

## Epidemiology of Skin Cancer in Japan

Motoi Nishi

Motoi Nishi, Department of Fundamental Health Sciences, Health Sciences University of Hokkaido, 1757 Tobetsu, Hokkaido, 061-0293 Japan

Correspondence to: Motoi Nishi, Department of Fundamental Health Sciences, Health Sciences University of Hokkaido, 1757 Tobetsu, Hokkaido, 061-0293 Japan.

Email: [motoi@hoku-iryo-u.ac.jp](mailto:motoi@hoku-iryo-u.ac.jp)

Telephone: +81-(0)133-23-1211 Fax: +81-(0)133-23-1669

Received: January 15, 2016 Revised: February 9, 2016

Accepted: February 10, 2016

Published online: April 18, 2016

### ABSTRACT

In this article, the changes in the mortality rates of malignant melanoma (C43 in the ICD-10 codes) and other skin cancers (C44) in Japan from 1999 to 2014 are discussed from the viewpoint of descriptive epidemiology, employing the vital statistics data. The crude mortality rates of C43 and C44 increased parallel to age, and that of C44 rapidly increased after 80 years of age. The crude mortality rates of C43 and C44 have been increasing for both males and females. The crude mortality rates in 2014 were from 1.6- to 2.0-fold those in 1999. The male/female ratios of both C43 and C44 were almost 1.0. The correlation coefficient between the age-adjusted mortality rate of C44 and the year was 0.523 ( $p < 0.05$ ), which suggests that its mortality is increasing, independent of the aging of the Japanese population. The correlation coefficient between the age-adjusted mortality rate of C43.5-7 (malignant melanoma; trunk, upper limb, lower limb) was 0.925 ( $p < 0.05$ ), and that of C44.0-4 (other skin cancers, head and neck) was 0.637 ( $p < 0.05$ ). The correlation coefficient between the crude mortality rate of C44.0-4 (other skin cancers, head and neck) and the latitude of the capital of each of the 47 prefectures of Japan was negative, but that of C43 was positive. In Japan the amount of ultraviolet (UV) B exposure has been increasing almost continuously, but the present results suggest that the contribution of UV to the occurrence of malignant melanoma is not large. The westernization of the lifestyle of Japanese people may have something to do with the continuous increase in C43.5-7. It is not contradictory that the

increasing amounts of exposure to UV radiation have brought about an increase in squamous cell carcinoma, one of whose causes is UV radiation, and consequently an increase in the age-adjusted mortality for C44.

© 2016 The Author. Published by ACT Publishing Group Ltd.

**Key words:** Descriptive Epidemiology; Japan; Malignant Melanoma; Skin Cancer; Squamous Cell Carcinoma; Vital Statistics

Nishi M, Epidemiology of Skin Cancer in Japan. *Journal of Tumor* 2016; 4(2): 369-373 Available from: URL: <http://www.ghrnet.org/index.php/jt/article/view/1666>

### INTRODUCTION

It is said that the occurrence of skin cancers is increasing due to the increase in ultraviolet (UV) radiation because of recent ozone depletion. Especially for Caucasians, this is a crucial problem. In fact, in Sweden, squamous cell carcinoma became 4 times more frequent during the period from 1960 to 2004<sup>[1]</sup>. This problem, however, does not seem to be so serious for Japanese people, since their skin type is mainly 3 or 4 (Fitzpatrick skin typing). In a meta-analysis, the odds ratio of skin type 1 to type 4 was 2.09 with respect to the occurrence of cutaneous melanoma<sup>[2]</sup>. The annual incidence of malignant melanoma in Japan is 11.2 per million persons, but that of white Americans is 243 per million<sup>[3]</sup>. In this article, the recent changes in the mortality from skin cancers in Japan are reported, employing the vital statistics data.

### Codes in ICD-10

Data on the number of deaths from neoplasms of the skin in 5-year age categories were obtained from the vital statistics of Japan from 1999 to 2014 (<http://www.e-stat.go.jp/SG1/estat/OtherList.do?bid=000001041662&cycode=7>). Codes C43 and C44 stand for malignant melanoma and other skin cancers, respectively. The data for subcodes C43.0 to C43.9 and C44.0 to C44.9 (Table 1), which indicate the original sites, were employed as well. (The data for subcodes in 5-year age categories began to be published in 1999.)

**Table 1** Subcodes of C43 and C44.

Subcode	Site
C43	Malignant melanoma of skin
C43.0	lip
C43.1	eyelid, including canthus
C43.2	ear and external auricular canal
C43.3	other and unspecified parts of face
C43.4	scalp and neck
C43.5	trunk
C43.6	upper limb, including shoulder
C43.7	lower limb, including hip
C43.8	overlapping sites of skin
C43.9	unspecified
C44	Other and unspecified malignant neoplasms of skin
C44.0	lip
C44.1	eyelid, including canthus
C44.2	ear and external auricular canal
C44.3	other and unspecified parts of face
C44.4	scalp and neck
C44.5	trunk
C44.6	upper limb, including shoulder
C44.7	lower limb, including hip
C44.8	overlapping sites of skin
C44.9	unspecified

**Table 2** Crude mortality rates (per million population) and sex ratios (M/F) of C43 and C44.

	C43			C44		
	Male	Female	M/F	Male	Female	M/F
1999	3.40	2.98	1.14	4.44	3.89	1.14
2000	3.97	3.18	1.25	4.20	4.37	0.96
2001	4.09	3.86	1.06	4.54	4.42	1.03
2002	3.98	3.51	1.13	4.11	4.55	0.90
2003	4.17	3.38	1.23	4.70	4.80	0.98
2004	4.41	3.76	1.17	4.75	5.11	0.93
2005	4.56	3.99	1.14	5.63	4.97	1.13
2006	4.62	4.22	1.10	5.37	5.75	0.93
2007	4.85	4.31	1.13	5.03	5.45	0.92
2008	5.10	4.48	1.14	5.50	6.04	0.91
2009	4.50	4.34	1.04	5.57	6.39	0.87
2010	5.13	4.78	1.07	5.68	6.60	0.86
2011	5.40	4.90	1.10	6.09	6.64	0.92
2012	5.38	4.98	1.08	6.60	7.72	0.86
2013	5.36	4.28	1.25	7.27	7.38	0.99
2014	5.68	5.33	1.07	7.37	8.03	0.92

Population statistics were obtained from the census and vital statistics data of Japan. For the statistical test of correlation coefficients (Pearson), t-distribution was employed.

#### Crude mortality rates by 5-year age categories

Figure 1 shows the crude mortality rates of C43 and C44 (from 1999 through 2014) by 5-year age categories. These mortality rates increased parallel with age, and that of C44 rapidly increased after 80 years of age.

#### Changes in the crude mortality rates of C43 and C44

Table 2 shows the changes in the crude mortality rates of C43 and C44. Both of them have been increasing for both males and females. The crude mortality rates in 2014 were from 1.6- to 2.0-fold those in 1999. The male/female ratios of both C43 and C44 were almost 1.0.

#### Changes in the age-adjusted mortality rates of C43 and C44

The Japanese population is aging. In 1970, the percentage of persons aged 65 years or older was 7.1%, but in 1994 it was 14.1%, and in 2007, 21.5%. This is the fastest increase in the world. It is natural that in such a society the number of deaths from cancers would increase. In a society where the percentage of aged people is increasing, an

**Table 3** Correlation coefficients between latitude and crude mortality rate.

Subcode	Correlation coefficients
C43	0.335
C43.0	0.125
C43.1	-0.024
C43.2	-0.013
C43.3	0.215
C43.4	0.078
C43.5	0.379
C43.6	0.423
C43.7	0.242
C43.8	0.295
C43.9	0.106
C43.0-4	0.217
C43.5-7	0.511
C44	-0.014
C44.0	-0.127
C44.1	-0.148
C44.2	0.046
C44.3	-0.158
C44.4	-0.005
C44.5	0.313
C44.6	0.155
C44.7	0.322
C44.8	-0.155
C44.9	-0.169
C44.0-4	-0.110
C44.5-7	0.362

age-adjusted mortality rate is necessary for comparisons over a long period. To calculate the age-adjusted mortality rate from 1999 to 2014, the model population in Japan in 1985 (0-4, 5-9, 10-14, etc., to 80-84 and 85 years of age or older) was employed.

Figures 2 and 3 show the age-adjusted mortality rates of C43 and C44. Their correlation coefficients with the year were 0.421 ( $p > 0.05$ ) and 0.523 ( $p < 0.05$ ), respectively. The significantly positive and high correlation coefficient of C44 suggests that its mortality is increasing, independent of the aging of the Japanese population.

#### Age-adjusted mortality rate by original site

Figures 4, 5, 6 and 7 show the age-adjusted mortality rates of C43.0-4 (head and neck), C43.5-7 (trunk, upper limb, lower limb), C44.0-4 and C44.5-7. The correlation coefficients with the year were 0.245 ( $p > 0.05$ ), 0.925 ( $p < 0.05$ ), 0.637 ( $p < 0.05$ ) and -0.300 ( $p > 0.05$ ), respectively.

#### Latitudes and crude mortality rates in the 47 prefectures of Japan

Crude mortality rates were calculated for all 47 prefectures of Japan, employing the average number of deaths from 1999 to 2014 and the average of the populations reported by the censuses performed in 2000, 2005 and 2010.

Table 3 shows the correlation coefficients between the crude mortality rate and the latitude of the capital of each of the 47 prefectures. The correlation coefficient of C43 was positive. Those of C44.0, C44.1, C44.3, C44.4 and C44.0-4 were negative.

#### Amounts of ultraviolet B radiation

In Japan the data on the amounts of UVB radiation have been available since 1997 only in the city of Sapporo. Figure 8 shows the annual average amounts of UVB radiation in that city ( $\text{kJ/m}^2$ ; Data of the Meteorological Agency, [http://www.data.jma.go.jp/gmd/env/uvhp/uvb\\_monthave\\_sap.html](http://www.data.jma.go.jp/gmd/env/uvhp/uvb_monthave_sap.html)).

The correlation coefficient with the year was 0.655 ( $p < 0.05$ ). That is, it has been increasing almost continuously.

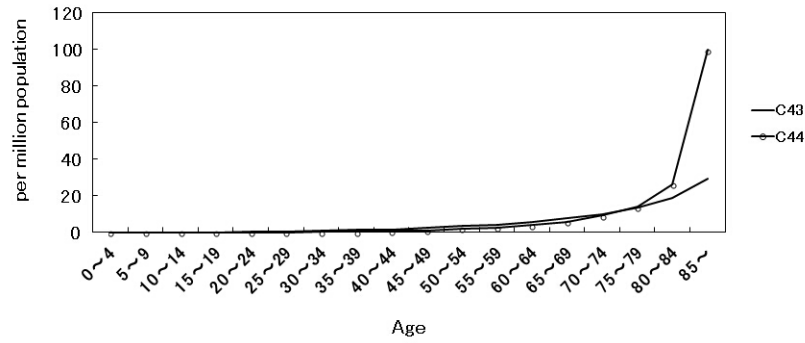


Figure 1 Crude mortality rates of C43 and C44 (from 1999 through 2014) by 5-year age groups.

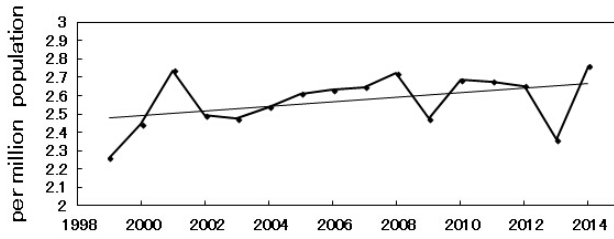


Figure 2 Age-adjusted mortality rates of C43 (malignant melanoma).

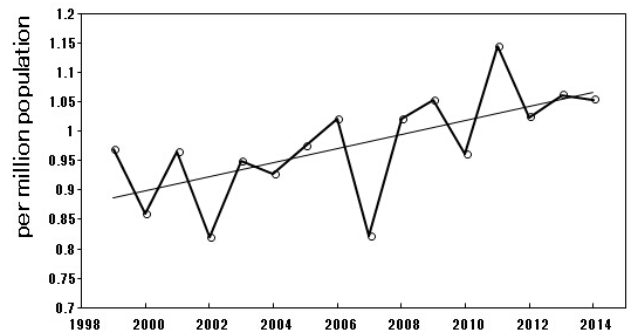


Figure 6 Age-adjusted mortality rates of C44.0-4 (other skin cancers; head and neck).

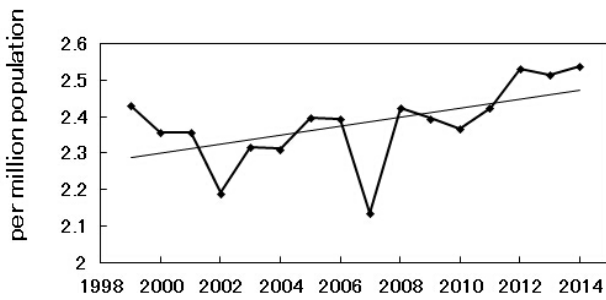


Figure 3 Age-adjusted mortality rates of C44 (other skin cancers).

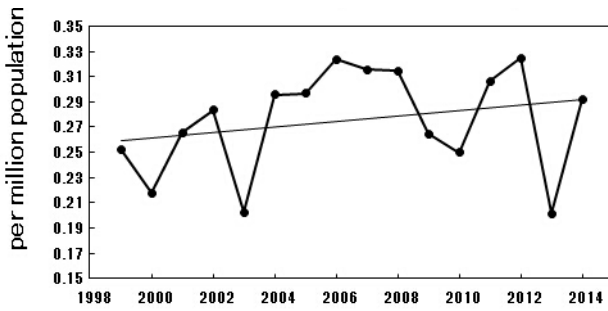


Figure 4 Age-adjusted mortality rates of C43.0-4 (malignant melanoma; head and neck).

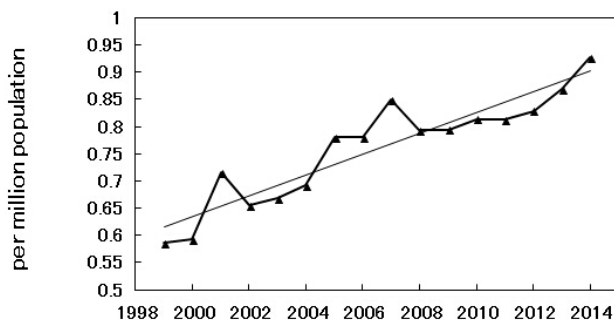


Figure 5 Age-adjusted mortality rates of C43.5-7 (malignant melanoma; trunk, upper limb, lower limb).

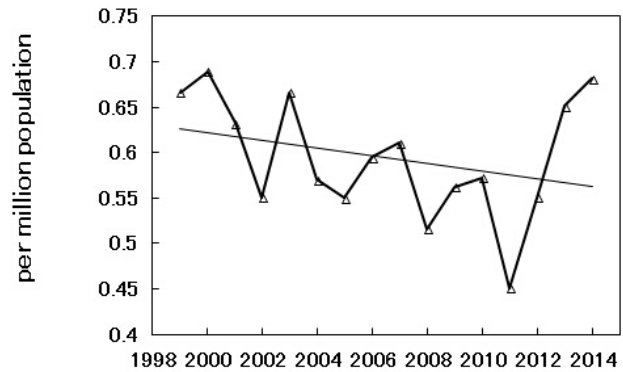


Figure 7 Age-adjusted mortality rates of C44.5-7 (other skin cancers; trunk, upper limb, lower limb).

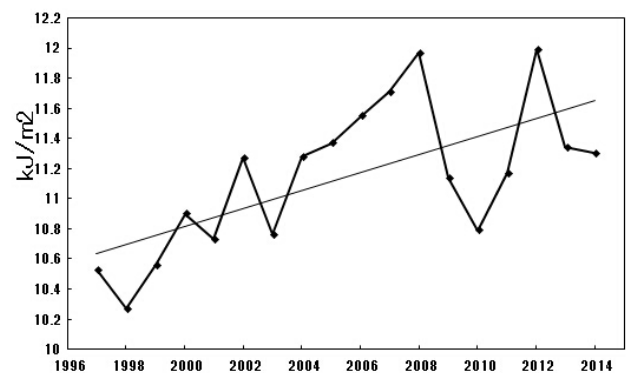


Figure 8 Amounts of ultraviolet B in the city of Sapporo.

## DISCUSSION

### C43 (malignant melanoma)

Classification of the codes of the ICD-10 is dependent on the original sites. In general, therefore, one cannot know the pathological diagnosis. Malignant melanoma is one of the exceptions.

Though the etiologies of skin cancers are not completely clarified, exposure to UV radiation is considered to be one of the strongest risk factors. Though the amount of UVB has been increasing in Japan, the correlation coefficient between the age-adjusted mortality from C43 and the year was not significant. The correlation coefficient between the crude mortality rate of C43 and the latitude was positive. These results suggested that the contribution of UV to the occurrence of malignant melanoma was not large. According to one report, UV does not make a large contribution to the occurrence of melanoma in nonwhite populations<sup>[4]</sup>, though it is reported that in white populations there is a positive association with intermittent sun exposure<sup>[5]</sup>.

Many of the original sites of malignant melanoma of Japanese people are those that have little exposure to sunlight. Ishihara et al<sup>[6]</sup> reported that the most frequent site of malignant melanoma in Japanese people was the sole of the foot (27.0%) in a total of 2065 patients. The trunk, abdomen, buttocks and shoulders accounted for 13.8%. This distribution is different from that of Americans whose most frequent site is the trunk (34%)<sup>[3]</sup>. This difference may derive from a genetic predisposition and/or lifestyle. The correlation coefficient between the age-adjusted mortality rate of C43.5-7 and the year was more than 0.9. This shows that the distribution of the original sites in Japanese people may become similar to that of Americans in the future. The cause could not be clarified in the present study, but the westernization of the lifestyle of Japanese people<sup>[7]</sup> may have something to do with this change.

### C44 (other skin cancers)

The difference in the crude mortality rates of C43 and C44 was small in the ages under 80 years, but in the age group 80 years and older, it became large (C44>>C43). Both the crude mortality rate of malignant melanoma and that of other skin cancers have been increasing. This is accounted for by the increase in the number of aged people since their mortality rates in the aged-population are high. However, the age-adjusted mortality from C44 has also been increasing since its correlation coefficient with the year was significantly high. That is, the occurrence of C44 is increasing independent of the aging of the Japanese population.

A case-control study in Australia reported that solar exposure was associated with squamous cell carcinoma<sup>[8]</sup>. In Japan, it is reported that solar keratosis is more frequent in low latitude regions<sup>[9]</sup>. Ishihara reported that in Japan 52.2% (554/1082) of squamous cell carcinoma was found in the scalp, face, ears, lips and neck, i.e., the sites exposed to sunlight<sup>[10]</sup>.

Since the fatality rate of basal cell carcinoma is generally low, many of the deaths classified into C44 might have been from squamous cell carcinoma, whose main cause is exposure to UV radiation. If so, it is not contradictory that the increasing amounts of UV exposure have brought about an increase in squamous cell carcinoma and, consequently, the increase in the age-adjusted mortality from C44. This is supported by the findings that the correlation coefficient between C44.0-4 (sites exposed to sunlight) and the year was significantly high, and that the correlation coefficient between C44.0-4 and the latitude was negative.

### Smoking

Smoking is one of the main causes of malignant diseases. However, there are virtually no reports that smoking is a significant risk factor for skin cancers. In Japan, the percentage of smokers has largely been different between males and females. In 1966, when the percentages were highest for both sexes, they were about 84% for males and 18% for females<sup>[7]</sup>. Although these percentages have been decreasing since 1966, that of males was about 30%, and that of females about 10% in 2014. However, since the sex ratio of the crude mortality rates of both C43 and C44 were almost 1.0, the contribution of smoking is not large. The age-adjusted mortality rate of lung cancer has been decreasing since 1995, i.e., since 30 years after the peak year (1966) of the percentage of smokers<sup>[7]</sup>. However, the age-adjusted mortality rates of C43 and C44 have not decreased.

### Sunscreen

One article reported that sunscreen prevented the occurrence of squamous cell carcinoma<sup>[11]</sup>. Another reported that sunscreen had no effect on the occurrence of melanoma<sup>[12]</sup>. It has not been long since we began to use sunscreen widely. Now in Japan, many females use it, but many males do not. At present, there is little difference between the sexes with regard to the mortality rates of C43 and C44. In Japan, in the future, there might be differences in the mortality rates of skin cancers (especially squamous cell carcinoma) between the sexes. In addition, it is only recently that we started to use sunscreen against UVA radiation. Therefore, we must carefully observe how the mortality rate of skin cancers changes.

## CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

## REFERENCES

1. Dal H, Boldemann C, Lindelöf, B. Trends during a half century in relative squamous cell carcinoma distribution by body site in the Swedish population: Support for accumulated sun exposure as the main risk factor. *J Dermatol* 2008; **35**: 55–62.
2. Gandini S, Sera F, Cattaruzza MS, Pasquini P, Zanetti R, Masini C, Boyle P, Melchi CF. Meta-analysis of risk factors for cutaneous melanoma: III. Family history, actinic damage and phenotypic factors. *Eur J Cancer* 2005; **41**: 2040-2059.
3. Fujisawa Y. Epidemiology of cutaneous malignant melanoma. *Jpn J Med Pharmacol Sci* 2015; **72**: 189-192.
4. Eide MJ, Weinstock MA. Association of UV index, latitude, and melanoma incidence in nonwhite populations—US Surveillance, Epidemiology, and End Results (SEER) Program, 1992 to 2001. *Arch Dermatol* 2005; **141**: 477-481.
5. Elwood JM, Jopson J. Melanoma and sun exposure: an overview of published studies. *Int J Cancer* 1997; **73**: 198-203.
6. Ishihara K, Saida T, Otsuka F, Yamazaki N. Statistical profiles of malignant melanoma and other skin cancers in Japan: 2007 update. *Int J Clin Oncol* 2008; **13**: 33-41.
7. Nishi M. Lifestyle and cancer after the Second World War in Japan. *J Tumor* 2014; **2**: 197-201.
8. English DR, Armstrong BK, Kricke A, Winter MG, Heenan PJ, Randell PL. Case-control study of sun exposure and squamous cell carcinoma of the skin. *Int J Cancer* 1998; **77**: 347-353.
9. Nagano T, Ueda M, Suzuki T, Naruse K, Nakamura T, Taguchi M, Araki K, Nakagawa K, Nagai H, Hayashi K, Watanabe S, Ichihashi M. Skin cancer screening in Okinawa, Japan. *J Dermatol Sci* 1999; **19**: 161-165.

10. Ishihara K. Statistics for skin cancers caused by ultraviolet radiation. *Biotherapy* 2005; **19**: 411-416.
11. Green A, Williams G, Neale R, Hart V, Leslie D, Parsons P, Marks GC, Gaffney P, Battistutta D, Frost C, Lang C, Russell A. Daily sunscreen application and betacarotene supplementation in prevention of basal-cell and squamous-cell carcinomas of skin: a randomised controlled trial. *Lancet* 1999; **354**: 723-729.
12. Dennis LK , Beane Freeman LE, VanBeek MJ. Sunscreen use and the risk for melanoma: a quantitative review. *Ann Intern Med* 2003; **139**: 966-978.