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Chapter 1

Incidence of Melanoma and Non-Melanoma Skin Cancer in the Inhabitants of the Upper Silesia, Poland

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Additional information is available at the end of the chapter

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1. Introduction

In recent years, non-melanoma incidence rate has been ranked in the 4th place, and cutaneous melanoma has not been recorded in the first ten places among the most frequent cancers in the inhabitants of the Upper Silesia. Despite high incidence rates, the prognoses of the skin cancers are good, thus the cancer mortality is ranked lower than in the first ten places [1-3]. The authors of the study have already presented epidemiological analyses of the incidence of those cancers [4-7]. Thus the aim of the present study was to continue the evaluation of the incidence rates of non-melanoma skin cancers in the inhabitants of the Upper Silesia in 1999-2007.

The Upper Silesia Industrial Area, occupying the central part of Silesia, has been the most industrial and most ecologically degraded area of Poland. Called the Silesia Agglomeration, it is the biggest urban and industrial agglomeration in the country assembling a number of big cities and industrial areas surrounding them. This affects the landscape and living conditions of habitants. Here, the main source of pollution is the industry, especially mining and energy industries. Heavy industry, underdeveloped as well as underinvested, emits enormous amount of the particulate matter and gases into the atmosphere [8].

Moreover, it was the most populated area of Poland where there were 393 inhabitants per $1km^2$.

2. Materials and methods

In a retrospective epidemiological analysis, we evaluated the statistical data of the non-melanoma skin cancer (C44 according to the 10th revision of ICD) and the cutaneous melanoma (C43) in the residents of the Upper Silesia, an administrative region established by the Local Government Reorganization Act of 1998 (effective 1 January 1999). The incidence data were obtained from the Department of Epidemiology and Silesia Cancer Registry, Maria Sklodowska-Curie Memorial Cancer Center and Institute of Oncology, Gliwice Branch. The non-melanoma and melanoma incidence were estimated by calculating both, age-specific and crude rates, and the standardized incidence rates (per the population of 100 000) with the use of a direct method and "the world's population" as a standard [9].

The cumulative risk was also calculated. The cumulative risk is the risk which an individual would have of developing the skin non-melanoma and melanoma from birth to age74 years if no other causes of death were in operation. Moreover, melanoma and non-melanoma skin cancer incidence rates were estimated according to the lesion distribution over the body. The following distribution was included into the study: the head and neck, trunk, arms and legs.

3. Results

Both non-melanoma and melanoma skin cancers belong to the group of cancers typical for the elderly, which can be also observed in the population of Silesia, a region in Poland (Figure 1). Incidence rates are of fundamental importance for the evaluation of a skin cancer risk due to growing effectiveness of treatment, which is related to early diagnosis, and the skin cancer's frequent recurrence.

In the Upper Silesia, continuous progression of melanoma as well as non-melanocytic skin cancers is observed. One in 60 males and one in 80 females runs a risk of developing the skin cancer till the age of 75 years. During the discussed period, i.e. 1999-2007, 4202 cases of cancer were recorded in men, and the standardized incidence rate was 14.96/100 000. The average age of the analyzed male population was 66.7 years, whereas it was 67.8 in the female population. Incidence rates increased systematically with age in both populations, and an increase in the rates was quite strong in older age groups. When compared to young males, young females developed the cancer more frequently, especially those aged 15–39 years. 4389 cases of skin cancer were recorded in women, and the standardized incidence rate was 10.94/100 000. The sex ratio was 1.37 for men due to higher incidence rates in men aged 50 years and more, and the difference increased with age (Table 1), (Figure 2).

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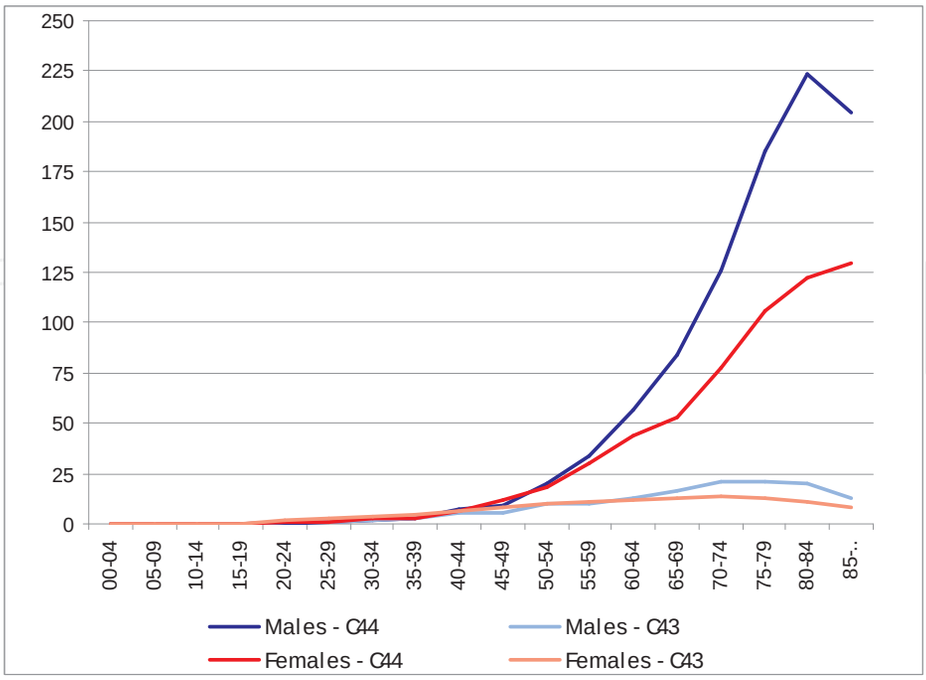

Figure 1. Age-specific incidence rates for non-melanoma cancer (C44) and melanoma (C43) of the skin by sex, Upper Silesia, 1999–2007.

	Males		Females	
Age (years)	**N**	**Rate**	**N**	**Rate**
0-4	0	0.00	0	0.00
5- 9	1	0.09	0	0.00
10-14	1	0.07	1	0.07
15-19	4	0.23	4	0.24
20-24	3	0.17	11	0.63
25-29	14	0.86	20	1.24
30-34	28	1.92	33	2.30
35-39	34	2.36	45	3.15
40-44	119	7.28	105	6.36
45-49	157	9.00	213	11.76
50-54	306	19.75	309	18.68
55-59	391	33.73	384	29.90
60-64	540	56.45	487	43.94
65-69	688	83.57	549	53.14
70-74	751	125.56	685	77.43

	Males		Females	
Age (years)	**N**	**Rate**	**N**	**Rate**
75-79	650	185.56	721	106.04
80-84	342	223.51	476	122.62
85+	173	204.64	346	129.19
N		4202		4389
Crude rate		20.39		19.97
ASR		14.96		10.94
Cumulative		0.02%		0.01%
Median age				
Mean age				
Sex ratio				

N – number of cases

Crude rate – cases per 100 000

ASR – age standardized rate (World Standard Population)

Cumulative – cumulative risk (0-74 years)

Table 1. Age-specific, crude and age-standardized incidence rates of non-melanoma skin cancer (C44) among men and women in Upper Silesia, 1999-2007.

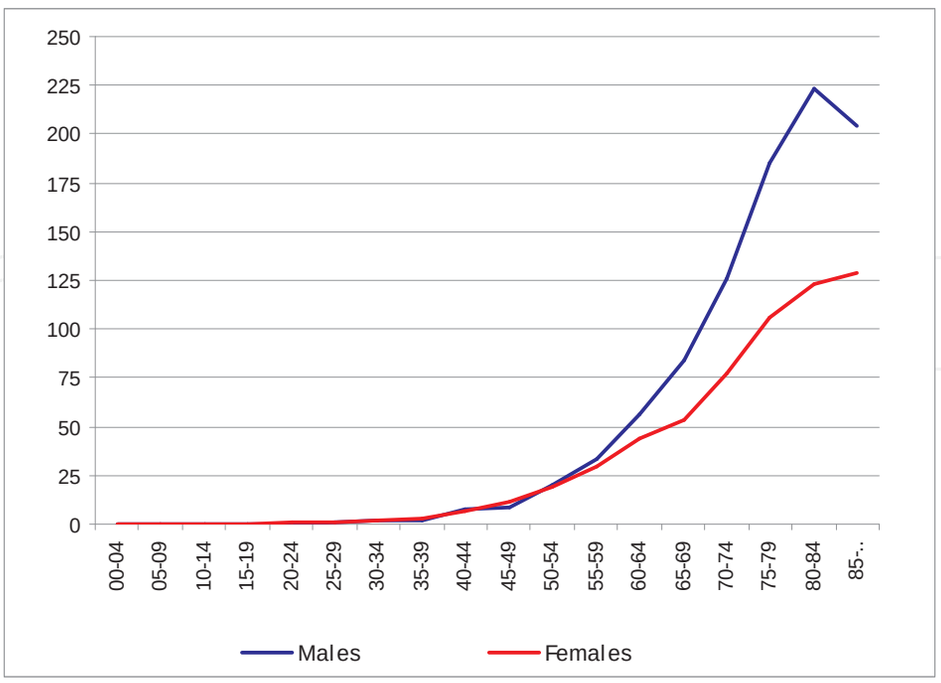

Figure 2. Age-specific incidence rates for non-melanoma skin cancer in males and females, Upper Silesia, 1999–2007.

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Cutaneous melanoma is significantly less frequent in comparison with non-melanoma skin cancers, and the same is observed in Silesia. In this area, recorded malignant melanoma incidence rates are approximately 4 times lower in men and 3 times lower in women than non-melanoma incidence rates (Table 1, 2), (Figure 1). During the period of our studies, there were 1072 cases of cutaneous melanoma diagnosed in men, and 1282 in women. An average age of the analyzed males was 57.3 years, whereas it was 55.5 in women, thus the age was lower than in the case of non-melanoma cancer patients. The standardized incidence rates for the Silesian population were $3.88/10^5$ and $4.02/10^5$ for males and females, respectively. Sex ratio was 0.96 for females, thus women run a slightly bigger risk of developing melanoma than men. Young adult and middle aged females are diagnosed with melanoma more frequently than males. Correspondingly to nonmelanocytic skin cancers, the cancer growth rate is bigger in men than in women, however men older than 60 years develop melanoma more frequently, and the difference increases with aging of the population (Table 2), (Figure 1, 3).

	Males		Females	
Age (years)	**N**	**Rate**	**N**	**Rate**
0-4	0	0.00	0	0.00
5- 9	1	0.09	0	0.00
10-14	0	0.00	2	0.15
15-19	7	0.41	5	0.30
20-24	16	0.90	29	1.67
25-29	19	1.16	45	2.80
30-34	27	1.85	53	3.69
35-39	45	3.12	61	4.26
40-44	86	5.26	104	6.230
45-49	101	5.79	143	7.89
50-54	150	9.68	172	10.40
55-59	118	10.18	135	10.51
60-64	126	13.17	133	12.00
65-69	137	16.64	130	12.58
70-74	124	20.73	122	13.79
75-79	73	20.84	84	12.35
80-84	31	20.26	41	10.56
85+	11	13.01	23	8.59
N		1072		1282
Crude rate		5.20		5.83
ASR		3.88		4.02
Cumulative		0.00%		0.00%
Median age				

	Males		Females	
Age (years)	**N**	**Rate**	**N**	**Rate**
Mean age				
Sex ratio				

N – number of cases

Crude rate – cases per 100 000

ASR – age standardized rate (World Standard Population)

Cumulative – cumulative risk (0-74 years)

Table 2. Age-specific, crude and age-standardized incidence rates of cutaneous melanoma (C43) among men and women in Upper Silesia, 1999-2007.

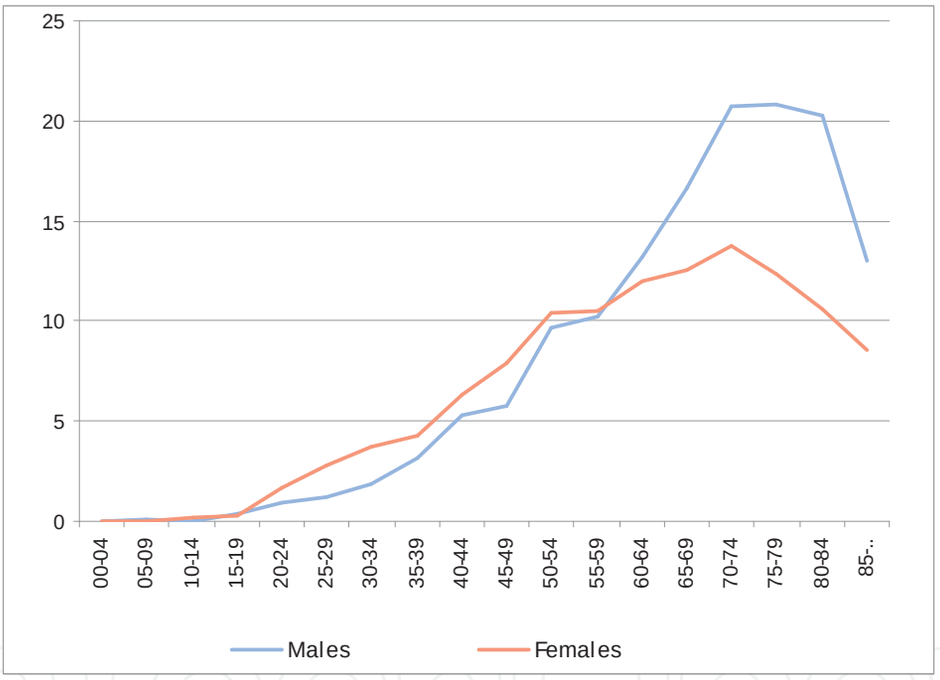

Figure 3. Age-specific incidence rates for cutaneous melanoma in males and females, Upper Silesia, 1999–2007.

Cutaneous melanoma affects mainly young adults. Our collected data show that in people younger than 40 years there are 10.7% of cases of cancer in men and 15.2 % in women. Just to compare, we can say that for non-melanoma skin cancers the percentage was 2% and 2.6% for men and women, respectively, whereas the incident cases of all cancers for all those age groups are 4.1% and 5.6% for men and women, respectively. The results suggest that there are 2 epidemiology reference groups of a melanoma incidence rate for the young and old subgroups, which corresponds to the observations from other parts of Europe [10-15].

When the incidence rates for non-melanomatous skin cancers were compared in relation to the part of the patient's body affected by neoplastic lesions, it was concluded that there were

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statistically significant differences between males and females, namely more men developed cancers in all studied cancer sites. Such results were most evidently observed for arms (sex ratio M:F 1.86) and trunk (sex ratio M:F 1.71) (Table 3), (Figure 4, 5).

	Males		Females		Sex ratio	
	N	ASR	N	ASR		95% CI
overall	**4202**	**14.96**	**4383**	**10.94**	**1.37**	**1.31-1.43**
Head & neck (C44.0-4)	3124	11.13	3402	8.43	1.32	1.25-1.39
Lip & eyelid (C44.0-1)	429	1.51	562	1.48		
external ear (C44.2)	376	1.34	98	0.24		
face (C44.3)	2035	7.26	2517	6.15		
Scalp & neck (C44.4)	284	1.01	225	0.56		
trunk (C44.5)	432	1.54	327	0.90	**1.71**	**1.47-1.99**
arms (C44.6)	185	0.67	142	0.36	**1.86**	**1.47-2.35**
legs (C43.7)	187	0.66	227	0.54	1.23	1.01-1.51
unspecified (C44.8-9)	247	0.97	291	0.71		

N – number of cases

ASR – age standardized rate (World Standard Population)

Table 3. Site-specific rate ratios of non-melanoma skin cancer (C44) in Upper Silesia, 1999-2007.

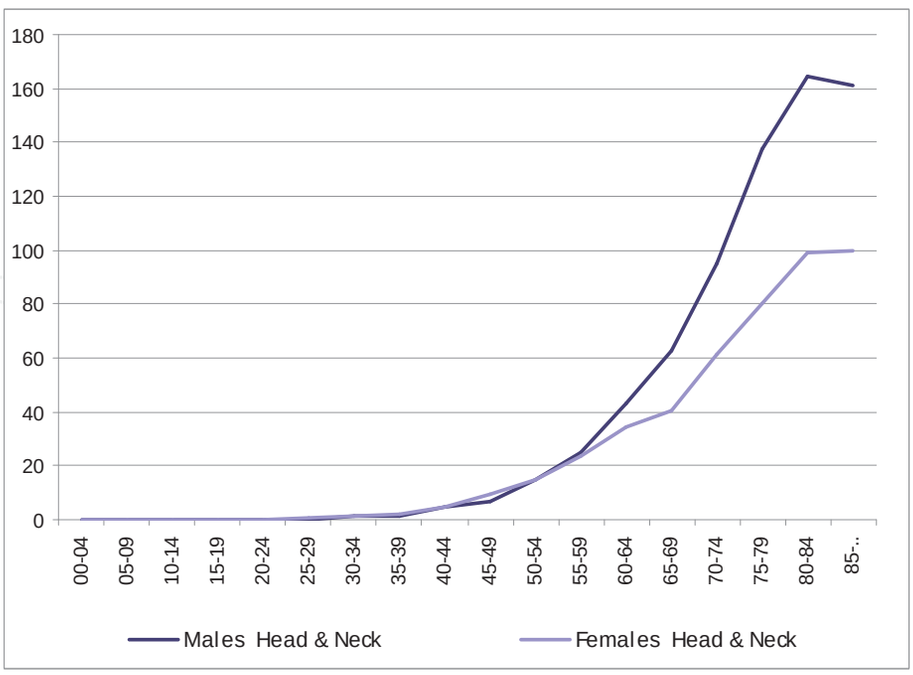

Figure 4. Incidence rates of non-melanoma skin cancer for head and neck in males and females by 5-year age groups, Upper Silesia, 1999-2007.

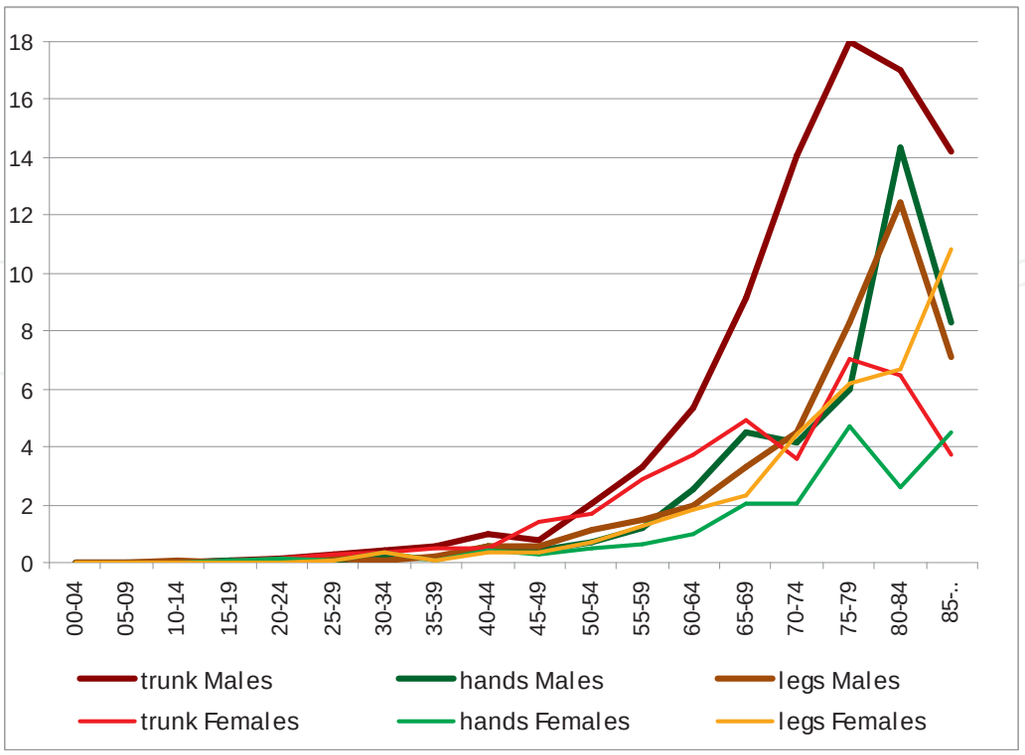

Figure 5. Incidence rates of non-melanoma skin cancer in males and females by 5-year age groups and anatomic site except head and neck, Upper Silesia, 1999-2007.

The majority of the lesions was localized on the head and neck (C44.0-C44.4), i.e. 74% of all neoplastic lesions in men and 78% in women. Most of the lesions were on the face (C 44.3), i.e. 48% and 57% in men and women, respectively. The standardized incidence rate for this cancer site (head and neck) was 11.13/100 000 in men and 8.43/100 000 in women. When compared to female patients, the incidence rates of the skin cancer localized on the head and neck are growing in males aged over 50 years, and the rates are two times higher in those aged more than 75 years, whereas among younger generations more lesions were recorded in young females (Table 3), (Figure 4).

The sites of neoplastic lesions in females were ranked in the following order: trunk (C44.5), legs (C44.7) and arms (C 44.6), whereas in males they were on the trunk (C44.5), arms (C44.6) and legs (C44.7). The analysis showed that young females developed skin cancers of such localizations more frequently than males. Higher incidence rates for males than for females were recorded for the lesions on the trunk, legs and arms in patients older than 35. A strong increase was recorded for patients older than 50, and the trend persisted until old age. To sum up, it can be observed that the incidence rates related to the cancer sites are systematically increasing with age in both populations (Table 3), (Figure 5).

A specific cancer site of melanoma is sex dependent. In males, the most commonly affected body part is the trunk (especially neoplastic lesions in elderly men), whereas they are legs in females, which is also observed in the inhabitants of Silesia (Table 4), (Figure 6, 7). Among all the cases of melanoma diagnosed in male inhabitants of the Upper Silesia, most of the lesions,

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	Males		Females		Sex ratio	
	N	ASR	N	ASR		95% CI
overall	**1072**	**3.88**	**1282**	**4.02**	**0.96**	0.89-1.05
Head & neck (C43.0-4)	151	0.54	180	0.52	1.03	0.82-1.29
Lip & eyelid (C43.0-1)	23	0.08	25	0.07		
external ear (C43.2)	15	0.05	16	0.05		
face (C43.3)	57	0.20	106	0.29		
Scalp & neck (C43.4)	56	0.21	33	0.12		
trunk (C43.5)	511	1.85	305	1.00	**1.85**	**1.60-2.14**
arms (C43.6)	147	0.53	225	0.72	0.74	0.60-0.91
legs (C43.7)	161	0.59	494	1.55	**0.38**	**0.32-0.45**
unspecified (C43.8-9)	102	0.37	78	0.23		

N – number of cases

ASR – age standardized rate (World Standard Population)

Table 4. Site-specific rate ratios of cutaneous melanoma (C43) in Upper Silesia, 1999-2007.

namely 48%, were on the trunk (C43.5). Such neoplastic lesions are equally frequent in women until they are aged 50 years, but in older patients the female incidence rates decreased, whereas the male rates increased strongly. In cancer patients aged 65-79 years, the male incidence rates for the trunk were 4 times higher than the female ones. In older men, the main cancer site is the trunk.

In females, in 38% of cases, the lower limbs were affected by cancer (C43.7), and a strong increase in the incidence rate was recorded for women aged 40-79 years. Such cancer site is 3 times more frequent in females than in males. We should emphasize that young females develop the skin cancer more frequently than young men, and the highest incidence rate for melanoma on legs were recorded for women aged 65-79 years. What is more, female incidence rates of melanoma for such a site are higher than male ones until old age. The incidence rate decreased in both population in the oldest age groups.

Arms are a frequent site of melanoma both in males and females (C43.6). In the group of patients younger than 70 years, higher incidence rates are recorded for females, whereas in those older than 70 years the incidence rates are 2 times higher in men than in women. The incidence rates increased systematically with age in both populations (Table 3, 4), (Figure 6, 7).

Summing up, until 50 years of age the body parts affected by melanomas are ranked in the following order in women: legs, trunk, arms, head and neck, whereas the order is the trunk,

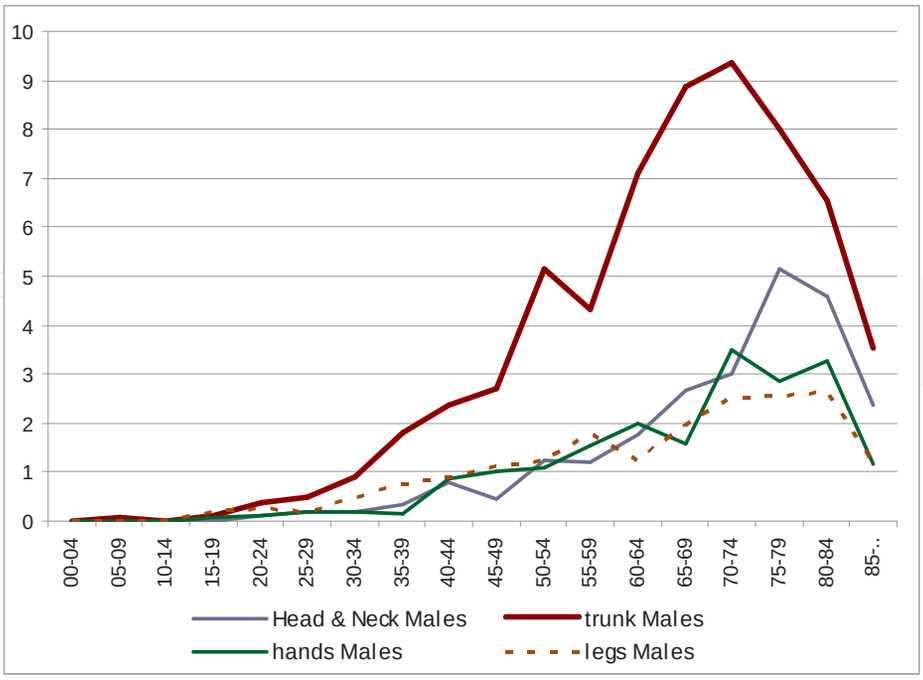

Figure 6. Incidence rates of cutaneous melanoma in males by 5-year age groups and anatomic site, Upper Silesia, 1999-2007.

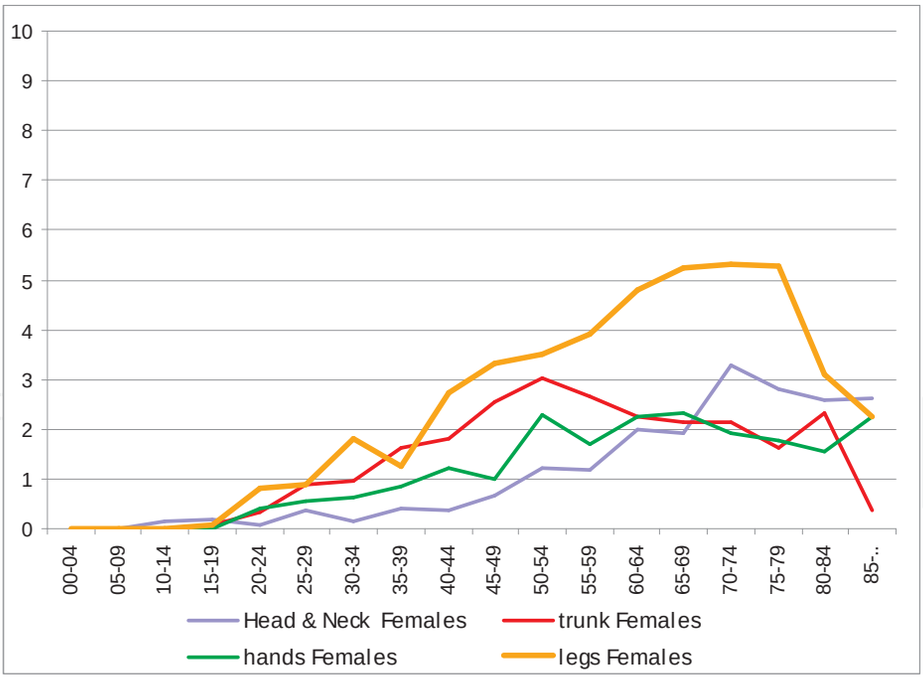

Figure 7. Incidence rates of cutaneous melanoma in females by 5-year age groups and anatomic site, Upper Silesia, 1999-2007.

legs, arms, head and neck in men. At this age, the risk of developing melanomas in all parts of the body (except the torso) is higher for women than for men. On the other hand, in patients

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over 50 years of age the rate of melanomas increases with age on legs and decreases for the trunk in women, but in men the rate increases for the trunk, however melanoma develops more slowly on legs.

When both types of skin cancers are compared, we can notice that the rates increase systematically with age. The incidence rate of non-melanoma skin cancer, in comparison with melanoma, is 4 times higher in men and 2.5 times higher in women. The distribution of age-specific incidence rates indicates a strong increase in melanoma rates in patients until 40 years of age. Yet over 40 years of age, namely with aging of the population, a strong increase in the rates of non-melanoma skin cancers can be observed. In the oldest age groups of men and women, the incidence rate is approximately 12 times higher than for melanoma.

The analyzed skin cancers differ in terms of the ratios of affected body parts. Huge disproportions between non-melanoma skin cancer and melanoma are recorded for the face. In men, non-melanoma skin cancers on the face comprise 48% of all skin cancers, whereas melanoma comprises 5%, while in women, it is 57% in case of non-malignant skin cancers and 8% for melanoma.

4. Discussion

Malignant neoplasms of the skin constitute the most numerous group of human malignancies, especially among representatives of a Caucasian race in the subtropical region. The two main groups of the skin cancer are non-melanomas and malignant melanoma.

The skin cancer incidence rates(C44,C43) are continually increasing in the world population [10-21]. In Poland, an increasing trend has also been recorded for all age groups since the 1970s, and according to the estimations this upward trend will continue in future [19]. A systematic increase in the rates is also observed in the Silesian population [2,3,20]. In 2009, all skin cancers, including melanoma, constituted above 8% of all malignant neoplasms in male and female inhabitants of Silesia. We can compare it with the values recorded for Poland, namely 8% of cases in men and 9% in women [18]. The results presented in the tables 1 and 2 indicate that a risk of non-melanomas and melanoma in young and middle aged adults is higher for females, whereas it is higher for men in the other age groups, especially in those aged over 50 years. In the years 1999-2003, an increased incidence rate was recorded for both skin cancer types in men aged 55 years. Both skin cancer types are more frequent in young women than in men, however the skin cancer growth rate in the population of middle aged adults is higher for men, and the difference increases with age. Similar situation has been observed in all regions of Poland [18,19], in Europe, and in the world population [10,16].

Standardized incidence rates of skin cancers were higher in the years 1999-2007 than the published values referring to the earlier periods [4-7,17]. In 1999-2003, the male standardized incidence rate of non-melanoma skin cancer was 13.50, whereas it was 9.70 for women. The incidence rate was 14.0 and 10.2 for men and women, respectively, in the years 1999-2005 [6]. During the analyzed period, i.e. 1999-2007, the value of male incidence rate increased up to

14.96, whereas the female rate reached a value of 10.94. In the years 1999–2003, an average annual non-melanoma incidence rate increased by 4.2% in men and by 4.8% in women. The sex ratio M:F was 1.1, but it increased to 1.37 during the presently studied period, which indicates a bigger risk of non-melanoma skin cancer for men than for women. In the first studied period, one in 68 male inhabitants of the Upper Silesia and one in 91 female ones could develop non-melanoma skin cancer, whereas in the years 1999-2005 one in 62 men and one in 87 women could be affected. The risk of developing the cancer until the age 74 years was still increasing, and in the years 1999-2007 one in 60 men and one in 80 women could develop non-melanoma skin cancer. On the other hand, one in 227 men and one in 232 women could develop malignant melanoma over this studied period.

In Silesia, cutaneous melanoma is diagnosed in men 4 and in women 2.5 times less frequently than non-melanomas, and this ratio is similar in the rest of Europe [10,14]. However, a slightly higher risk of cancer is recorded for men younger than 74 years than for women. Over a quite long period of time, an upward trend have been observed for both sexes. The results of our previous analyses in the years 1985-1989:1990-1994:1995-1998 show that incidence rates were increasing systematically.

In men, the consecutive incidence rates were 1.92, 2.69, and 2.86, while a cumulative risk was 0.20%, 0.32%,and 0.33% [17]. In the following years, a further progression of cancer was recorded, namely, in1999-2003 the incidence rate was 3.53 and the risk was 0.40% [4]. In the years 1999-2007, the highest incidence rate and the biggest cumulative risk were recorded, i.e. 3.88 and 0.44%, respectively, for men.

In the years 1985-1989:1990-1994:1995-1998, the following female incidence rates were registered:2.13, 2.56, and 3.11, while a cumulative risk was 0.21%, 0.26%, and 0.32% [17]. In 1999-2003, the incidence rate increased to 3.72, whereas a risk of cutaneous melanoma was 0.4% for women, which indicates that both sexes ran a similar risk of developing the cancer over this period of time [4,21].

In the previous years, men ran a slightly higher risk of cancer than women, though women developed the skin cancer more frequently, and such a trend is also observed at present. In the analyzed period of time, a standardized rate per 100 000 was also high for women, i.e. 4.02. The sex ratio M:F was 0.96 and it was unfavorable for women like in the previous years. To compare, the sex ratio M:F was 0.97 in the 1985-1998, and 0.95 in 1999-2003. This trend is similar to the one observed in Germany in the 1990s, where the incidence rates were equal for both sexes. However, cutaneous melanoma incidence rate recorded in Australia is higher for men [22].

In comparison to the age of non-melanoma patients (men 66.7; women 67.8), an average age suggests that malignant melanoma affects younger population in Silesia (men 57.3; women 55.5). It is worrying that the incidence rates are increasing for both sexes in all age groups in Silesia (C44 and C43). What is more, the age of afflicted persons is decreasing, especially in women, which is in agreement with observed world trends [6,22-24]. Additionally, the values of male and female incidence rates of non-melanoma skin cancers are getting equal in older age groups, whereas cutaneous melanoma rates are reaching similar values in younger age groups. This might indicate that in future more cases of non-melanoma skin cancers will be diagnosed in older women, and more younger men will develop melanoma.

When the non-melanoma and melanoma incidence rates are compared, it can be observed that in the Silesian population, people younger than 40 years developed mainly cutaneous melanoma. In people older than 40 years, there is a strong increase in the non-melanoma incidence rate with aging of the population. Both in the oldest male and female age groups, non-melanoma incidence rate is approximately 12 times higher than melanoma incidence rate.

The number of epidemiological studies on the non-melanoma and melanoma incidence and mortality rates in the inhabitants of the Upper Silesia is more than modest. In this area of Poland, the etiology of those cancers was poorly defined, since very first publications on the non-melanoma incidence and mortality rates in the inhabitants of the Upper Silesia pertained to the years 1985–1993. During that period, the ratio of histologically confirmed non-melanoma skin cancers held rather steady. The standardized rate for the Silesia was 6.3 per 100,000, and it was 6.4 per 100,000 in the cities. The carcinomas were recorded in males aged 10-15 years, and they were diagnosed until a very old age with evident increase in the incidence rate from 35 to 39 years of age [5,21].

Melanoma and non-melanoma skin cancers (NMSC) are now the most common types of cancer in white populations. Both cancers show an increasing incidence rate worldwide, but a stable or decreasing mortality rate. The rising incidence rates of NMSC may be caused by a combination of increased sun exposure or exposure to ultraviolet (UV) light, higher levels of outdoor activities, changes in clothing style, increased longevity, ozone depletion, genetics and immune suppression in some cases. A dose-dependent increase in the risk of squamous cell carcinoma (SCC) of the skin was found to be associated with exposure to psoralen and UVA irradiation. Intensive UV exposure in childhood and adolescence was a causative factor of basal cell carcinoma (BCC), whereas early chronic UV exposure was considered the cause of SCC [22]. In Poland, UVI (ultraviolet index) rarely exceeds 7, i.e. a value indicating a high UV radiation intensity [25].

An increase in incidence rates of skin cancers can also be caused by frequency of other risk factors such as oncogenic viruses or immunosuppressive drugs [26-28]. Other factors favorable for developing the skin cancer are post-burn scars, excessive keratosis, cutaneous horn, leukoplakia, xerodermapigmentosum (XP), nevoid basal cell carcinoma syndrome, and Bowen's disease (squamous cell carcinoma in situ). Immunological mechanisms may be involved in the pathogenesis of melanoma. Genetic predisposition is associated with about 10% of cases, and a number of genes whose mutations are a direct cause of cancer. The best known genes associated with familial melanoma include CDK4 (12q14), P16 (9p21) and CMM1 (1p36) [22,29-31].

The incidence of cutaneous melanoma is most rapidly increasing among all cancer rates in white populations. Its incidence is closely associated with constitutive skin color, and depends on a geographical zone. The highest incidence rates have been reported in Queensland, Australia, with 56 new cases per 100,000 men and 43 per 100,000 women per year. Mortality rates of melanoma have stabilized in the USA, Australia and also in European countries. Neoplastic lesion thickness is the most important prognostic factor for the primary melanoma. For the last two decades, thin melanomas have been diagnosed more frequently. Epidemiological studies have confirmed the hypothesis that the majority of all melanoma cases are

caused, at least in part, by excessive exposure to sunlight. Unlike squamous cell carcinoma, a melanoma risk does not seem to be associated with cumulative, but rather intermittent exposure to sunlight [22,32].

The basal cell carcinoma incidence rate increases linearly with the UV intensity. The increase in the incidence rate is proportional to the distant to the equator, and a squamous cell carcinoma incidence rate is doubled with decreasing latitude by every 8-10 degrees. On the equator, UV dose per unit of time is by 30% higher than in the south of the United States, and by 200% higher than in Europe, and in the northern part of the US [27,33-35]. An increase in the intensity of UV radiation that reaches the earth surface is explained by continuous and significant reduction of the ozone layer [31,36,37]. In Australia, Brazil and the USA, the skin cancer incidence rates are higher than in Northern, Central and Eastern Europe since there the sun exposure is proportionally higher than in Europe [38].

Non-melanoma skin cancers (NMSC) are the most common cancers diagnosed in the United States. Over 1 million new cases of basal and squamous cell carcinomas of the skin are diagnosed annually, and the exposure to UV radiation is a leading risk factor [39]. The ultraviolet (UV) band of the solar radiation is often divided into three sub-bands, namely, UV-C (wavelengths less than 280 nm); UV-B (280-320 nm), and UV-A (32-400 nm) when considering the biological effects. The atmosphere blocks the Sun's output of UV-C range (highly dangerous for plants and animals). UV radiation at the Earth's surface consists mostly of UV-A and UV-B. Ozone absorbs much of the UV-B radiation but this absorption weakens as a wavelength of 320 nm is approached. Life on the Earth is particularly affected by this part of the solar spectrum. An overexposure to UV-B radiation causes skin reddening and reduction of vitamin-D synthesis (result of a short-term overexposure), and the more serious skin cancer developing after long-term overexposure. Yet higher skin cancer incidence rates are recorded in Brazil, and they are related to a higher UVI as well as higher ozone concentration in the air. The UVI has strong seasonal variability in regions and parts of the year [38]. It can also be observed in Silesia, since the mountainous part of this region (i.e. Bielsko-Biała region) has higher non-melanomas and melanoma incidence rates than other regions of Silesia [4,5].

In Silesia, increased rates are recorded for women and men, however squamous skin carcinoma is more frequent in men [5]. The most common non-melanoma is basal cell carcinoma (BCC) diagnosed in 80% of cases, and squamous cell carcinoma, which originates in the malpighian layer, and is developed by 20% of patients. Our previously published studies showed that in the years 1999-2005, the ratio of basal cell carcinoma to squamous cell carcinoma was 4:1 and 7:1 for the male and female populations, respectively [6]. This can be related to the fact that men more frequently work outdoors and practice outdoor sports. Non-melanoma skin cancers, which are almost 100% curable, may occur in people who are overexposed for very long periods of time, like farmers, or construction workers and postal workers, street peddlers and other informal workers in cities [40].

The incidence rate may also be related to the exposure to other occupational factors, e.g. employment in industry. Silesia is the most industrialized region of Poland, where intensive development of industry began in the 19th century and continued in the 20th century.

Arsenic and its inorganic compounds is one of the factors that play a special role in the pathogenesis of skin cancers related to the industrial exposure[41,42]. In Slovakia, for instance, in the Prievidza region, elevated concentration of arsenic in the air and soil near the power plant where coal is used for heating, increased the incidence rate of skin cancers [43]. Special attention should be paid to this factor in the Upper Silesia since there are several power plants, thermal-electric power plants and coking plants in which coal is used. Additionally, skin cancer development is induced by groundwater or drugs contaminated by arsenic [26,27,42,44-46].

In the 1970s, there was an increase in the number of people who spent their vacations in the sunny areas of Europe and Northern Africa. Nowadays, India or Central America have also become vacation destination. People also tend to spend their weekends in the nearby mountainous region of Bielsko-Biała. What is more, suntan has been regarded as the symbol of social status, which imposes taking additional doses of UV radiation in solar salons, especially during those seasons when there is little sunshine in our climate zone.

The malignant melanoma incidence rate is sex and age dependent [22,26]. In countries where the malignant melanoma incidence rate is low, the rate is usually higher for women than for men, whereas a different trend is observed in the USA. When compared to men, American women younger than 40 years run a slightly bigger risk of skin cancer, while in persons over 40 years the proportion changes and the risk is higher for men. The differences are getting bigger with aging of the population [17,23].

The shape of age-related incidence curve for the inhabitants of the Upper Silesia is similar to the one for the US population, however a significant increase in the male incidence rate is recorded in those aged 50 years [23]. Our studies indicate that a male incidence rate has clearly increased in older age groups over the years [4,5,17], and in the nearest future the incidence rate in male inhabitants of the Upper Silesia may increase especially for elderly males. It can also be concluded that soon the age of the population in which more men than women will be affected by the skin cancer will decrease.

The fact that melanoma and non-melanoma skin cancers are more frequently diagnosed in inhabitants of regions with intensive insolation can suggest that a total UV dose may have a significant effect on developing skin cancers, which was also confirmed by our analyses. The mountainous Bielsko-Biała region with low air pollution and high UV radiation had the highest melanoma incidence rate in the whole Upper Silesia [4,5].

The highest risk of developing cutaneous melanoma occurs due to occasional solar exposure, which can be called recreational one. This especially applies to childhood years and repeated sunburns. It was established that as much as 80% of total solar exposure in a lifetime falls on the first 18 years. Multivariate analysis shows that in individuals who suffered from repeated sunburns when they were younger than 18 years, the risk of developing the cancer increases almost 6.5 times [2-5,17,21,47,48]. Nowadays, it is agreed that suffering from sunburns in childhood, especially before the age of 12 years, is a significant risk factor of cutaneous melanoma [22,47]. In children with sunburns, a decrease in 7-dehydrocholesterol level, converted into vitamin D3 in the skin, was recorded even 14 months after sunburn. Corre-

spondingly, low levels of an active form of vitamin D3 was diagnosed in malignant melanoma patients [49,50].

Skin cancers are neoplastic lesions typical for elderly people. However, cutaneous melanoma is disproportionally more frequently diagnosed in young adults. Cutaneous melanoma is assumed to occur after 20-40 years since the exposure to a risk factor, e.g. ultraviolet (UV) radiation. Thus, the incidence rates of cohorts consisting of the inhabitants of the Upper Silesia from 1978 and 1998, respectively, were compared. After 20 years, a significant increase in the number of neoplastic lesions could be seen among the people who were young then [17].

Numerous studies suggest that solar exposure is not the only but a highly probable environmental risk factor in developing malignant melanoma, especially in the population where cutaneous melanotic nevi ('moles') do not occur. Solar exposure may play varied roles in etiology of malignant melanoma [6,32,51,52]. UV radiation is a significant carcinogenic factor in people but only one of about 60 risk factors recognized by WHO [53]. It was observed that in people with diagnosed elastosis, the mortality rate due to malignant melanoma was half of the rate recorded in individuals who were not afflicted by the disease.

The positive influence of sunlight is related to its role in the synthesis of the vitamin D3 in human body. A direct reaction which occurs in the skin after UVB exposure is the synthesis of inactive form of the vitamin D3, i.e. cholecalciferol, into an active form, i.e. 1.25- dihydroxyvitamin, which has a diversified, beneficial effect on cells since it induces apoptosis in many disease processes. The vitamin D3 inhibits proliferation and induces differentiation of melanoma cells. The ability to convert provitamin into an active form of the vitamin D3 is highly impaired in the residents of northern latitudes. Populations living far from the equator may suffer from vitamin D3 deficiency during winter months [54]. Consequently, a low level of 1.25-dihydroxyvitamin is detected in malignant melanoma patients' serum. The opinion that sunlight might have a healthful effect on certain types of cancers has been around for a few decades [53]. When compared to the southern states inhabitants, increased mortality rates were reported for leading cancer types including breast, prostate and colon cancers in individuals of Caucasian race who inhibit northern states of the USA [55]. In 1990, the vitamin D3 was mentioned as a factor which could explain the differences in geographic distribution of the mortality rates [56]. In individuals who regularly spend some time outdoors, the vitamin D3 deficiency decreases. Thus, this hypothesis may elucidate not entirely expected protective effects of sunscreens [57]. High SPF value of sunscreen products can fully block the vitamin D3 synthesis in the skin, which is undesirable. Sun tanning serves as a protection against sunlight since melanin granules absorb the sunlight and, to some extent, neutralize the negative effect of UBV, e.g. by promoting degradation of connective tissue due to the damage of collagen fibers and elastin, or inducing DNA mutation which can result in neoplastic transformation [49-51].

This is consistent with the observations that people working outdoors with certain intervals run lower risk of developing malignant melanoma localized in the skin exposed to UV radiation than people who work indoors [58-60]. Continuous sun exposure may reduce a risk of sunburns, which are a known etiologic factors of malignant melanoma. What is more, smaller vitamin D3 deficiency in individuals who are regularly exposed to sunlight can serve

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as another explanation for low malignant melanoma incidence rate values [54]. However, it is only an assumption which should be confirmed by further studies, since all the effects of vitamin D and its receptors are not completely known.

The worldwide incidence trends are reflected by the skin cancer incidence rates in the Upper Silesia, namely, the highest rates are recorded in older age groups, which may result from the accumulating of risk factors over time and a continuous increase of life span. Our results show that there are 2 different groups of epidemiological factors of malignant melanoma for young and old age subgroups, which was also observed by other authors [12].

Distribution of non-melanomas (head and neck) and malignant melanoma (trunk) correspond to the worldwide trends, too [22,47,48,61]. Longer exposure to sunlight may be a causative factor of skin cancers developed on the head, neck, trunk and lower limbs [17,50].

Basal cell carcinoma (BCC), which is the most common among non-melanomas and constitutes 75%-86% of all cases, occurs on the head and neck a slightly more frequently in men [62,63]. In the Upper Silesia in 1999-2003, one in 107 men ran a risk of BCC, whereas one in 68 men could develop all types of skin cancer [4]. In the years 1999-2007, in comparison with 1999-2003, both populations ran a significantly higher risk of developing non-melanoma skin cancer in all cancer sites. Still, most neoplastic lesions were on the patients' head and neck. When compared to an earlier period, the incidence rate for this cancer site, i.e. the head and neck (C44.0-4), increased especially in men. A standardized incidence rate was 9.60 per 100,000 in 1999-2003, while it was 11.13 per 100,000 in 1999-2007. The same trend but a slower rate was recorded in women. Still, the sex ratio is unfavorable for men, and resembles the one in the years 1999-2003. Over these years, the female incidence rate increased from 7.36 to 8.43, but men ran a higher risk of neoplastic lesions on the head and neck than women. Corresponding results were obtained for the neoplastic lesions on the trunk (C44.5) and legs (44.7), but the disproportion between sex ratios was getting bigger in comparison with 1999-2003,and in men the ratio increased for neoplastic lesions on the trunk, whereas it decreased for arms and legs.

In the whole area of the Upper Silesia, a continuous increase in malignant melanoma incidence rate can be observed. The growth rate for this cancer in people older than 50 years is higher for men than for women, and the difference is increasing with age. A specific cancer site is age and sex dependent. More frequently, neoplastic lesions on the trunk and lower limbs are typical for older age groups, while an increase in malignant melanoma incidence rate for the head and neck (80%) characterizes the oldest age groups [21].

In the younger population, i.e. among persons younger than 50 years, cutaneous melanoma develops most frequently on the body parts continually exposed to the sun such as arms and legs, and on the neck and face in those older than 50 years [17,21,64]. Corresponding observations were made for the inhabitants of the Upper Silesia. The analysis of melanoma incidence rate related to the affected body parts indicates that neoplastic lesions in elderly men were most frequently on the trunk, while in women older than 20 years, cutaneous melanoma affected lower limbs and the trunk. In older age groups, especially in men, malignant melanoma incidence rate increased for the head and neck as well as for arms.

In the years 1999-2007, both men and women ran the same risk of malignant melanoma on the head and neck (C43.0-4), whereas in 1985-1998 the sex ratio M:F was 1.25, thus the risk of developing cancer at such a site decreased in men. In the years 1999-2003, neoplastic lesions on the face (C 43.3) were 2 times more frequent in women than in men. However in 1999-2007, such huge differences were not recorded, which resulted from an increased incidence rate in men but a decreased rate in women.

In men, most frequently malignant melanoma affected the trunk. As early as in 1985-1998, the sex ratio M:F for the trunk (C43.5) was 1.58 and was unfavorable for men, and increased significantly in the following years (1999-2003) up to 1.60. The differences between sexes were getting bigger [17,21]. In here presented analysis of the years 1999-2007, the ratio was 1.85, which indicates that the disproportions between sexes for this cancer site were increasing. When we compared the years 1995-1998 and 1985-1989, we noticeda 2-fold increase in the number of neoplastic lesions on the trunk in men.

Additionally, the sex ratio was unfavorable for women when the results for neoplastic lesions on legs (C43.7) were analyzed. This trend has prevailed in the Upper Silesia for years. In the above mentioned periods of time, the sex ratio M:F was ranked as follows: 0.47, 0.41, 0.38. In the years 1999-2007, the female incidence rate of malignant melanoma on lower limbs was almost 3 times higher than in men, in 1999-2003 it was 2.5 times higher, whereas it was 2 times higher in 1985-1999. In comparison to men, more young women developed malignant melanoma on legs. After the comparison of the previous analyzed periods, we could observe that incidence rates of those cancer sites increased in both sexes. The highest relative increase in female incidence rate was registered for arms (C43.6), was also recorded during the past years [7]. The values of female standardized incidence rate were as follows: 0.37 in 1985-1999, 0.63 in 1999-2003, and 0.72 in 1999-2007 [18,23]. The differences between cancer sites in both sexes may result from the differences in the way they dress, which suggests that there are variations in time of UV exposure of body parts

However, the UV radiation dose inducing skin cancer in humans is still unknown.

The development of all nevi types, including dysplastic nevi, is related to skin pigmentation degree and malignant melanoma is most frequent in white people. For instance, in Argentina, in the population of Cordoba with high values of malignant melanoma incidence rates, the risk of developing the cancer increases over 2 times if grandparents were Europeans and over 5 times in individuals of fair skin and eyes [5].

The risk also increases with the number of melanotic nevi ('moles'). Adults have 15-20 moles on average and their location can be varied, i.e. they can occur on the scalp or places exposed to solar radiation. Developing malignant melanoma in solarium clients is also related to a large number of moles and the neoplastic lesions are most frequently located on the trunk [17]. In general, solarium clients are young people, predominantly young women. Thus, indoor tanning can also contribute to the increase in the number of the lesions on the trunk in female inhabitants of the Upper Silesia.

The number of detected dysplastic nevi significantly decreases in people who consumed small quantities of food but of large vitamin D, α- and β-carotene, cryptoksantin and lute in content.

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Although this is directly related to the skin response to repeated exposure to UV radiation, supplementation of the above listed components does not bring the required effect [26].

Extensive case-control studies of the population of the Silesia would be necessary to establish which environmental risk factors play an essential role in developing cutaneous malignant melanoma. Due to the increase in the values of malignant melanoma incidence rates, also in the inhabitants of the Upper Silesia, appropriate health education and prophylactic strategies related to solar exposure have to be implemented.

Slip-Slop-Slap was the iconic and internationally recognized sun protection campaign prominent in Australia during the 1980s. Launched by Cancer Council Victoria in 1981, the Slip! Slop! Slap! campaign features a singing, dancing Sid Seagull encouraging people to reduce sun exposure and protect themselves against an increased risk of skin cancer [65,66]. Sid had Australians slipping on long sleeved clothing, slopping on sunscreen and slapping on a hat. This successful program was funded by public donations. The health campaign was extended in later years by the Sun Smart to encourage the use of sunglasses and shade. That is: Slip on a shirt, Slop on the 30+ sunscreen, Slap on a hat, Seek shade or shelter, Slide on some sunnies. - "Slip, Slop, Slap, Seek, Slide". By this stage, however, the skin cancer aware message of the campaign had successfully been absorbed into the Australian psyche. Slip, Slop, Slap was also used in New Zealand, where the mascot is a lobster, voiced by Ants from What Now. Some Canadian cities have also started their own Slip-Slop-Slap campaigns.

The campaign is considered one of the most successful and recognizable health campaigns in Australia, but despite its popularity and success, Australia has the highest incidence of skin cancer in the world. Each year in Australia, various forms of skin cancer are diagnosed in more than 300 thousand people, about 1,600 people die from malignant melanoma.

The American Cancer Society recommends the following:

- Slip on a shirt with sleeves.
- Slop on sunscreen (at least an SPF 15) and remember to reapply.
- Slap on a hat with a brim wide enough to shade your face, ears, and neck.
- Sunglasses to protect your eyelids from UV damage and your eyes from getting cataracts [67].

Appropriate cancer screening programs and doctors' training should also be introduced, which would facilitate early detection and proper care of patients with melanotic nevi characterized by high risk of developing malignant melanoma. Such implementations have brought satisfactory results in Australia and Scandinavian countries.

5. Conclusion

Due to the increase in the values of malignant melanoma incidence rates in the inhabitants of the Upper Silesia, it is necessary to implement health education and prophylactic strategies

related to solar exposure. What is more, it would be advisable to sensitize doctors to attentively observe patients' skin lesions.

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