the most important risk factor in developing non melanoma skin cancer (basal cell carcinoma – BCC and squamous cell carcinoma – SCC), and melanoma although epidemiology of those cancers differs (4). Cumulative sun exposure during lifetime is responsible for developing SCC. Head, neck, dorsum of hands and forearms are parts of the body almost always exposed to sunlight. Therefore it is the most frequent place where SCC occurs. On the other hand, cumulative and intermittent exposure to sunlight is in charge of developing BCC. BCC mostly presents on the head and neck, but also on the sun-protected areas like inner canthus (5). Development of melanoma is connected with intermittent intense sun exposure. Back in men and lower legs in women are typical localisations in

presentation of melanoma. Melanoma is considered to be one of the most aggressive skin tumors. Various studies show that the incidence rate of melanoma is rising rapidly all over the world. The incidence of melanoma in Croatia is approximately 3% of all detected skin cancers. In the last 40 years the incidence of melanoma has increased for more than 300% (6). Women and men are almost equally affected. Skin cancer will soon become a major public health problem.

The most frequent exposures to UVR take place during outdoors activities and outdoor work in the open sunlight. Because UV light is not visible there is no way to know the level of exposure until it has caused a health effect. The appropriate UV hazard precautions should include the usage of Ultraviolet Safety Meters. It is, however, less known that even indoor activities under artificial light sources of special kind can be also harmful if the light sources contain UVC and UVB components in the power spectrum (7). There are many artificial sources of UVR that are potentially dangerous for occupational exposure. Some equipment can generate concentrated UVR in all the spectral regions, as shown in Figure 1 for the case of a mercury lamp (8).

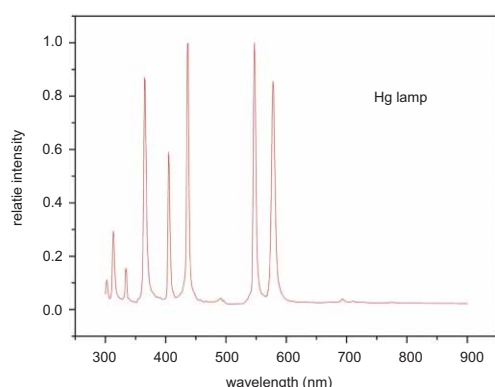


Figure 1. Power spectra of a mercury lamp showing presence of UV components.

The main sources of UV radiation are sunlight, fluorescent lamps, germicidal lamps (blue light), and electric arc welding. For example, biosafety cabinets have very clean air relative to airborne particles in the surrounding area but are dangerous to workers without safety glasses that absorb over 99% of UV radiation. But, there are artificial sources of UVC that are common in many research laboratories, medical institutions and now even in ordinary light sources in use in offices and at home (7). Their usage without the appropriate shielding and personal protective equipment can cause serious health problems.

Aims

The aim of this paper was to study the possible relationship between occupation and the appearance of melanoma as the most fatal kind of skin cancer.

Methods

We retrospectively analysed the epidemiological data on melanoma from the Croatian Referral Center for melanoma. Patients were divided into two groups: people with university diploma and people with high school diploma. Group of people with university diploma were patients by occupation medical doctors, dentists, lawyers. In the group of people with high school diploma were patients with various polytechnic, medical school diplomas.

RESULTS

One thousand fifty one patients were registered in Croatian Referral Centre for melanoma in 8-year period (2002–2009).

TABLE 1

Melanoma incidence and level of education, ND-no data.

Year	Total	High education	Medium education	Others
2009	260	27	57	176
2008	253	20	26	207
2007	192	23	51	118
2006	125	ND	ND	ND
2005	121	ND	ND	ND
2004	128	14	15	99
2003	104	13	30	61

DISCUSSION

Our results show there was no much difference of the incidence of melanoma between group of people with university diploma and people with high school diploma. It would be expected that people with university diploma possess some knowledge of the UV damage on skin. Therefore they would avoid activities that imply UV exposure and use UV protective measures at outdoor work. Results from our previous study about knowledge and attitudes toward sun protection and perception of melanoma in randomized outdoor patients visiting Department of dermatology University Hospital »Sestre milosrdnice« showed no significant correlation between level of education and attitudes toward sun protection (9). Furthermore summer holidays in areas with high insolation and winter holidays in mountains are more usual among people with university diploma; who earn more money and usually have more money for extra expenses. In this way they are exposed to intense intermittent UV light, which is one of the main pathways leading to melanoma (10).

Other studies showed results on patients divided in groups of outdoor and indoor occupation. Radespiel-Tröger *et al.* found no significant association between outdoor work in men and women and incidence of melanoma (11). Also relative risk of lentigo maligna melano-

noma in outdoor workers was slightly but not significantly increased, as well as in the study by Gabre *et al.* (11, 12). Outdoor workers are exposed to chronic cumulative UVR which is responsible for non melanoma skin cancer and lentigo maligna melanoma of head and neck which develops from precancerous lentigo solaris/senilis. Perez-Gomez *et al.* found a specific risk pattern for head and neck melanoma in which the influence of socio-economic class and town size was negligible (13). Patients that developed lentigo maligna melanoma on the head and neck were older and had lots of signs of damage of the skin.

Slightly decreased association of melanoma and outdoor work was presented by Gandini *et al.* although Bataille *et al.* showed no association between melanoma and chronic occupational sun exposure (14, 15). Typical outdoor occupations like farmer, welder, waterman, police officers, physical education teacher would be thought to have increased incidence of melanoma. In a study by Ramirez *et al.* increased incidence of non melanoma skin cancer in outdoor workers was confirmed (5). Investigators Page *et al.* presented increased death from melanoma in prisoners of World War II from the Pacific theater compared with non-prisoners of World War II from the European theater (16). Probably great stress from the war as psychoneuroimmunological process and high level of solar radiation in young adulthood played main roles in development of melanoma (17).

Another occupation with increased risk for melanoma are pilots and flight attendances. First explanation for this was that increased risk could be caused by exposure to cosmic radiation. Other studies showed increased incidence in those pilots who had flown routes that extended five time zones (18). Disturbance in circadian rhythm probably plays a role in melanoma etiology.

Outdoor sport is one of the possible risk factor for melanoma. In a recent case control study sun exposure during sports at the beach and outdoor sports in general showed only slightly non significant odds ratio for melanoma (19). Professional sport practitioners like athletes, beach volleyball, mountain trainers are for sure in risk of consequences of cumulative UVR and much more important excessive exercised-induced immunosuppression which is one of the pathway in developing melanoma.

CONCLUSION

Our results show almost the same incidence of melanoma between high and medium educated people even though they are insufficient and certain conclusion can not be made. Worldwide incidence of melanoma is increasing alarmingly and furthermore mortality from melanoma is also rising. Cumulative UVR known as a main environmental agent has not yet been proven as a role in developing melanoma. Except from occupational exposure, behavior and attitudes toward sun are important segment in developing melanoma. Sun prevention is not just use of sunscreen. People should learn and adopt

other sun pattern behaviors like seeking shade, wearing protective clothes, hats and gloves. Certainly sun prevention campaigns should be targeted for specific groups at risk like people with outdoor occupation, children, adolescents and young parents.

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