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INVESTIGATIVE REPORT

The Incidence of Melanoma is Increasing in the Susceptible Young Australian Population

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The number of melanomas removed from Australians is increasing. Despite this, it has been reported that the incidence of melanoma is decreasing in the young Australian population. However, the denominator for these estimates includes individuals at low risk of melanoma, and the proportion of such individuals has changed over recent decades due to immigration. In this study, the incidence was calculated for the susceptible young population. Data from the Australian Bureau of Statistics were analysed to determine the number of people younger than 30 years at low risk of developing melanoma in 1982 and 2009. Low risk people were defined as those born in Asia, the Pacific Islands, The Middle East, or Sub-Saharan Africa, or had parents born in these regions. There was a significant increase in the number of young Australians at low risk for melanoma. If these people are not included when calculating the crude rate of melanoma, the rate increased from 5.9 per 100,000 in 1982 to 6.3 in 2009. If the estimated number of young Maoris and young Aborigines is excluded from the susceptible population, the crude rate increased from 6.0 per 100,000 in 1982 to 6.8 in 2009. This is the first calculation of the rate of melanoma for the susceptible young Australian population.
Key words: melanoma; incidence; young Australians.

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The number of invasive melanomas removed per year from Australians has increased by 325% between 1982, when records commenced, and 2009 for which the latest figures are available (1). Pathologists are required by law to notify the Cancer Registry of every case of invasive melanoma and the data are accurate. Despite the big increase in melanomas removed from Australians, claims have been made that the incidence of melanoma is decreasing in young Australians as a result of public health campaigns that have focused on the dangers of sun exposure (2, 3). The health campaigns started in 1980 and if they were effective, the incidence of melanoma should be decreasing in people under the age of 30 years, people who have been born and raised while the campaigns have been running.

However, the authors claiming a reduction in the incidence of melanoma in young Australians failed to mention that the incidence of melanoma was calculated for the entire population and not the susceptible population. The Australian population has greatly changed in the last 30 years with a large number of dark skinned immigrants settling (4). These people have a low risk of developing melanoma and if they are included in the total population when calculating the incidence, the incidence will appear lower than if immigration had not taken place. This apparent change in incidence might be used to support the impression that public health campaigns were working, even if they were not.

Not all people have a high risk of developing melanoma. The crude rate of melanoma for the entire Australian population was 526/1,000,000 in 2008 (1). In other countries it is much lower. The incidence of melanoma per million people was 2 in Egypt, 1 in India, 3 in China, and 4 in the Philippines (5). In Singapore, the rate in Chinese was 3/1,000,000 in 2008 and it was 3/1,000,000 for Singaporean Indians (6). The marked differences in the incidence of melanoma among different races are still present when people migrate and live in Australia (7).

Until the 1960s the Australian Government had a policy of accepting white immigrants and excluding other races. Since the policy was abolished many immigrants arrived from Asia, the Middle East, the Pacific Islands, and recently from Sub-Saharan Africa. Data relating to the number of immigrants and their places of birth is available from the Australia Bureau of Statistics. This information is obtained from a census held every 5 years and people are compelled by law to answer the questions (8). The country of birth of the resident and the country of birth of the resident's parents are two of the questions asked. The resident's race is not asked.

Table I sets out the percentage of the population born in different regions of the world for selected census years since 1981. In 30 years the percentage of people born in Asia more than quadrupled and there were substantial numbers of people born in the Middle East and the Pacific islands. Most of the immigrants were young and had children in Australia. Their children are also at low risk for melanoma. In addition, there was a doubling of the number of New Zealanders living in Australia and a large percentage of these New Zealanders are Maoris who have a low risk of developing melanoma (9).

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Table I. *The percentage of the population born in different world regions. Selected census years*

	1981	1991	2001	2006	2011[a]
Asia	1.7	3.9	5.5	6.4	7.6
Middle East	0.9	0.8	1.2	1.3	1.0
Pacific Isles	0.2	0.3	0.6	0.5	0.3
Africa[b]	0.2	0.2	0.4	0.5	n.a.
New Zealand	1.2	1.7	2.0	2.0	2.4
South Africa	0.2	0.3	0.5	0.7	0.7
Total population	14.6×10^6	16.9×10^6	18.8×10^6	20.7×10^6	21.5×10^6

[a]Preliminary data. [b]Sub-Saharan Africa excluding South Africa and Zimbabwe.

In this article the crude rate of melanoma for the susceptible Australian population aged less than 30 years is compared between 1982 and 2009.

MATERIALS AND METHODS

Data for the Australian population were obtained from the Australian Bureau of Statistics (8, 10–12). The catalogues studied were; 2,443.0 Census of population and housing; 3,130.0 Births Australia; 3,238.0 Experimental Estimates of Aboriginal and Torres Strait Islander Australians; and 3,412.0 Migration. Every five years a very detailed Census is held in Australia but every year the Bureau of Statistics publishes data on the Australian population giving information such as country of birth, age and sex of the population. Every year data on all births registered in Australia are published and the birth-place of the parents is given.

In the present article, the crude rate of melanoma for the susceptible Australian population aged under 30 years of age was calculated for 1982 when melanomas were first registered, and for 2009, which was the year of the latest available data. The susceptible population was defined as the total population under 30 minus the total number of Australians in a low risk group (LRG). People in a LRG were Australians born in Asia, the Pacific Islands, the Middle East, or sub-Saharan Africa; and Australian-born children whose parents were born in these regions. The number of people born in New Zealand and in South Africa were calculated but recorded separately because not all of these immigrants are white. The percentage of New Zealand immigrants identifying themselves as Maoris was recorded in 2006 and it is possible to estimate the number of Maoris in Australia but the race of South African immigrants is not available (8).

Data for children born in Australian for each year between 1981 and 2009 were obtained and the number of births, and the birth place of the parents were recorded (11). The number of births where one or both parents was born in Asia, the Pacific Islands, the Middle East, or Sub Saharan Africa was grouped together as one LRG. Children whose parents were born in New Zealand or South Africa were recorded separately.

The number of Australians identified as Aborigines was not recorded until 2006. The percentage of the young Australian population identified as Aborigine in 2006 was used to estimate the number of young Aborigines in 1982 and 2009 (10). The percentage of young New Zealanders identifying themselves as Maoris in 2006 was used to estimate the number of young Maoris in Australia in 1982 and 2009.

The number of invasive melanomas removed from Australians between 1982 and 2009 was obtained from The Australian Institute of Health and Welfare (1).

Table II. *The crude rate of melanoma in the susceptible population. Under 30 years of age*

	1982	2009
Population < 30 years	7,554,433	8,900,480
Susceptible population	7,321,826	7,195,655
Melanomas removed	438	457
Rate per 100,000[a]	5.9	6.3
Rate per 100,000[b]	6.0	6.8

[a]For the susceptible population. [b]If the estimated number of Maoris and Aborigines is excluded from the susceptible population.

RESULTS

The results are summarized in Table II. In 1982 there were 438 invasive melanomas removed from 7,554,433 Australians under 30 years of age. Of this population there were 219,078 in a LRG according to country of birth and 13,529 born in Australia whose parents were in a LRG. The number of susceptible young Australians was 7,321,826 giving a crude rate of 5.9 melanomas per 100,000.

Between 1981 and 2009 there were 7,172,897 births registered in Australia. Of these 773,665 were born to couples where one or both parents were in a LRG. In 2009 there were 457 invasive melanomas removed from 8,900,480 Australians aged less than 30 years. Of these, 931,170 were in a LRG according to their countries of birth and 773,665 were born in Australian to parents in a LRG. The susceptible population was 7,195,655 giving a crude rate of 6.3 melanomas per 100,000 people.

In 2009 there were 171,510 New Zealand born people under the age of 30 years in Australia and, between 1981 and 2009, there were 176,610 children born in Australia to New Zealanders. In 2009 the number of young people with New Zealand ancestry was 348,120. However, in the 2006 census, 37% of New Zealanders living in Australia said they were Maoris. This meant that in 2009 the estimated number of young New Zealanders and their children at low risk for melanoma was 128,804. In addition, in the 2006 census there were 330,837 people under 30 years of age who were registered as Aborigines or Torres Strait Islanders (ATSI), both of whom have dark skin and a low risk of melanoma (13). If the number of Maoris and ATSIs were removed from the susceptible population, the number of susceptible people was reduced to 6,683,014 and the crude rate of melanoma was 6.8 per 100,000 in 2009 (Table II).

In 1982 the number of ATSIs and Maoris was not recorded. The estimated number of these people was calculated assuming that the same percentage of the population with these ancestries was the same as it

Table III. *The percentage of children born in Australia to Low Risk People (LRP). In selected census years*

	1981	1986	1991	1996	2001	2006	2011
Births	233,535	240,699	253,861	250,363	242,340	261,550	297,072
% LRP	5.6	7.4	9.5	11.4	12.2	14.1	19.8
% NZ[a]	1.6	1.9	2.5	2.4	2.7	3.2	3.5

[a]Parent born in New Zealand (NZ).

was in 2009. If the number of these low risk people is removed from the susceptible population, the crude rate of melanoma was 6.0/100,000.

DISCUSSION

This is the first Australian study that has calculated the incidence of melanoma for the susceptible population, not the entire population. It found a significant increase in the crude rate of melanoma during the period for which data are available. The crude rate of melanoma is likely higher than 6.8/100,000 because migrants who arrived in the 1970s and 80s had children who were born in Australia and as a result their grandchildren will not be recorded as being at low risk because they will be recorded as Australian-born children of Australians. Including these people in the susceptible population will give a lower crude rate than is otherwise the case.

Previous Australian studies have failed to take into account the substantial change in the population that has occurred in one generation. The percentage of the population born in low risk regions increased from 3% in 1981 to 8.7% in 2006. Data from the 2011 census are not complete but the percentage was nearly 10% without including sub-Saharan Africans. The percentage of Australian born children at low risk for melanoma increased from 5.3% in 1981 to 19.8% in 2011 (see Table III). Such dramatic changes would have affected the data on melanoma incidence for the entire population and cannot be ignored by epidemiologists when they calculate melanoma rates. These population changes are almost certainly the cause for the reported decrease in the incidence of melanoma in young Australians.

A weakness of the present study is that the number of people of different races could not be accurately determined because of the race of Australians is not asked in the census and not recorded on birth certificates. The country of birth of Australians is asked and recorded, and so was used as a surrogate to estimate the number of low risk people. The country of birth is a reliable surrogate as the Globocan data show. The incidence of melanoma is between 131 and 526 times lower in countries from where many immigrants come, than in the entire Australian population (5).

Studies from the United States have also found an increase in the incidence of melanoma in the susceptible young population. There was an increase of 2% a year from 1973 to 2009 in white Americans aged less than 19 years (14). A study from Minnesota found an 8-fold increase in women aged 18 to 39 years between 1970 and 2009. The increase for men was 4-fold (15).

In Sweden, there has been a decrease in the incidence of melanoma in people aged less than 20 years (16). The authors of the study determined the incidence for the entire population but acknowledged that immigration could be a factor in the reported decrease. In 2002, 14% of Swedes under the age of 20 were born in countries other than Scandinavia and 19% had at least one parent who was not Scandinavian.

The increase in the incidence of melanoma occurred when many public health campaigns were run and the age group studied was born and raised while these campaigns were in action. Claims that the campaigns have been effective at reducing the incidence of melanoma in young Australians cannot be taken at face value. The Australian Bureau of Statistics should survey the population and determine the number of people of different races. This will enable epidemiologists to avoid biases caused by immigration and will enable public health officials to see if their campaigns are working.

The author declares no conflicts of interest.

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