SUPPLEMENTARY INFORMATION

to the Skin Cancer Prevention and Early Detection Strategy

2024 – 2028

Last updated February 2025

MelNet

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1. About this document

This document has been prepared by the Melanoma Network of New Zealand (MelNet) on behalf of the national Skin Cancer Prevention and Early Detection Strategy Working Group. Funding to support the development of this document has been provided by Health New Zealand – Te Whatu Ora.

It is to be read in conjunction with:

1. The Skin Cancer Prevention and Early Detection Strategy 2024 - 2028
2. Guidance for skin cancer prevention and early detection messaging in New Zealand

It includes a breadth of research on the epidemiology of skin cancer in New Zealand, the effectiveness of prevention and early detection interventions globally, and the current state of skin cancer prevention and early detection in New Zealand.

The content is current at the time of publishing and will be reviewed periodically with best endeavours to keep it an up-to-date resource.

The information contained in this resource has been developed in partnership with a range of sector experts and key stakeholders (see Section 9).

2. Epidemiology of skin cancer in New Zealand

Skin cancers are commonly classified into two groups: cutaneous melanoma (melanoma) and keratinocyte cancer[1] (also known as non-melanoma skin cancer). Keratinocyte cancer includes mainly squamous cell (SCC) and basal cell (BCC) cancers.

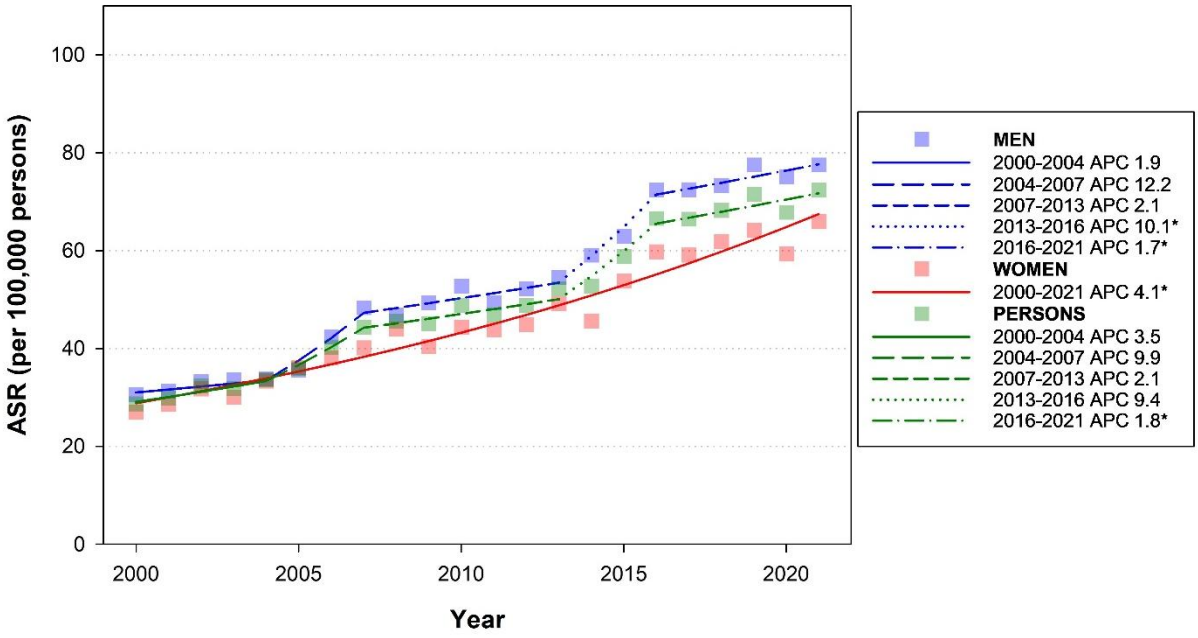
Skin cancer is by far the most common cancer affecting New Zealanders. It has been estimated that all types of skin cancer together account for just over 80% of all new cancers diagnosed annually (O'Dea 2009). Melanoma was the third most commonly registered cancer in 2020 for males (behind prostate cancer and colorectal cancer) and for females (behind breast and colorectal cancer) (Environmental Health Intelligence, 2024).

2.1 Melanoma

In 2021, 7,249 new cases of melanoma were diagnosed in New Zealand. This comprised of 4,418 cases of in situ melanoma and 2,831 cases of invasive melanoma.

The incidence of melanoma in situ is much higher than invasive melanoma and is continuing to increase. In 2021, the incidence of melanoma in situ was 53% higher than the incidence of invasive melanoma. The age-standardised incidence rate of melanoma in situ increased from 28.7/100,000 in 2000 to 72.4/100,000 in 2021, an average increase of 4.4% per year (95% CI 2.2-6.7) (Figure 1; Table 1). Case numbers increased four-fold between 2000 and 2021, from 1044 cases to 4418 cases.

Figure 1. Age-standardised incidence of melanoma in situ in New Zealand (2000-2021)



[1] The term "keratinocyte carcinoma" (KC) has been used increasingly to refer to BCC and SCC when they are considered jointly because they are carcinomas that share lineage with keratinocytes and histologically resemble epidermal keratinocytes (Karimkhani et al 2015).

Due to population growth, aging and improvements in early detection, the number of cases of invasive melanoma has increased by over 70% between 2000 and 2021 (Figure 2). This is despite a decline in the age-standardised incidence rate, which has been falling since 2008 at an average rate of 0.6% per year (95% CI -1.0 to -0.2) (Figure 3; Table 1).

Figure 2. Number of cases of invasive melanoma in New Zealand (2000-2021), by prioritized ethnic group.

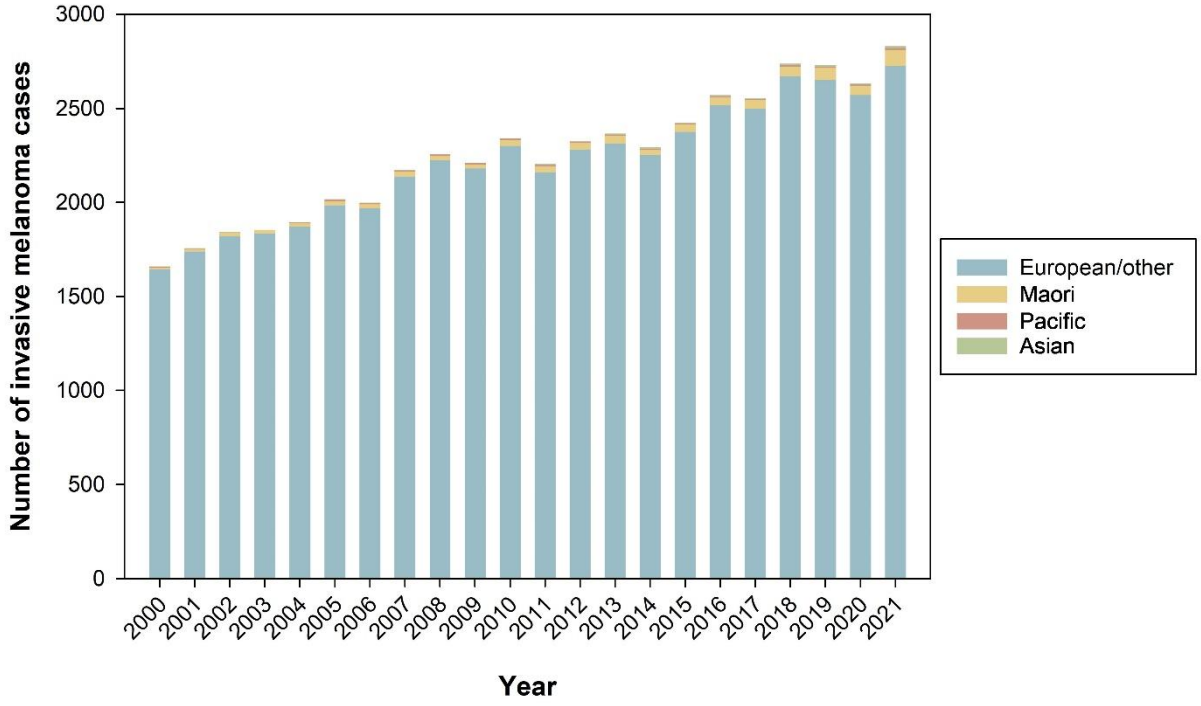
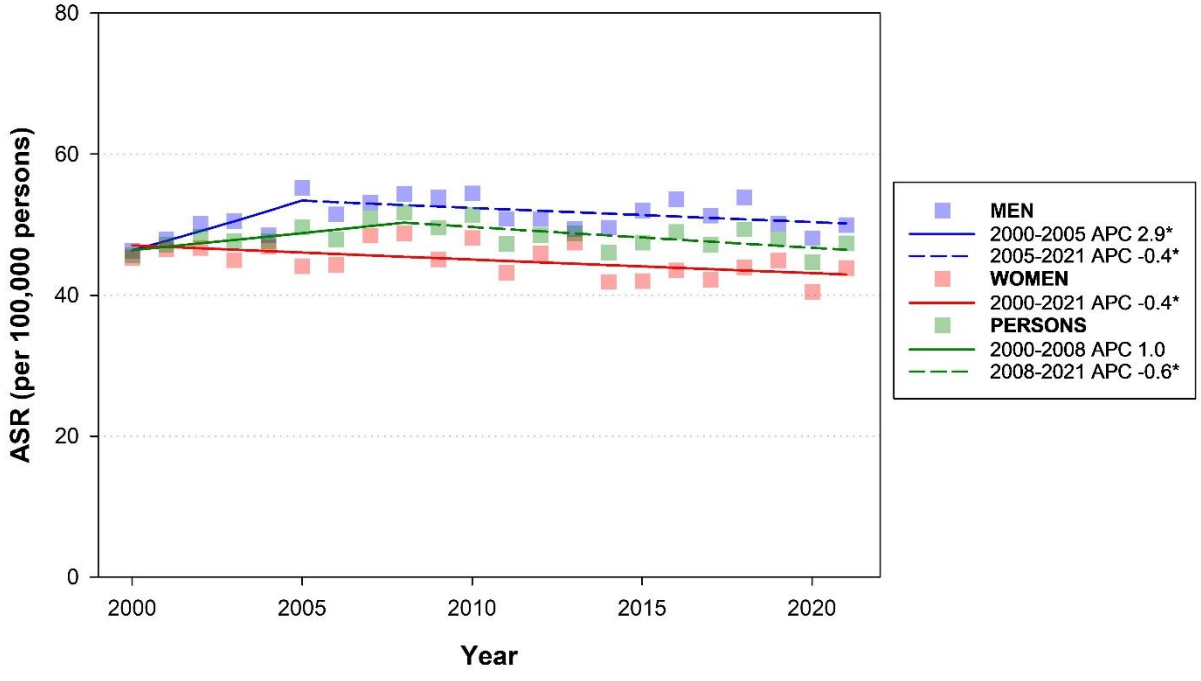


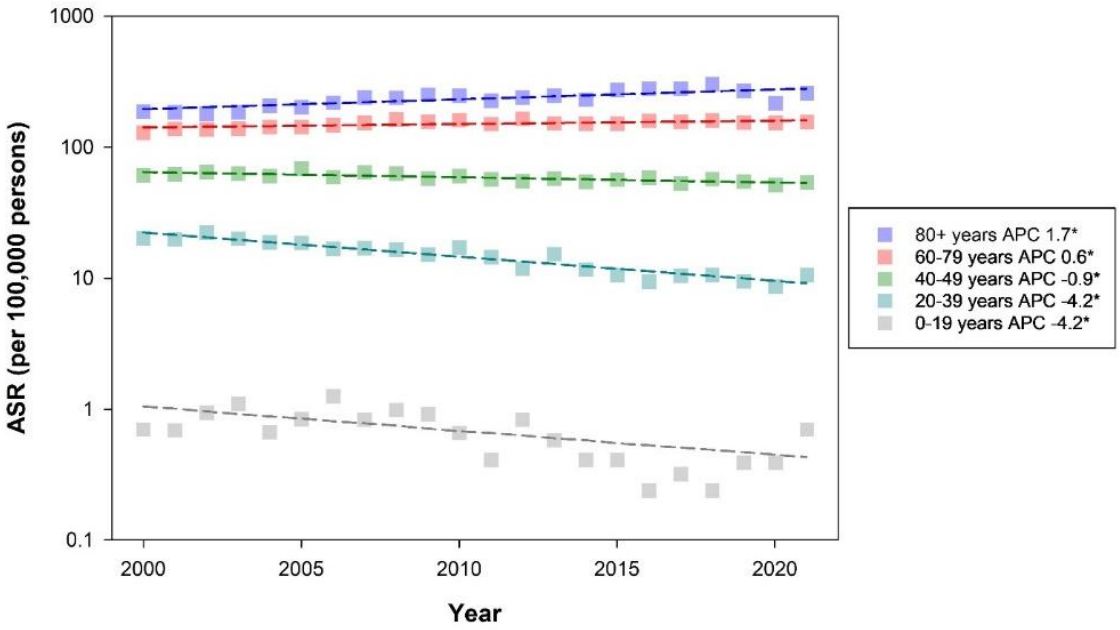
Figure 3. Age-standardised incidence of invasive melanoma in New Zealand (2000-2021).



Invasive melanoma is more common in men than women (50.0/100,000 vs. 43.9/100,000 in 2021). Among men, incidence increased between 2000 to a peak in 2005, followed by a significant decline to 2021. Among women, incidence declined significantly over the entire period 2000-2021 (Figure 3; Table 1).

The incidence of invasive melanoma increases with age, with rates being highest among those aged 80 years and older (281/100,000 in 2021). Between 2000 and 2021 incidence declined significantly in all age-groups under 40 years and increased significantly for those aged 60 years and older (Figure 4; Table 1). For those aged 40 to 59 years, incidence was stable over the period 2006-2021.

Figure 4. Age-standardised incidence of invasive melanoma in New Zealand (2000-2021), by age-group[2]



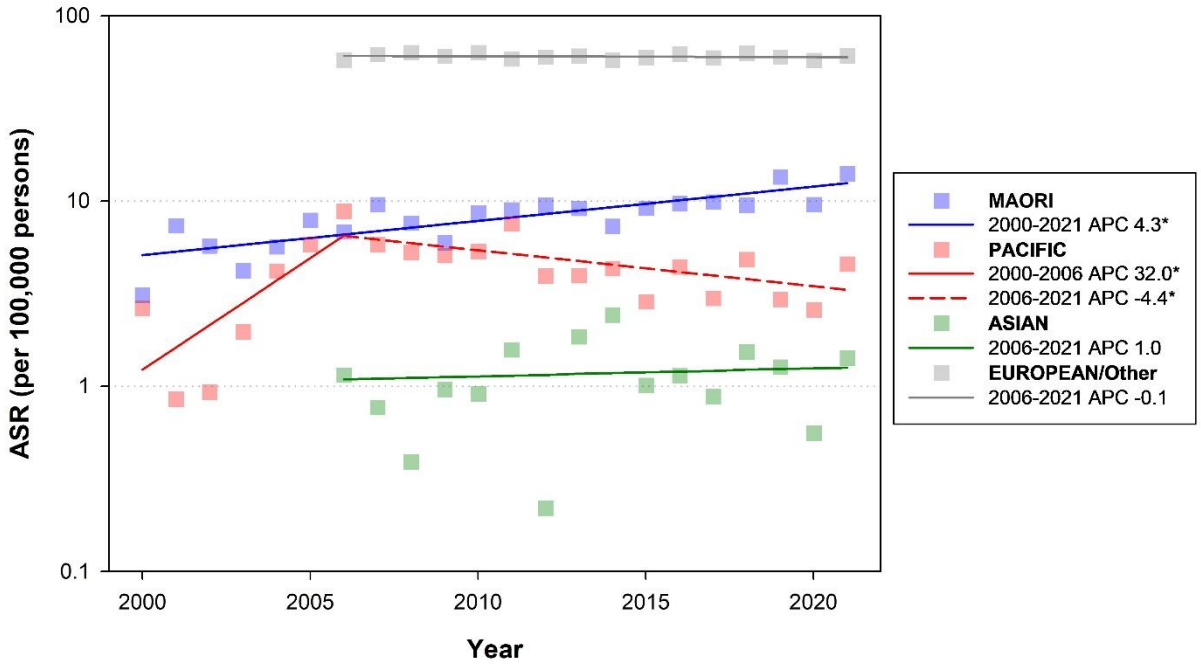
Invasive melanoma is substantially lower among New Zealand Māori and Pacific than Pākehā.[3] In 2021, most melanomas were diagnosed in Pākehā (2725/2831, or 99.96%) (Figure 5; Table 2).

However, the incidence of invasive melanoma in the Māori population is increasing. In Māori, incidence increased from 3.1/100,000 in 2000 to 14.0/100,000 in 2021, an average annual rate of 4.3% (95% CI 3.0-5.7) (Figure 5; Table 2). For the Pacific population, incidence declined from a peak of 8.8/100,000 in 2006 to 4.6/100,000 in 2021, an average rate of 4.4% per year (95% CI -7.8- to -0.8). For the Asian population, incidence is very low (1.4/100,000 in 2021) and has been stable over the period 2006-2021.

[2] Figure 3 uses a log scale on the y-axis to better show a wide range of values; the increments on the y-axis are in factors of 10

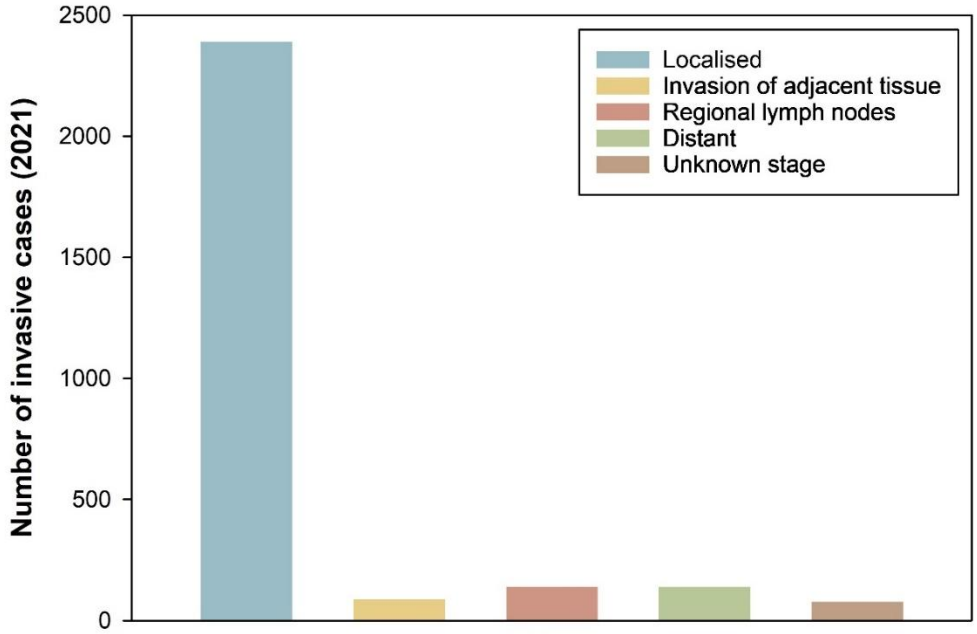
[3] The Cancer Registry derives ethnicity using a prioritisation process such that each ethnic group is statistically independent of all others. This is a different methodology than that used by Statistics New Zealand, which counts people who record multiple ethnicities in each ethnic group. Data on melanoma registrations and population denominators according to ethnicity were available for the years 2000-2021 for the "Māori" and "Pacific" ethnic groups, and for 2006-2021 for the "Asian" ethnic group. Counts and population denominators were calculated for the "European/other" ethnic group by subtraction; while a large proportion this group is European, it includes other ancestries such as African, Middle-Eastern and Latin American.

Figure 5. Age-standardised incidence of invasive melanoma in New Zealand (2000-2021), by prioritised ethnic group



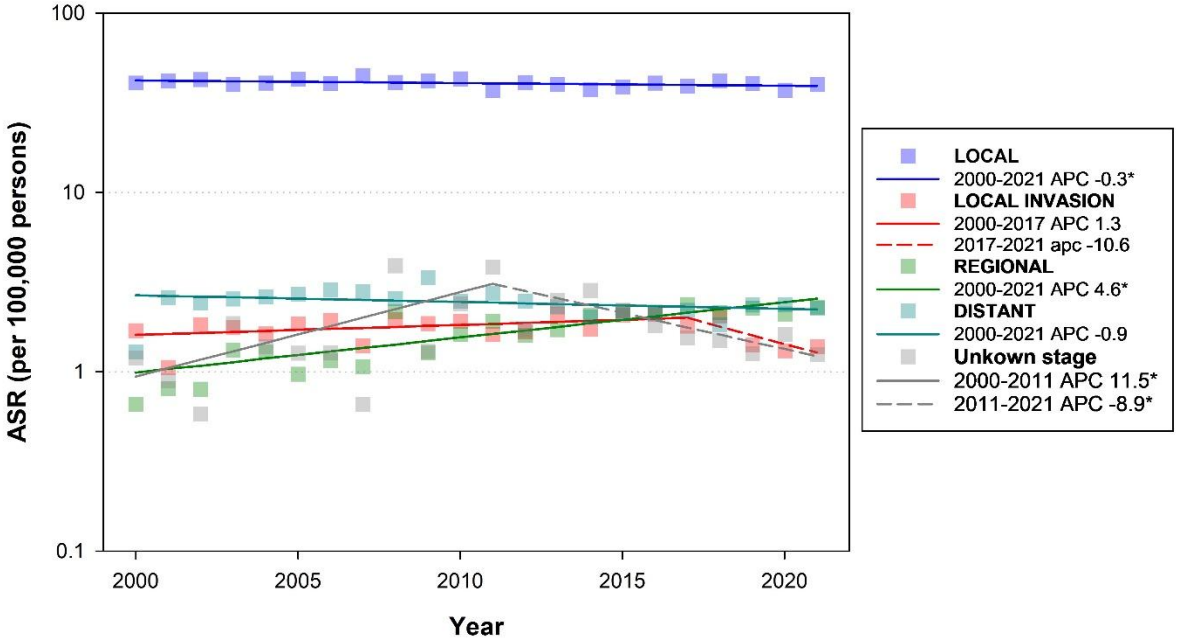
In 2021, most invasive melanomas were local at diagnosis when the prognosis is generally good. 84.4% of invasive melanomas were local at diagnosis, 3.1% had invaded locally, 4.9% had spread to regional lymph nodes, and 4.8% had spread to distant sites. 2.7% had unknown stage. (Figure 6).

Figure 6. Number of invasive melanoma cases in New Zealand in 2021, by stage of disease



Incidence trends differ by stage of disease. The incidence of local disease declined between 2000 and 2021 (from 40.8/100,000 in 2000 to 40.1 in 2021), consistent with the overall trend for all stages combined (Figure 7; Table 3). The incidence of regional disease increased significantly from 0.7/100,000 in 2000 to 2.3/100,000 in 2021, and the incidence of distant disease was relatively stable over time (1.3/100,000 in 2000, 2.3/100/000 in 2021).

Figure 7. Age-standardised incidence of invasive melanoma in New Zealand, by stage of disease (2000-2021)

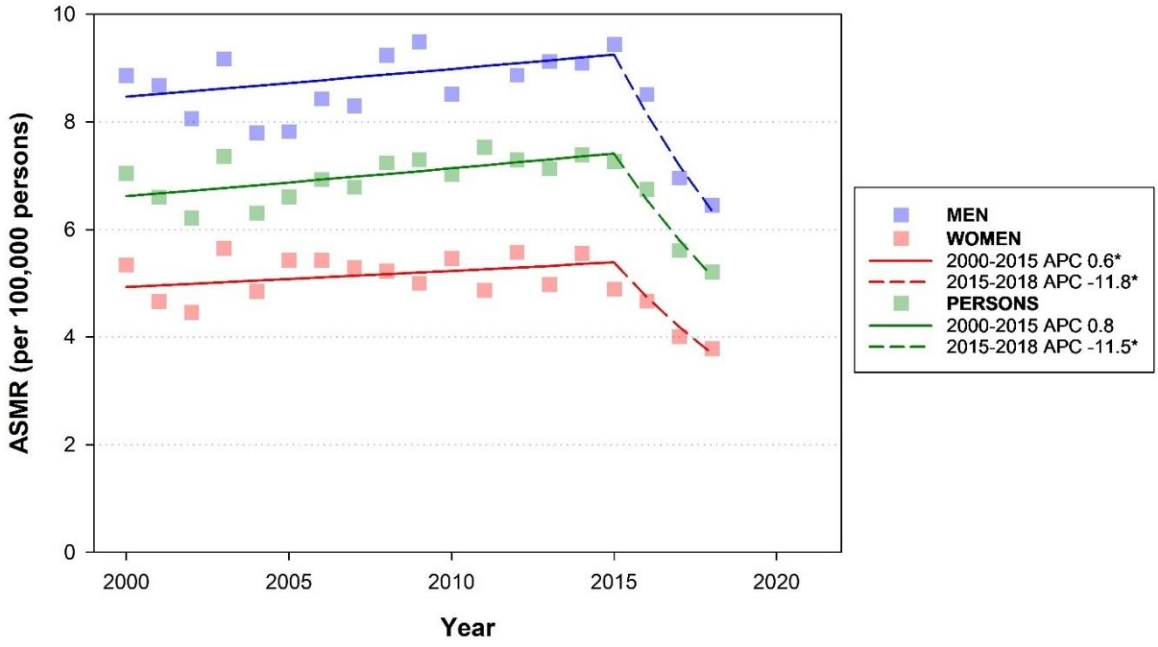


Of the three most common types of skin cancer, melanoma tends to present the greatest potential threat to survival. In 2018 (the latest year of available data), 296 people died from melanoma in New Zealand. The age-standardised melanoma mortality rate declined from a peak of 7.3/100,000 in 2015 to 5.2/100,000 in 2018 (Table 4). This is higher than in Australia, where the age-standardised melanoma mortality rate in Australia in 2018 was 4.7/100,000.

While the number of deaths from melanoma is decreasing, New Zealand's melanoma mortality rate is still the highest in the world. Before 2015, the mortality rate had increased steadily over time (Figure 8). The decreasing mortality rate from 2015 coincides with the funding of new treatments – nivolumab and pembrolizumab – for advanced melanoma (Environmental Health Intelligence, 2024). This trend in mortality was similar to that seen in Australia, although the inflection point in Australia at which mortality began to decline was four years earlier, in 2011. In 2022, New Zealand recorded the world's highest melanoma mortality rate, with an age-standardised melanoma mortality rate of 3.94/100,000 (IARC, WHO, 2024).

Overall melanoma mortality is higher in men than in women. The mortality rate was more than 40% higher among men than women (6.5/100,000 vs. 3.8/100,000 in 2018), but the trends over time were similar for both sexes, with significant declines from 2015 (Figure 8).

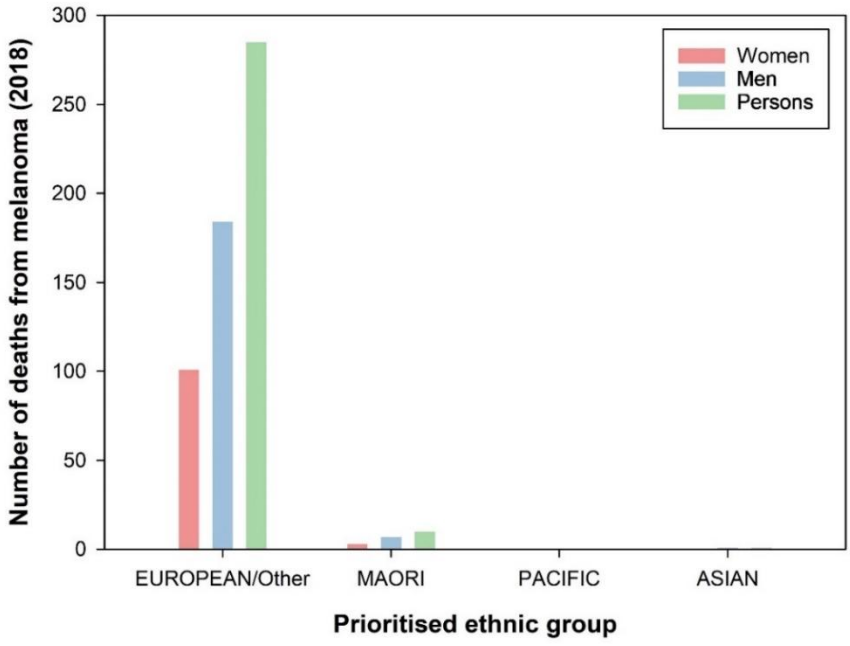
Figure 8. Age-standardised melanoma mortality rate in New Zealand (2000-2018)



Mortality increases with age. Mortality rates were highest amongst those aged 85 and over (88.3/100,000 in 2018). In 2018, there were no deaths among people aged less than 35 years. Amongst those aged 80 years and over, the mortality rate increased significantly over the period 2000-2018, with declines or stable rates for younger age-groups.

In 2018 most melanoma deaths occurred in Pākehā (96%) (Figure 9). Melanoma rates are nearly six times higher for non-Māori than Māori, however, Māori are more than twice as likely to die of their melanoma (Environmental Health Intelligence, 2024). Of the 296 deaths in 2018, 10 were reported in persons identifying as Māori (3%). The age standardised mortality rate for the Māori population in 2018 was 2.2/100,000.

Figure 9. Number of melanoma deaths in New Zealand in 2018, by prioritised ethnic group



2.2 Keratinocyte cancers

Keratinocyte cancers are more common than melanoma and incidence rates are likely increasing. In comparison to other malignancies, little is known about the incidence of keratinocyte cancers as these tumours are not registered by the New Zealand Cancer Registry. However, it is known that in white populations worldwide, keratinocyte skin cancers have the highest incidence of all cancers and rates are continuing to increase globally (Urban, 2021). Australia has estimated that keratinocyte cancer incidence rates have increased by 2 – 6% over the past three decades, and 2 out of 3 Australians will experience a keratinocyte cancer in their lifetime (Olsen, 2022).

Estimates of disease burden in New Zealand have relied on population-based studies conducted in geographically defined regions. The most recent data are provided by a study based on the examination of pathology records of skin biopsies taken in the Bay of Plenty region in the period 2010-2012.

That study estimated that 70,030 people were diagnosed with an invasive keratinocyte cancer in New Zealand in 2013 (52,073 with one or more BCCs and 28,800 with one or more SCCs). This was projected to increase in 2018 to **80,023 people diagnosed with at least one invasive keratinocyte cancer,** (59,410 for BCC and 33,078 for SCC) and **over 90,400 people diagnosed with at least one in situ or invasive keratinocyte cancer** (Sneyd, 2018).

In comparison, 236 Māori were diagnosed with an invasive keratinocyte cancer in 2013 (178 with BCC and 66 with SCC), with an estimated projected increase to 323 people in 2018 (244 with BCC and 90 with SCC) (Sneyd, 2018).

The estimated age-standardised incidence rates (WHO standard population) in 2013 for the non-Māori population were 608/100,000 for BCC and 289/100,000 for SCC (38/100,000 and 15/100,000 respectively for the Māori population) (Table 5). The lesion-based rates were 1375/100,000 for BCC and 506/100,000 for SCC in the non-Māori population, and 70/100,000 and 31/100,000 respectively for the Māori population (Table 5).

An earlier study conducted in the Auckland region in 2008 reported lesion-based **incidence rates of 1906/100,000 for keratinocyte cancer**, 1385/100,000 for BCC and 522/100,000 for SCC (Table 5) (Pondicherry, 2018). These lesion-based rates are very similar to those reported by Sneyd and Grey for the Bay of Plenty region in 2013 (Sneyd, 2018) and compare with Australian estimates of 3154/100,000 for keratinocyte cancer, 1565/100,000 for BCC and 580/100,000 for SCC for the period 2011-2014 (Pandeya, 2017). Person-based rates were not estimated in the 2008 Auckland study (Pondicherry, 2018), but the corresponding person-based incidence rates in Australia were 1531/100,000 for keratinocyte cancer, 770/100,000 for BCC and 271/100,000 for SCC (Pandeya, 2017).

In the Auckland study, **incidence was higher among men than women** (crude rate 1500 vs. 868/100,000 for BCC and 535 vs. 321/100,000 for SCC) (Table 5). The incidence of all keratinocyte cancers was low among younger age-groups but rose steeply with age from approximately 45 years, and the increase with age was greater for men compared with women (Pondicherry, 2018).

Previous studies conducted in the upper central North Island in 1982 (Freeman, 1982) and the Bay of Plenty in 1998 (O'Dea, 2000), reported much lower rates, suggesting that **the incidence of both BCC and SCC has increased significantly since the early 1980s** (Brougham, 2010).

The mortality rate of keratinocyte skin cancers is lower than melanoma but trending upwards. In 2018, 204 people died from keratinocyte cancer in New Zealand (137 men and 67 women) (Environmental Health Intelligence, 2024). The age-standardised mortality rate increased from 1.5/100,000 in 2012 to 2.0/100,000 in 2018 (WHO 2001 standard population), and this increase was primarily driven by an increase among men.

The mortality rate was highest for those aged 85+ years (162.7/100,000 for men and 66.6/100,000 for women) (Environmental Health Intelligence, 2024). In all age-groups over 64 years, the age-standardised mortality rate was **higher among men than women**.

Over the period 2009-2018, 97.7% of deaths occurred among Pākehā; 1.5%, 0.4%, 0.3% of deaths occurred among the Māori, Pacific and Asian ethnic groups, respectively.

3. Health economics

3.1 The cost of skin cancer in New Zealand

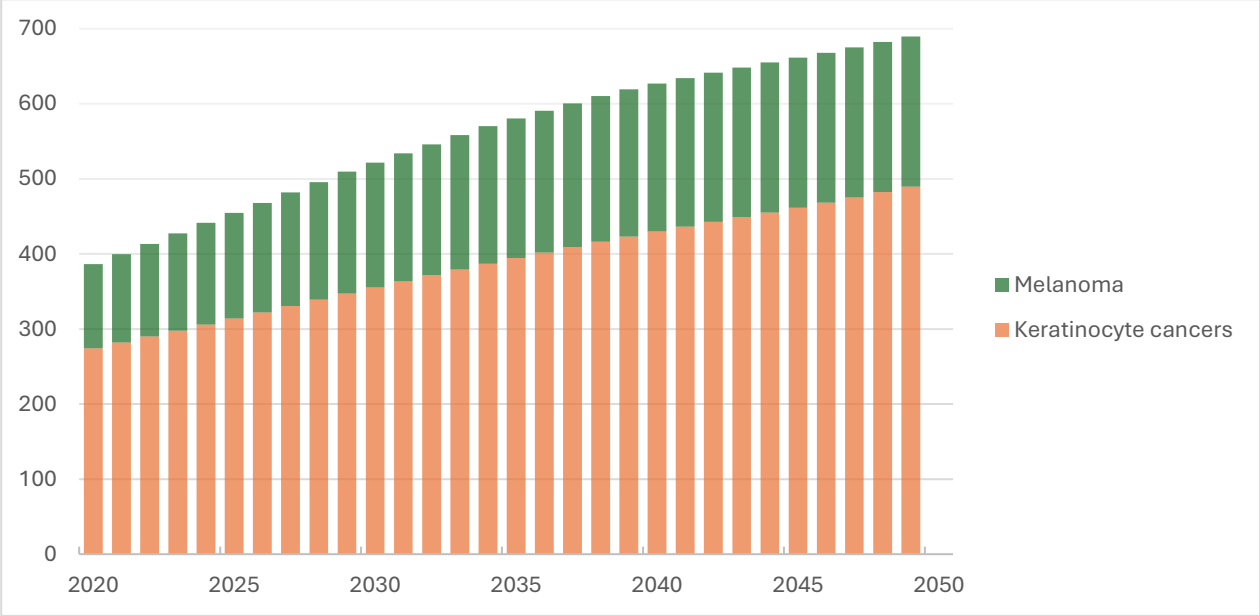
The total cost of skin cancer in 2025 is estimated at $494.92 million (Table 6). This included $454.58 million in health system costs (92%) and $40.34 million in lost productivity from premature mortality (8%). Costs are anticipated to be higher in males, older adults and non-Māori, reflecting patterns in skin cancer incidence.

Table 6. The estimated cost of skin cancer in New Zealand in 2025 (millions)[4]

	Health system costs[5]	Non-health system costs[6]	Total costs
Melanoma (including in situ)	140.56	35.35	175.46
Keratinocyte cancers (BCC and SCC)	314.02	4.99	319.01
Total (melanoma and keratinocyte)	454.58	40.34	494.92

Due to population growth and demographic shifts, direct healthcare costs for melanoma and keratinocyte cancers combined are projected to increase by approximately $235 million by 2049 – rising from $454.58 million in 2025 to around $689.7 million in 2049 (Figure 10, Table 7).

Figure 10. Projected increase in skin cancer healthcare costs over time



[4] These results have been cross-checked with experts for accuracy and validity. However, they have not yet been submitted for publication in a peer-reviewed journal and may be subject to further revisions.

5 Health system costs include the costs of diagnosis, treatment and follow up care.

[6] Non-health system costs included productivity losses from premature mortality. This was estimated for those aged <65 years using the human capital approach, based on average earnings for those in paid employment (sourced from Stats NZ). Annual earnings were calculated as $1,523 × 52 weeks. Future costs (e.g. follow-up consultations) and earnings were discounted at 3.5% per year.

About the research methods

An incidence-based 'bottom-up' approach was used to estimate the cost of new skin cancer diagnoses in 2025, using two Markov microsimulation models (one for melanoma and one for keratinocyte cancers). The models tracked disease progression from diagnosis to cure or death, drawing on inputs from national datasets, a survey of GP and private clinics, published research and expert consultation.

Melanoma incidence in 2025 was projected based on historical trends from 2021 and up to 2049, while keratinocyte cancer incidence was assumed to remain at a similar rate to 2012 levels (adjusted for demographic shifts) due to limited data. This is likely a conservative estimate in light of global trends and the increasing rates observed in NZ from 1997 to 2007 (Brougham et al, 2011).

Health system costs of skin cancer were projected by applying 2025 estimates to population projections. Melanoma costs reflect projected case changes, while keratinocyte cancer costs assume stable rates with population growth.

3.2 The cost-effectiveness of skin cancer prevention

Consistent evidence indicates that multi-faceted skin cancer prevention interventions – combining education, policy and environmental measures (such as shade creation) across multiple settings - are effective in improving sun protection, reducing skin cancer risk, and are cost-effective (Collins 2024, Shih et al 2017).

A cost-effectiveness analysis comparing the costs and health outcomes of a multi-faceted skin cancer prevention intervention with current practices in New Zealand suggests significant potential for both improved health outcomes and reduced costs.

With an investment of approximately $1.05 per person per annum over the next 25 years (a total annual cost of around $5.5 million for the entire population), a multi-faceted skin cancer prevention intervention is estimated to prevent 417,735 skin cancers and 1940 skin cancer deaths, and save $699.6 million of health system costs and $97.52 million of productivity losses from mortality (Table 8). Additionally, the intervention is projected to save 1622 life years (before age 65) and generate 4,251 QALYs (a generic measure of survival in life years adjusted for quality of life).

Table 8. Results of the cost-benefit analysis over 26 years (2024-2050)[7]

Outcome	Current practice	Intervention	Difference
Melanoma	261,004	238,882	22,122
Keratinocyte (cases)	1,824,483	1,668,090	156,392
Keratinocyte lesions (average of 2.5 per person)	2,946,800	2,551,187	395,613
Melanoma deaths	8,512	7,420	1,092
Keratinocyte cancer deaths	7,314	6,466	848
Years of life lost (before age 65)	14,405	12,784	1,622
QALYs	81,206,876	81,202,625	4,251
Health system costs	$7,144,400,000	$6,444,800,000	$699,600,000
Lost productivity	$648,720,000	$551,200,000	$97,520,000

From a health system perspective (excluding QALYs gained), each dollar invested in skin cancer prevention is estimated to generate $10.80 in healthcare savings. When considering only government-funded healthcare costs, the return on each dollar invested is estimated at $4.85. When including non-health system costs from productivity losses, the total return on investment is estimated at $11.90.

About the research model

Standard methods for economic evaluation were followed. Given that skin cancer prevention programmes are not widely implemented in NZ, intervention costs were set five times higher than a comparable study in Australia, at approximately $1.05 per capita NZD (approximately 5.5 million per annum) (Shih et al. 2017). A conservative relative risk was estimated using the population attribution approach, linking intervention effects on sunburn to skin cancer risk via established relative risks, with sensitivity analyses exploring a range of values, including those from Australian studies as a lower-cost alternative.

[7] Based on a microsimulation of 500,000 individuals, scaled to the 2025 population of 5.3 million with follow-up to 2049. A 3.5% discount rate was applied. Keratinocyte cancers include basal cell carcinoma, squamous cell carcinoma and squamous cell carcinoma in-situ.

4. Risk factors

Several factors are known to increase skin cancer risk.

Exposure to harmful ultraviolet radiation (UVR) increases the risk of all three major forms of skin cancer. UVR causes DNA damage and genetic mutations, which subsequently lead to skin cancer (Olsen, 2019). Exposure to harmful UVR is the primary *modifiable* risk factor for skin cancer and therefore the focus of most primary prevention activities.

For melanoma, intermittent exposure to harmful UVR from the sun (such as sunbathing on holiday or outdoor recreation activities) and a history of sunburns, particularly in childhood, appear to be more important than lifetime cumulative sun exposure (Olsen 2019, Gandini, 2005), although this does vary depending on the individual (Whiteman 2003). It is estimated that more than 90% of all melanoma cases in New Zealand can be attributed to UVR exposure (Environmental Health Intelligence, 2024).

Intermittent exposure and exposure in childhood are also important for BCC, while SCC is strongly associated with lifetime cumulative sun exposure (IARC Working Group, 2012).

Exposure to harmful UVR at any age increases the risk of melanoma. Childhood is the 'critical period' during which melanocytes are most susceptible to the mutagenic effects of UVR. After this, the further development of melanoma appears to depend on the anatomic site of the target cell and the susceptibility of the host (Whiteman 2001, Whiteman 2011). The role of chronic sun exposure in melanoma development is also reflected in studies of occupational exposure. Historically, it was observed that indoor workers had higher risks of melanoma than outdoor workers. Subsequent studies that analysed the occupational data according to the anatomical location of the melanoma found that outdoor workers had higher risks of melanoma on exposed sites (such as the face, ears and neck), but lower risks of melanomas on covered sites (such as the trunk) (Beral 1981, Vagero 1986, Vagero 1990, Linet 1995).

The use of sunbeds is associated with an increased risk of all three cancers (Dessinioti, 2022).

Personal risk factors for skin cancer include:

- **Number and type of moles.** High numbers of common moles and atypical moles, which are larger than common moles and more variable in appearance increase the risk of melanoma (Gandini, 2005). For people with many moles on the skin, only modest amounts of sun exposure later in life are needed to drive melanoma development. In contrast, people with few moles tend to require ongoing, cumulative exposures to the sun for melanoma to develop.
- **Lighter skin, hair and eye colour and a skin type that burns easily and does not tan** (Whiteman, 2016 and Olsen, 2019**):** Darkly pigmented people develop skin cancer on sun-exposed sites at lower rates than lightly pigmented people. However, incremental amounts of UVR do increase the risk of developing skin cancer for all people, including those with more darkly pigmented skin (Pennello, 2000). In New Zealand, people who identify as Pākehā have the greatest risk of developing skin cancer.
- **A personal history of skin cancer.** Queensland studies have demonstrated that a history of skin cancer or sunspots is one of the strongest risk factors for melanoma. Once a person has developed a melanoma, they are at approximately 5 to 10 times higher risk of developing another primary melanoma (Cust, 2020).

- **A family history of melanoma**. Up to 10% of melanomas occur in people with a family member who has also been diagnosed with melanoma (Olsen, 2010). About half of all familial cases are now known to be due to rare mutations in high-risk melanoma genes; the remainder are likely related to a mix of 'private' mutations, inherited traits such as pigmentation and moles, and shared environmental exposures between family members.
- **Age.** Melanoma incidence increases dramatically with age (Whiteman, 2016)**.** Melanoma rates in people in their 80s are more than one hundred-fold higher than melanoma rates in children and adolescents.
- **Sex.** Melanoma incidence is about two-fold higher in men than women overall, although women have higher rates below age 40 years, after which melanoma rates in men overtake women and rise steeply with age thereafter (Olsen 2024, Olsen 2020).
- **Genetic disposition**. The most common high-risk melanoma gene is *CDKN2A*, a tumour suppressor gene. Several other high-risk genes have been identified, including *CDK4* (Tucker, 2003), *MITF, POT1,* and *TERT* (Aoude, 2015). Many low-risk melanoma genes have also been identified, mostly associated with pigmentary characteristics and the development of moles (Law, 2015). Many low-risk genes for keratinocyte cancers have been identified, and many are associated with both BCC and SCC (Liyanage, 2019). Some of the identified low-risk genes are related to pigmentation, but the functions of others are not yet known.
- **Immunosuppression:** Immunosuppression is a well-documented risk factor for skin cancer (Green, 2015). It is estimated that organ transplant recipients have a 65- to 250 times higher squamous cell carcinoma risk, 10 times higher basal cell carcinoma risk, and 0 to 8 times higher melanoma risk than the general population (Kreher, 2023). The tumours are more aggressive, with a greater likelihood of recurrence, metastasis and death (Ludgate, 2005). Risk increases with multiple cancers and a longer duration of immunosuppressive therapy (Ludgate, 2005).
- **Certain rare genetic disorders**: Xeroderma Pigmentosum (XP) and Albinism significantly increase the risk of SCC and BCC (Cleaver, 2005). These conditions affect DNA repair mechanisms, leaving the skin highly susceptible to sun damage. Another rare genetic disorder, Gorlin syndrome (or nevoid basal cell carcinoma syndrome, NBCCS) is associated with the development of multiple BCCs at an early age; it is caused by mutations in the *PTCH1* gene, which is important in regulating cell growth.

5. Ultraviolet radiation in New Zealand

There are three types of UVR. All can cause skin and eye damage.

- **UVA** goes deep into the skin and plays a major part in skin aging and wrinkling. It also contributes to the growth of skin cancer through immunosuppressive mechanisms. UVA is present all year round and is not filtered by clouds or glass.
- **UVB** damages the skin's outer layers. It is the main cause of sunburn and plays a key role in the growth of skin cancer by directly damaging DNA. Most UVB is filtered by the atmosphere.
- **UVC** has the highest energy and also damages DNA, contributing to the risk of skin cancer. The Earth's atmosphere absorbs UVC before it reaches the Earth's surface. However, there are other sources of UVC, such as in arc welding, which can cause painful blistering burns and eye damage.

Solar elevation (the angle of the sun relative to the Earth's horizon) determines UVR. Throughout the day, the sun changes its position in the sky. From zero degrees at sunrise, solar elevation increases until it reaches its daily maximum at solar noon – this is when the absorption path through the stratospheric ozone layer is shortest. During the New Zealand summer, this is typically around 1:30 pm. Solar elevation is at its maximum in summer and minimum in winter.

The amount of ozone in the atmosphere, pollution, cloud, reflective surfaces (in particular snow) and altitude also affect UVR levels (McKenzie, 2011). The effect of cloud is deceptive - optically thin cloud like cirrus has minimal effect and reflection from broken clouds with the sun unobscured can increase solar radiation above the clear sky intensity.

The UV Index (UVI) measures the strength of UVR. The larger the number, the more intense the UVR. There are corresponding sun protection recommendations associated with various UVI levels.

In the New Zealand summer, UV Index values regularly exceed 11 (Figure 12), even in the south of the country where UV is less intense – that is around 40% more than at similar latitudes in the northern hemisphere (McKenzie, 2006). In winter the UV Index typically reaches peak values of 1 or 2. Values greater than 10 are considered "extreme". Recent work has shown that because of the success of the *Montreal Protocol on Protection of the Ozone Layer*, UV has now started to decrease (McKenzie, 2019). But our problem of overexposure to UVR will persist.

Several smartphone apps provide forecasts of the UV index. The UVNZ app uses data from NIWA to provide forecasts of the UV Index at various locations throughout New Zealand. It can be personalised depending on skin type and clothing.

The Sun Protection Alert also uses data from NIWA to provide the time each day when sun protection is required for various locations around New Zealand. It also provides reminders about which SunSmart behaviours to use. The Sun Protection Alert can be found on the SunSmart website year-round. From September to April it is also available on the MetService website and app, and the weather section of main newspapers.

Figure 11. Number of days per year when UV Index was high (greater than or equal to 6) by Council

This graphic was provided by the Cancer Society of New Zealand. UVI data was provided by Ben Liley, Atmospheric Scientist, NIWA.

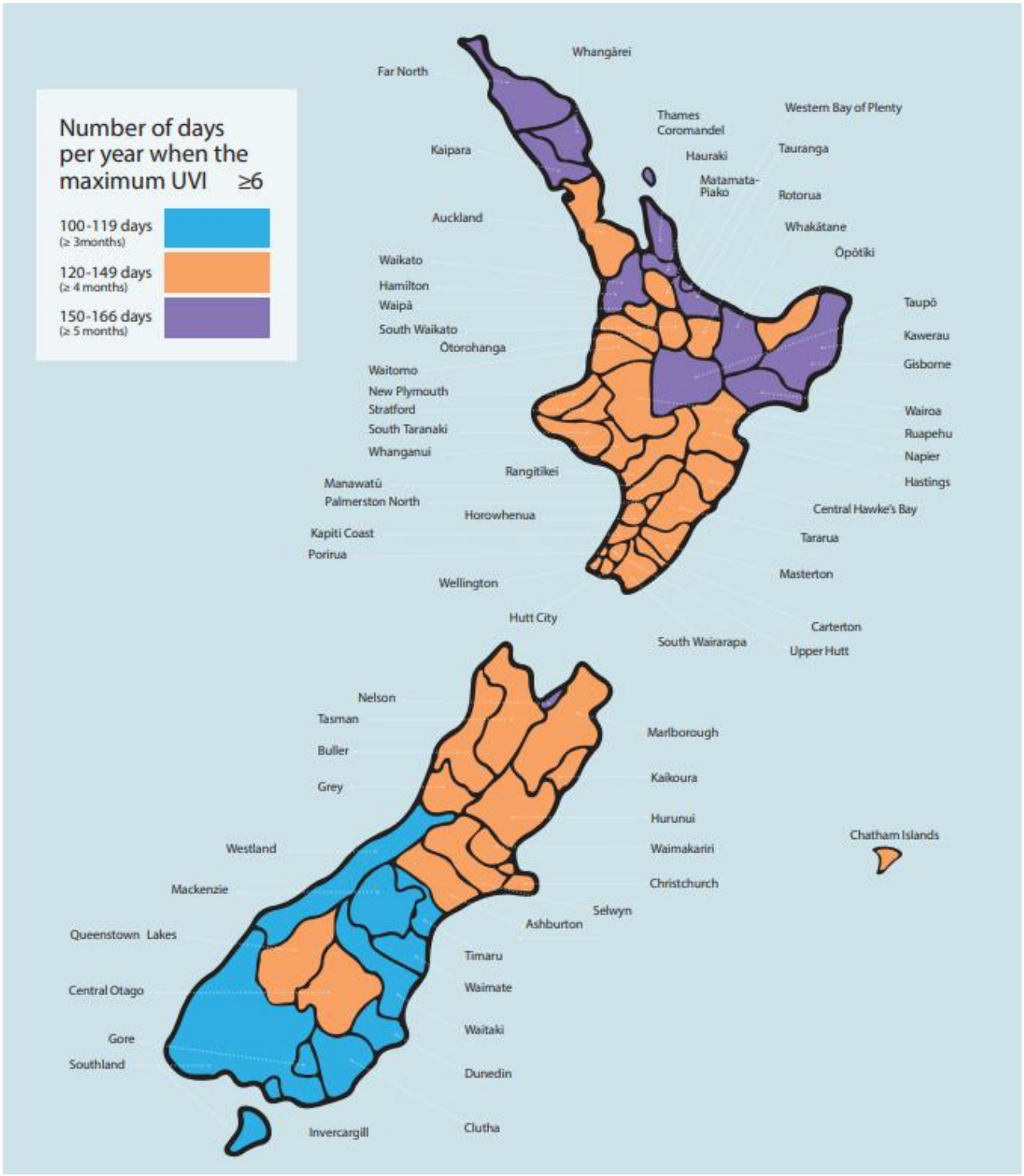
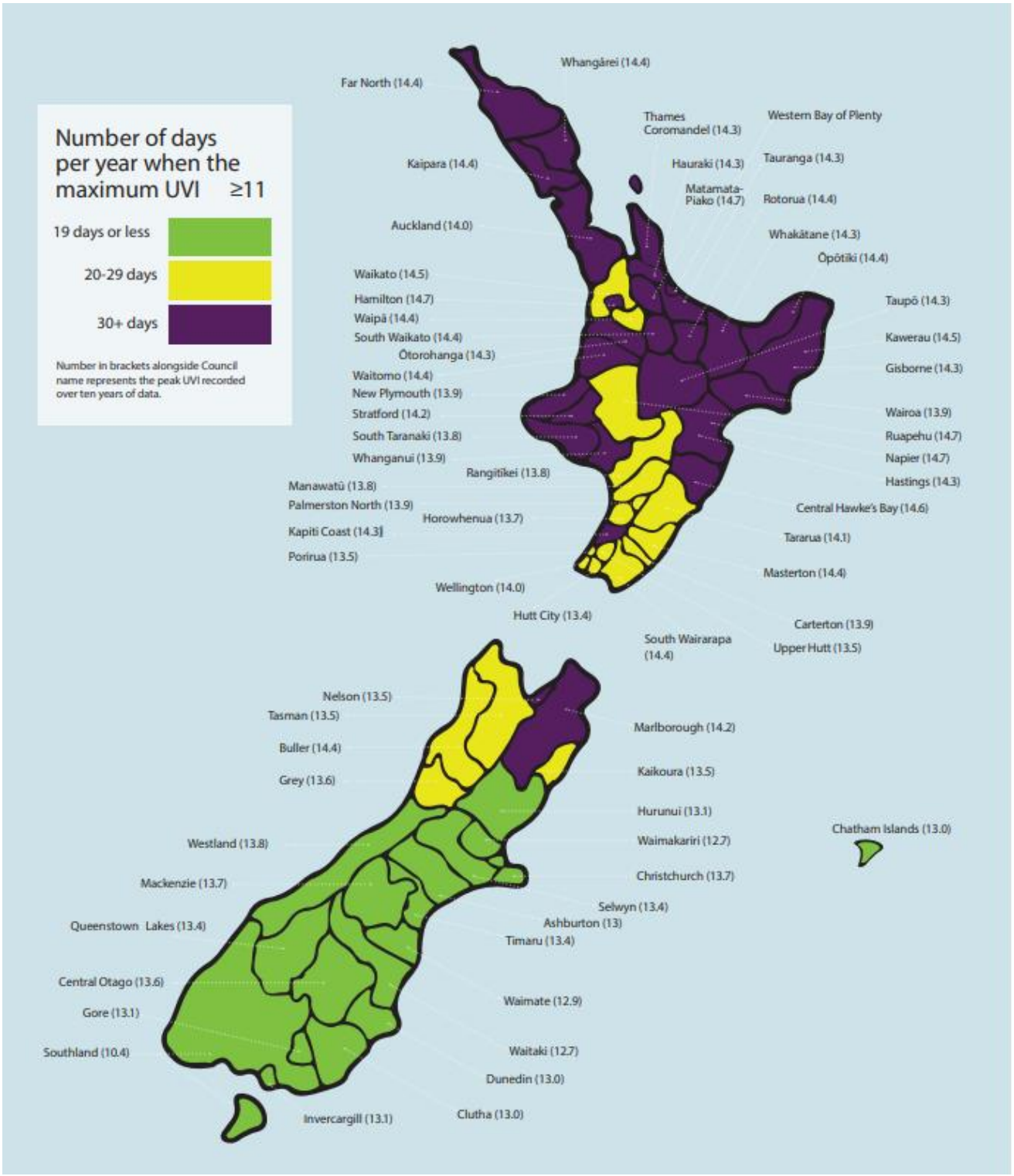


Figure 12. Number of days per year when UV Index was extreme (greater than or equal to 11) by Council

This graphic was provided by the Cancer Society of New Zealand. UVI data was provided by Ben Liley, Atmospheric Scientist, NIWA.



6. Primary prevention

The subsequent sections examine specific settings to assess the risk of skin cancer within the population exposed and identify effective interventions tailored to those environments.

Each area covers:

1. Findings from The Community Preventive Services Task Force (CPSTF) on effective interventions as well as any other supplementary systematic reviews conducted since these were completed (Sandhu, 2016).[8]
2. The regulatory landscape in New Zealand, including legislation, local government regulation, and organisational policies.
3. An overview of policies, practices, and recent research in New Zealand, including ongoing prevention activities and current research projects.
4. Identified gaps in knowledge in New Zealand.
5. Key recommendations from organisations such as Te Aho o Te Kahu – Cancer Control Agency and the Melanoma Network of New Zealand (MelNet).

[8] The CPSTF, appointed by the Director of the Center for Disease Control (CDC), evaluates scientific evidence on community-level interventions for population health improvement including for skin cancer (The Community Guide, 2022). Their systematic reviews guide recommendations for policymakers and practitioners, informing effective strategies. Recommendations classify interventions as effective, having insufficient evidence, or not recommended.

6.1 Education settings

Evidence of association with skin cancer

Exposure to excessive UVR throughout life is a key risk factor for increasing melanoma risk and may be particularly harmful during childhood and adolescence (Whiteman, 2001). For keratinocyte cancers, childhood and adolescence intermittent UVR exposure increases the risk of basal cell carcinoma, while cumulative exposure increases the risk of squamous cell carcinoma (Kricker, 2017). Learning skin cancer protection practices early in life can increase habitual use of sun protection later in life (Hill, 1999). Therefore, preventing excessive exposure to UVR, and resulting episodes of sunburn, in childhood and adolescence through sun-protection practices is crucial to reducing the incidence of skin cancer.

Children and adolescents spend a considerable amount of time at school and the school day encompasses the main period of high solar UVR. Students can spend at least part of that time outdoors and can receive a substantial proportion of their total daily UVR exposure while at school (Wright, 2007). In addition, students often take part in outdoor school events, such as sports days, beach days and camps that can result in extended periods of exposure to high solar UVR levels.

Evidence from Australia indicates that sun protection behaviours tend to deteriorate around the time students transition from primary to secondary school (Skin Cancer Prevention Queensland, 2023). Regrettably, this behaviour decline has led to higher levels of sunburn among young adult age groups.

Effective interventions

Educational and policy approaches are recommended by The Community Preventive Services Task Force for child-care and primary/middle school settings (The Community Guide, 2022). The evidence for high school and college interventions is insufficient largely due to a lack of published studies in this area.

The World Health Organization has issued recommended guidelines for appropriate sun protection in schools (WHO, 2003). This includes having a written sun protection policy, classroom lessons on UVR and sun-protection behaviour, incorporation of shade in the school playground, the use of sunscreen, sun protective clothing and hats, rescheduling of outdoor activities to outside peak solar UVR hours, and encouraging parents and staff to role model appropriate sun protective behaviours.

Regulatory environment in New Zealand

In educational settings there are legislative requirements governing health and safety. In New Zealand, individual schools are self-managing entities that are responsible for school governance and operational management. There is legislation that early childhood providers and school boards are required to comply with. Those directly relevant to risk minimisation from exposure to hazards such as solar UVR are as follows:

- **Health and Safety at Work Act (2015)** — stipulates that school boards and early learning service providers are classified as persons conducting a business or undertaking (PCBU). As such, they are obligated to ensure, as far as reasonably practicable, the provision and maintenance of a work environment free from health and safety risks. This encompasses the responsibility to provide and uphold a safe working environment that mitigates risks to health and safety. This would include exposure to solar UVR although this is not specifically stated.

PCBUs are expected to demonstrate their commitment to the health, safety, and well-being of workers and others within their school or early learning service.

- **Education and Training Act (2020)** – this Act took effect on 1 January 2023 and covers the education spectrum from early childhood to tertiary education. It mandates that early learning services and school boards ensure places of learning are safe, inclusive, and free from racism, discrimination, and bullying. Additionally, within the Act there is the Pastoral Care of Tertiary and International Learners Code of Practice (2021) which sets out the expectation that tertiary education organisations and schools enrolling international students must ensure the safety and wellbeing of learners.
- **Education (Early Childhood Services) Regulation 2008 –** requires that every licensed service provider takes all reasonable steps to promote the good health and safety of children enrolled in the service.

The Education Review Office (ERO) as the Government's external education evaluation agency, plays a critical role in monitoring and improving the quality of education in New Zealand by conducting evaluations, providing feedback, and promoting accountability and improvement in educational settings (McNoe meeting minutes, 2022). ERO does not have a team that reviews schools directly but contracts this responsibility to ERO evaluation partners (EP) of which there are about 150-200 around New Zealand. A critical underlying component of every school review is compliance with the legislative requirements. As part of the review process, all boards and early childhood service providers must attest to meeting regulatory and legislative requirements. As of January 2024, they do this by completing the Board Assurance Statement self-audit checklist 3: Health, Safety and Welfare including those relevant to solar UVR exposure[9]:

i. "Have health and safety policies, and procedures/guidelines/practices in place including for providing a safe physical and emotional environment for students" (item 1)
ii. "Protection for staff and students from excessive UVR exposure over the summer months" (item 14)
iii. "Complying with the Health and Safety at Work Act (2015)" (item 29).

If any significant issues or risks are identified under any sections of the self-audit checklists, these are discussed as part of the review process (Education Review Office, 2024).

Evaluation partners conduct a walk-around of the school premises to assess various factors, including health and safety measures (McNoe meeting minutes, 2022). It is important to note that this assessment doesn't involve a checklist specifically for determining the presence of a sun-protection policy or practices as this is not mandated under legislation.[10] ERO places greater emphasis on the implementation of procedures that prioritise student well-being rather than simply having a policy in place. During assessments, Evaluation Partners will ensure that sunscreen provided has not expired, which is considered a 'good practice' element under health, safety, and welfare guidelines. This falls under the management and recording/administering of medicine protocols.

Shade provision in outdoor areas in schools is important to minimise solar UVR exposure for students while at school and also for any public recreational use outside of school hours

[9] A range of health and safety factors were removed in the November 2024 review of the ERO Board Assurance Statement and Self-Audit Checklists, including "Protection for staff and students from excessive UV radiation exposure over the summer months"

[10] The Board will have completed the self-audit checklist including the item on "Protection for staff and students from excessive UVR exposure over summer months.

(Parliamentary Commissioner for the Environment, 2023). The Ministry of Education's (MoE) support and funding for shade in schools is very limited; according to the Ministry, providing shade is primarily the responsibility of the school board (Ministry of Education, 2024). The Ministry discourages the installation of shade sails due to perceived risks and costs associated with them. If shade sails are installed, the school board is responsible for their ongoing maintenance costs and insurance coverage.

The MoE has a five-year agreement for upgrading, modernizing, or replacing existing Ministry-funded buildings and facilities within individual schools. Funding available is based on several factors with a minimum budget for each school of $45K over the five years (Ministry of Education, 2024). The Ministry stipulates shade sails are only eligible for funding as part of priority 4 (discretionary projects) of the five-year agreement. Alternatively, they suggest, schools can seek funding for shade sails through fundraising or community grants. Verandas are eligible for five-year agreement funding as part of priority 3 projects (modern learning environment) if they contribute to creating an outdoor learning area or as part of a replacement project classified as priority 2 (essential infrastructure). Interestingly, neither shade sails or verandas can be funded as priority 1, which encompasses health and safety considerations. No information is provided about funding of covered outdoor learning areas now being constructed in some schools, but presumably this would be eligible as a priority 3 project.

In terms of school design for new builds the Designing Schools in Aotearoa New Zealand School Property Design Standards (2022) only mention sun protection briefly; ”Key outdoor spaces need to be comfortable and pleasant, offering adequate shelter from rain, wind and excess sun” (Ministry of Education, 2022).

Prevention activities in New Zealand

Early Childhood Centres

In 2017, The Cancer Society of New Zealand introduced a free of charge online professional development module tailored for professionals in Early Childhood Education settings (Knewstubb, 2018). The module aims to educate individuals on the significance and timing of practising sun protection behaviours with young children and covers UVR basics, sun and skin cancer, prevention, vitamin D, and facts and myths. Verbal commentary is provided in Te Reo Māori. This module is very popular, with 616 people completing the module between May 2023 and April 2024.

The Office of Early Childhood Education provides online education resources, sun protection policy guidelines and assistance to early childhood education centres, and home-based teachers and service providers.

Primary Schools

The SunSmart Schools Accreditation Programme (SSAP), based on the WHO recommended guidelines was first developed in Australia in 1994 and launched nationally in 1998 (Jones, 2008) and then adopted in New Zealand as “The SunSmart Schools Programme” in 2005. The programme has always been fully funded and delivered by the Cancer Society of New Zealand. Schools seeking enrolment in the SSAP must meet 12 minimum criteria aligned with WHO recommendations. Having a comprehensive school UVR or Sunsmart policy in place is of paramount importance in qualifying as a Sunsmart School. It informs staff, Board members, and parents entering the school, of the importance of the expectations of the school community regarding sun protection.

In 2014, in partnership with curriculum and subject experts, the Cancer Society of New Zealand developed curriculum resources that teach students about the UVR and sun protection. They are inquiry-based, cross-curricula and are linked to the National Standards for Levels 1 to 4.

In 2017, a cross-sectional comparison revealed that schools enrolled in the SSAP had better sun protection policies and practices compared to those not enrolled (McNoe, 2018). Currently, 28.2% of primary schools (with a combined school roll of 119,957 students) are enrolled in the SSAP, reflecting a decline of 8% since 2021. This can primarily be attributed to the long-lasting impacts of Covid, and financial constraints faced by the Cancer Society of New Zealand, resulting in insufficient resources to comprehensively support the programme. Programme delivery is inactive in much of the South Island and varies across Cancer Society of New Zealand divisions. In August 2024, just under 50% of all New Zealand primary and intermediate schools had never applied to be a SunSmart School. no active SunSmart schools programme in the south Island and little activity in the north island

The introduction of the professional agency SchoolDocs, which specialises in drafting school policies, has significantly alleviated the administrative burden on school leadership and governance in New Zealand. Through a fixed annual subscription based on school roll size, ranging from $1,200 to $3,200 (excluding 15% GST), SchoolDocs offers schools access to customizable policy templates, including those for sun protection (Reeder, 2020). As of April 2024, in a personal communication, SchoolDocs reported that all 2,000 primary and secondary schools[11] currently subscribed to SchoolDocs have a sun protection/UVR policy (J Gregg, personal communication, 10 April 2024). This is because sun protection is one of the areas about which ERO expects to receive compliance reports from principals/school boards about.

Secondary schools

Due to resourcing, the Cancer Society of New Zealand is not undertaking any sun protection activities in secondary schools. No other government agencies or non-government organisations undertake any national prevention activities in secondary schools. This is a risk as adolescence is a critical period for sun exposure.

Policies, practices and recent research in New Zealand

Early Childhood Education

The most recent empirical data on sun protection policies and practices in ECE is based on focus groups with teachers in Wellington-based ECE centres in 2014 (Signal, 2014). Given that children can spend up to six hours per day outdoors, sun protection was viewed as particularly pertinent. Teachers expressed awareness of the importance of sun protection in preventing the development of skin cancer later in life and demonstrated a commitment to providing sun protection, viewing it as part of their responsibility to promote children's well-being and an opportunity to educate both children and parents on the matter. However, the focus groups uncovered ineffective practices, including an over-reliance on sunscreen and underutilisation of protective clothing and shade. Teachers acknowledged the significance of teaching children about sun protection and serving as role models, although consistency in role modelling sun-protective hat wearing varied across centres, suggesting a degree of personal discretion among teachers. An analysis of sun protection policies in participating ECE centres against recommendations from the Cancer Society of New Zealand revealed that these policies covered most recommended sun protection strategies and

[11] There are approximately 2,500 school in New Zealand

behaviours. Another study by Duignan, Signal and Thompson in 2014 identified a lack of comprehensive sun protection policies and practices in early childhood centres resulting from insufficient emphasis on sun protection in government early childhood regulatory and monitoring processes and centre staff lacking access to sun protection information (Duignan, 2014).

Primary schools

Australian and New Zealand primary aged children spend considerably more time outdoors than children elsewhere in the world. Schofield reported that children in New South Wales are spending 9.9 hours per week (or about two hours per day) outdoors while at school (Schofield, 1991). Similarly, in New Zealand, Wright et al. reported children spending 2 hours per day (42 minutes during physical education, 23 minutes for morning tea and 54 minutes for lunch) outdoors (Wright, 2007). In comparison, studies in the United States and Europe commonly report children spending only half an hour per day outdoors (Hunter 2010, Boog 2016). Wright et al. also provides the only empirical data of mean Standard Erythemal Dose (mSED) received by New Zealand children during school hours (Wright, 2007). During PE classes children received 5.9 $mSEDmin^{-1}$, during morning tea break 3.3 $mSEDmin^{-1}$, and during lunch time 4.4 $mSEDmin^{-1}$. Males have been shown to spend more time outdoors while at school and thus have higher solar UVR exposure while at school than females, although their rates of accumulating daily exposure when outdoors were the same (Gies, 1998).

In 2017, 57% of primary schools reported that their school had a formal sun protection policy, with a further 37% reporting a sun protection procedure document in place with most informing their school communities of the document (McNoe, 2019). Almost all schools either enforced or encouraged student hat-wearing outdoors, with consequences for non-compliance including 'no-hat play in the shade', being required to wear spare school hats, or playing indoors. Nearly three-quarters of schools (72%) allowed only sun-protective hats to be worn. Three-quarters (75%) of schools encouraged students to wear broad-spectrum sunscreen of at least SPF30 and most (93%) provided sunscreen at least some of the time. Three-quarters of schools (74%) had at least sufficient shade for passive activities like eating lunch, but far fewer (14%) had sufficient shade for active pursuits such as playground activities.

Secondary Schools

A national survey of secondary school principals was conducted in 2014 and found far poorer sun protection policies and practices than those in primary schools (Reeder, 2016). For example, when asked about sun-protective hat requirements for outdoor activities, 44% of respondents reported that students are encouraged to wear a sun-protective hat. Shade provision in school outdoor areas was very poor with only 6% reporting sufficient shade for both active and passive pursuits. Only 37% of responding schools reported that sun protection was routinely covered in their curriculum.

Current research projects in New Zealand

Two studies are currently in progress.

The first is with primary school teachers and covers their current self-perceived ability to teach about UVR and sun protection, knowledge of the topic, how skin cancer prevention is prioritised against the other health areas, own personal sun protection habits and willingness to engage in sun protection in the school environment, and awareness about the SunSmart Schools Accreditation Programme and the curriculum materials that the Cancer Society of New Zealand has available.

The second project is a collaborative project with Australian researchers investigating preschool teacher training with respect to UVR and other health behaviours across Australia and New Zealand.

Knowledge gaps

Most evidence regarding sun protection policies and practices in schools relies on self-report data, posing a significant limitation, especially concerning shade availability and utilisation.

All available evidence predates recent legislative changes, which are crucial for monitoring school practices. Future assessments could examine post-legislation sun protection policies and practices in schools, building upon existing pre-legislation data for both primary and secondary schools.

It would be beneficial to incorporate empirical measures of UVR exposure, especially for secondary school students and staff, particularly during outdoor events, mirroring the existing measures for primary school children.

Currently, there is a lack of quantitative data on sun protection practices in Early Childhood Education (ECE) settings.

Key organisational recommendations

Te Aho o Te Kahu, the Cancer Control Agency's report on cancer prevention identifies school environments as a key focus area, recommending creating supportive school environments that protect children and young people from excessive UVR and implementing comprehensive sun protection policies and monitoring in all education settings (Te Aho o Te Kahu, 2022).

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand states that prevention strategies should include "schools and other education settings having a sun protection policy, using sun protection practices and participating in the Cancer Society of New Zealand Sunsmart Schools accreditation programme" (MelNet, 2023).

6.2 Workplace settings

Evidence of association with skin cancer

The World Health Organization (WHO) and the International Labour Organization (ILO) have conducted the most recent, comprehensive systematic review of the risk of occupational exposure to solar UVR on keratinocyte cancer and melanoma (Mathieu, 2021).

The conclusions drawn on occupational solar UVR exposure were:

- **Keratinocyte cancer incidence** – there is 'sufficient evidence of harmfulness',
- **Melanoma incidence** – there is 'limited evidence of harmfulness',
- **Keratinocyte cancer or melanoma mortality** – there is an 'inadequate body of evidence' to assess effect.

In this review melanoma was considered as one disease. However, there is research that suggests occupational solar UVR exposure may differ according to anatomical site, with some studies finding a positive association for melanoma on heavily sun exposed areas such as the head and neck (Juzeniene 2012, Beral, 1981, Linet 1995). Including all melanoma sites as one, as was the case with the WHO/ILO systematic review may dilute the strength of association between occupational exposure to solar UVR and melanoma risk.

Both keratinocyte and cancers and melanoma are recognised as occupational diseases in the ILO Diagnostic and Exposure Criteria for Occupational Diseases (International Labour Organization, 2022).

Several countries recognise keratinocyte cancer and/or melanoma as occupational diseases which are then potentially eligible for workers' compensation. For example, in Australia both melanoma and keratinocyte cancers are listed on the 2021 Australia "revised list of deemed occupational diseases" (Driscoll, 2021). Keratinocyte cancer is recognised as an occupational disease in eight European countries (Loney, 2021).

Effective interventions

Educational and policy approaches are recommended by the Community Preventive Services Task Force for outdoor occupational settings (The Community Guide, 2022). In workplaces, a risk management process for solar UVR exposure must be implemented and should be clearly documented in a written policy endorsed by senior management (John, 2021). This policy should specify how both employers and employees manage the risk of exposure to solar UVR on a day-to-day basis (Worksafe New Zealand, 2017). Greater leverage for positive change is likely to be achieved at the workplace and higher organisational levels compared with attempting to directly influence the knowledge, and attitudes at the level of individual workers (Reeder, 2013). Workplace policies and workplace support have been shown to be the most effective way to encourage and enforce appropriate protective behaviours in workers (Hammond, 2008). Mandatory policy has been demonstrated as more effective than voluntary policy (Woolley, 2008). For solar UVR, appropriate sun protective products should be provided, and shade and work systems implemented that minimise the amount of time workers spend in the sun.

Regulatory environment in New Zealand

The Health and Safety at Work Act 2015 requires a duty of care of employers to keep employees safe in the workplace, including from exposure to UVR. The Act mandates that employers provide a safe

physical and emotional environment for employees. Significant occupational hazards must be identified and assessed, and appropriate controls implemented and monitored.

The Accident Compensation Act 2001 excludes coverage for injuries or conditions that develop over time, except in cases where they likely result from work exposure, known as "gradual process conditions" under Schedule 2 of the Act. This schedule includes a list of covered exposures and conditions, including radiation. However, it remains unclear whether the Accident Compensation Corporation (ACC) will deem skin cancer claims likely caused by workplace exposure to solar UVR as eligible for compensation. An official information request (Accident Compensation Corporation, 2023) revealed that ACC lacks specific guidelines or policies for such claims, though a 2007 document from ACC indicates coverage for keratinocyte cancers (Accident Compensation Corporation, 2007). A current research project aims to investigate this issue further. Furthermore, in 2023, The Ministry of Business, Innovation and Employment released a consultation document regarding possible extensions to Schedule 2 of the ACC Act. The Cancer Society of New Zealand, Southern Cross, the University of Otago, and MelNet submitted recommendations urging the specific naming of solar UVR in Schedule 2 (rather than 'radiation') and the inclusion of melanoma and keratinocyte cancers as named conditions.

Sunscreen and other sun protective products can be claimed as a tax-deductible expense by employers (Parker, 2021). However, under the Income Tax Act 2007, salary and wage earners may not claim deductions for expenses incurred in deriving an income which includes sun protection products. It is anticipated by the Government that these costs would generally be met by the employer under contractual obligations.

Prevention activities in New Zealand

WorkSafe New Zealand has a joint responsibility to enforce health and safety legislation and work collaboratively with employers to promote good health and safety practices at work (Worksafe New Zealand, 2020). Exposure to UVR has long been acknowledged by government agencies in New Zealand as a potential hazard in an occupational setting, first beginning in 1994 by the Department of Labour (Occupational Safety and Health Service, 1997). In 2018, WorkSafe New Zealand, in consultation with skin cancer prevention experts, developed guidance resources for employers and employees for staying safe in the sun (WorkSafe New Zealand, 2018).

Melanoma New Zealand has an online subscription-based Melanoma Workplace Education course with a curriculum that covers nine short modules, totaling approximately 45 minutes for the whole course. The course is provided free of charge to approximately half of the subscription base, including schools, sponsors and industry groups. Other workplaces can purchase the course subscription. The content includes information on New Zealand statistics, personal stories, risk factors, skin cancer and melanoma, UVR, prevention, early detection, and treatment, most of which is also freely available on the Melanoma New Zealand website. Since launching the course in October 2020 until April 2024, 48,512 employee course links have been provided (A Newland, personal communication, 2 May 2024).

The Cancer Society of New Zealand provides recommendations on how to look after employees who work outside as well as providing a workplace policy template (Cancer Society of New Zealand, 2024).

Policies, practices and recent research in New Zealand

WorkSafe New Zealand has estimated that there are 5,000 to 6,000 work-related health hospitalisations in New Zealand per annum, with one-third of those caused by cancer, including

skin cancers (20%) (WorkSafe New Zealand, 2024). According to a recent WorkSafe New Zealand report, the second most frequent workplace carcinogen exposure is solar UVR, accounting for 27% of exposure (WorkSafe New Zealand, 2023). Of those workers, 54% spent four or more hours outdoors which is equivalent to 190,400 workers exposed to high solar UVR.

A request made under the Official Information Act (OIA) to the ACC ascertained that there have been approximately $11 million in claims related to UVR exposure in the past 11 years (McNoe 2021), just a fraction of the total cost of treatment in New Zealand. There was no information on whether any of these injuries occurred at work.

All research on policies and practices of outdoor workers in New Zealand is over 15 years old. This includes empirical measurement of occupational solar UVR exposures of 74 outdoor workers from Central Otago, using electronic dosimeters (Hammond, 2009). All workers recorded mean daily solar UVR exposure exceeding current recommended occupational limits. The arithmetic mean total daily (11am-4pm) personal solar UVR exposure was 6.85 Standard Erythemal Dose (SED) (95% CI: 6.30, 7.40 SED). Few workers sought shade during lunch breaks, with most remaining in highly exposed conditions. There was no evidence of work tasks involving substantial sun exposure being scheduled outside high solar UVR periods.

Two surveys have been conducted on sun protection practices in outdoor workers. The first was among local territorial authorities which found that only 17% had occupational health and safety policies for outdoor workers (Reeder, 2006). Interestingly, 62% reported that contractors were not required to provide the same level of sun protection as council-employed staff at the time. The second survey was of nine occupational groups in which outdoor work was common (McCool, 2009). This revealed poor protection from solar UVR with only one-third of workers wearing sunscreen or suitable protective hats. There was a notable association between workplace equipment provision, supportive workplace culture, and workers' sun protection practices (Reeder, 2013).

Current research projects in New Zealand

Australia is doing far better in the primary prevention of skin cancer than New Zealand. Recent research identified several contributory factors including one related to workplace settings (McNoe, 2022). The workplace legislation in both countries is similar in that it mandates a duty of care on employers to provide a safe physical environment for employees. Both have a health and safety regulator, WorkSafe (or SafeWork in Australia) for which New Zealand regulations are enforced at a national level and Australia at a state level. Unfortunately in New Zealand, despite WorkSafe clearly recognising UVR as a workplace hazard (WorkSafe New Zealand, 2017), we are not aware of a single case where the regulations have been enforced through litigation. WorkSafe New Zealand priorities are on acute workplace harm (particularly in forestry, agriculture, manufacturing and construction) (Murray, 2014).

In Australia, an individual who has suffered work-related harm as the result of exposure to a hazard can seek compensation through legal processes. During a 10-year period (2000-2009) there was a total of 1,360 successful workers' compensation claims in Australia for sun related injury/disease at a total cost of $38.4 million (Cancer Council Western Australia, 2011). In New Zealand, injury caused by a work-related gradual process such as UVR exposure could be covered under ACC, however it is unclear if an ACC claim of this nature has been made or succeeded to date. A population-based approach would suggest that work-related claims in New Zealand could be more than $8 million although this estimate is based on outdated information.

The aim of the current project is to explore whether outdoor workers who have developed skin cancer are eligible for ACC compensation for both treatment and entitlement costs (such as loss of

income). If claims were successful, this would ensure equity in care for these patients regardless of their ability to pay for treatment and potentially encourage ACC to invest in skin cancer prevention initiatives.

In some cases, an individual in New Zealand may be able to sue an employer for exemplary damages, even if the injury is also covered by ACC. Exemplary damages are awarded in cases of particularly blatant and reckless behaviour that causes injury to someone.

Knowledge gaps

Lack of recent data on exposure to UVR by outdoor workers or policies and practices in workplaces where workers spend time outdoors poses a significant impediment to advances in occupational health and safety skin cancer prevention initiatives in this population.

The number of outdoor workers, or people who work outdoors cannot be determined from national datasets.

The exposure to carcinogens survey conducted by WorkSafe New Zealand may be useful if it released further information by industry or occupation rather than total data. The sample size was approximately 4,000 workers, so it may not be sufficiently powered to report UVR exposure at individual occupational or industry levels.

Key organisational recommendations

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand states that prevention strategies should include "Comprehensive workplace policies and programmes, especially for outdoor workplaces (Health and Safety at Work Act 2015). Workplaces should be supported to implement sun protection policies to guide best practice in scheduling work, personal protective equipment and skin checks" (MelNet, 2023).

Te Aho o Te Kahu, the Cancer Control Agency's report on cancer prevention identifies workplaces as a key focus area, recommending creating supportive work environments that protect people from exposure to excessive UVR and ensuring employers are meeting their legal obligations to protect workers from sun exposure (Te Aho o Te Kahu, 2022).

6.3 Sporting and recreation settings

Evidence of association with skin cancer

Individuals participating in some outdoor sports or recreational activities have been reported as experiencing high solar UVR exposure doses and high rates of sunburn, putting them at increased risk for melanoma and keratinocyte cancers (Moehrle 2008, Snyder 2020). For example, epidemiological research indicates that engaging in recreational activities like beach activities or participating in water sports is linked to a higher risk of some skin cancers (Bennett, 2022). Furthermore, individuals who engage in some outdoor sports exhibit common risk factors for cutaneous melanoma, such as a high prevalence of pigmented lesions in sun exposed body sites (Snyder, 2020).

Effective interventions

Educational and policy approaches are recommended by the Community Preventive Services Task Force for outdoor recreational and tourism settings (The Community Guide, 2022).

The World Health Organization (WHO) promotes the involvement of community settings, including sports organisations, in the implementation of policies or interventions aimed at enhancing health (World Health Organization, 1986). Sports settings offer centralised access to large populations through existing infrastructures for intervention delivery and health promotion messaging (Crisp, 2003). Additionally, they exert regulatory and sanctioning influence over the sporting environment and participants. Most sporting organisations recognize the significance of health in the development and performance of their members. Sport New Zealand, the leading sporting body in New Zealand, explicitly states its mission as contributing to the wellbeing of everyone in New Zealand (Sport New Zealand, 2024).

Recommendations from the WHO and Centers for Disease Control and Prevention recommend seeking shade as one of the primary strategies for sun protection and skin cancer prevention. Shade provides a physical barrier between the sun and the skin, reducing direct exposure to excessive solar UVR. Studies have demonstrated that spending time in shaded areas significantly reduces the risk of sunburn and other UV related skin damage, both of which are important for skin cancer prevention.

Regulatory environment in New Zealand

- **Health and Safety at Work 2015** applies to all workplaces, including where volunteers (such as sports officials or coaches) are engaged in work activities. Sports organisations have a duty of care to ensure the health and safety of all individuals involved in their activities including volunteers.
- **Local Government (Community Well-being) Amendment Act 2019** empowers local authorities to consider and promote community well-being when making decisions and developing policies. This includes the provision of amenities and infrastructure that contribute to the health and safety of the community, such as providing shade in public spaces like outdoor recreational areas.

Prevention activities in New Zealand

Currently, the only prevention effort in this area involves a local Cancer Society division's promotional video targeting sports coaches and focusing on sun protective sports uniforms.

A collaboration between the Cancer Society of New Zealand and the University of Otago is underway to map all council-controlled playgrounds, youth parks, and outdoor swimming pools nationwide. This initiative aims to create a freely available database accessible via mobile phones or desktop computers. Each facility will be accompanied by photographs of the facility and shade availability evaluations. Other information on whether the facility is smokefree, drinking fountains, public toilets, barbecues, accessible play equipment, and fencing will also be provided. Complimenting this resource will be an advocacy tool for councils that will enable them to compare shade provision in recreational areas with that of other councils, and offer examples of high-quality shade, and practical shade solutions derived from real case studies.

Policies, practices and recent research in New Zealand

In 2018, among the 71 National Sporting Organisations (NSOs) where a solar UVR policy would be relevant – meaning that at least one aspect of the sport is conducted outdoors when the UV Index (UVI) is potentially 3 or higher – only 12 mentioned sun protection, sun exposure/sunburn, or sun protective uniforms in their policy documents (McNoe, 2022). Just two NSOs had a reasonably comprehensive sun protection policy which largely met the recommendation of best practice.

Of 67 territorial authorities, just five have a solar UVR/sun protection policy, four of which are reasonably comprehensive (McNoe, 2021).

A 2023 shade audit of all school outdoor swimming pools found that approximately 90% had no shade over either the water or supervision zones, with no substantial differences by latitude or equity funding. Approximately half of all pools had no shade over spectator zones; however, spectator zones at more prosperous schools were more likely to be shaded (Blank, submitted).

A study focused on secondary school rowers during competition used electronic dosimeters to measure real-time solar UVR exposure (Buxton, 2021). Data collected during two consecutive rowing seasons at Lake Ruataniwha showed a median personal UVR exposure of 1.15 SED, with a mean race-time of 46 minutes. Over two-thirds of race-times (69.6%) exceeded the recommended safe exposure level of 1 SED per day by the Australian Radiation Protection and Nuclear Safety Agency. 25.0% of race-times exceeded the threshold of 1.5 SED, which can cause perceptible erythema for people with light-coloured skin.

During direct observation of secondary school sports days in Dunedin it was found that adequate shade was not available, only half of the competing schools provided students with sunscreen, adult supervisors were not routinely role modelling appropriate sun protective behaviour and students were usually not using sun protection (McNoe, 2016). For example, just 3% of students were wearing a sun protective hat.

A study was conducted where 168 children aged 11 to 13 years from 16 schools in Wellington wore cameras and GPS units for four days (Kids'Cam study), capturing around 1.3 million images in various settings. Images captured in outdoor recreational areas between 10am and 4pm during weekends from September to April were extracted. Of people observed in the images, only 11% used shade and 4% were wearing a sun protective hat (Gage, 2018).

A 2013 nationally representative survey found that more than three quarters of New Zealand adults 'strongly agreed' or 'somewhat agreed' that their council should use money from rates to provide shade in public places (Health Promotion Agency, 2015).

Current research projects in New Zealand

A comprehensive census of all 3,491 playgrounds available in the 67 local government areas was conducted in 2023/24. Recent satellite images and eye-level photographs were obtained for every playground. A shade audit was conducted using validated methods (Gage 2018) for each playground which included the amount and type of shade available for play equipment, spectator areas, seating, and picnic tables. Information on other key variables such as neighbourhood deprivation level, playground type and size, and rurality were also collected. This study updates a pilot study conducted on a small sample of playgrounds in 2018 which showed limited shade with less shade in more deprived neighbourhoods (Gage, 2019).

Two students in the School of Landscape Architecture are undertaking research relevant to skin cancer prevention. The first is conducting shade audits of 63 parks in Christchurch with a particular focus on whether parks in more deprived areas have less shade than those in less deprived areas. The second project is a PhD study that uses school grounds as a case study to evaluate the effectiveness of sun protective measures in school playgrounds in Christchurch.

A research report commissioned by the Health Promotion Agency in 2016 provided a series of six cases studies of build shade in New Zealand public spaces (Mackay, 2016).

In 2020, a qualitative study was conducted to delve into the attitudes, awareness, and concerns regarding UVR and SunSmart practices (Kingstone, 2020). The focus of this research was on 96 young adult outdoor enthusiasts aged 18 to 24, who frequently engage in outdoor activities like attending concerts, sports events, and beach outings. The findings revealed that despite these individuals having a strong awareness of recommended SunSmart practices, they often do not implement them. Short-term desires such as tanning, appearance enhancement, or comfort frequently override the potential long-term benefits of adopting SunSmart behaviours. The study highlighted that although there is room for improvement in knowledge regarding UV risks, many already possess sufficient awareness of these risks and the measures to mitigate them. However, this awareness does not consistently translate into action. Furthermore, while awareness of UVR risk exists among many, it does not necessarily influence their decision-making.

Knowledge gaps

There is a lack of data regarding the policies and practices of sporting organisations at levels below the National Sporting Organisations – this will vary by sport.

There is limited data on solar UVR exposure by sport.

More information on “what works” in terms of advocacy with local government on the provision of shade and encouraging UV policy would be useful.

An audit of shade in recreational areas not covered by existing research would be useful.

Key organisational recommendations

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand recommend including quality shade structures in public areas like sports facilities, recreation spaces, education spaces, workplaces and private areas (MelNet, 2023).

Te Aho o Te Kahu’s cancer prevention report identifies outdoor environments as a key focus area, with a recommendation to “Require local government to develop and implement comprehensive UVR protection policies, including increasing availability of and access to good-quality shade outdoors” (Te Aho o Te Kahu, 2022).

6.4 Public education campaigns[12]

Evidence of association with skin cancer

Mass media and social marketing public education campaigns have been shown to effectively contribute to skin cancer prevention efforts (Wakefield 2010). However, their efficacy relies on integration with complementary interventions and utilisation across multiple media platforms. Given the influential role of popular media in shaping social norms and behaviour, sustained efforts are crucial for enduring impact. These supplementary strategies should encompass social, environmental, policy, and cultural dimensions (World Health Organization, 1986).

Effective interventions

It is important to note that the Community Preventive Services Task Force found insufficient evidence to determine the effectiveness of mass media campaigns for skin cancer prevention, however when mass media campaigns were part of a multi-component programme then they were recommended (The Community Guide, 2022).

Australian research highlights the positive impact of the SunSmart mass media and social marketing campaigns on fostering sun-protective attitudes and behaviours (Dobbinson, 2008). Campaigns in skin cancer prevention have evolved in content, tone of messaging and target audience to reach both the general population and specific hard-to-reach or at-risk groups (Iannacone, 2014). In Victoria, Australia, mass media or social marketing campaigns sit alongside a comprehensive Sunsmart programme.

Regulatory environment in New Zealand

Nil

Prevention activities in New Zealand

The Cancer Council Australia has estimated that a properly funded and evaluated campaign in Australia, where there is a population of 25.6 million people, would cost AUD $20 million per annum (Walker, 2022). This is equivalent to approximately NZD $4 million per annum. The investment in Sunsmart activities by Te Whatu Ora over the last two years (including social marketing education campaigns) has been $200,000 per annum, with this currently being contracted to the Cancer Society. This is a reduction from $500,000 per annum between 2019 and 2021, and $600,000 between 2012 and 2018 (Health Promotion Agency, 2021). This is a very low budget for a social marketing campaign. Over the last two years the Cancer Society has been contracted to deliver this campaign, which they have done by refreshing the historic Tiger the Prawn campaign to promote sun protection behaviours in children and families.

Prior to this, the Health Promotion Agency ran a campaign on, '*What's your look? - don't make it #Dumbburn'*. This targeted people aged 18 to 24 in social or workplace settings and ran from February until mid-March 2019. The campaign used outdoor and digital channels, reaching approximately 13,000 social media users (World Health Organization, 2019).

[12] Information on early detection campaigns are included as part of section 7 (Early Detection)

The Sun Protection Alert is included as part of weather forecasts in the weather section of main newspapers and on the MetService website from September to April each year (refer to Section 5 for more information).

Policies, practices and recent research in New Zealand

Please refer to section 6.6 Sun protection and UVR population-based guidelines for data on sun protection behaviours and UVR exposure.

Knowledge gaps

There is limited routine monitoring of sun protection behaviours on which to base a campaign evaluation. The last health and lifestyle survey run in 2020 had 3 variables – sunburn, intentional tanning and generic sun protection. In 2021 and 2023, Consumer New Zealand carried out SunSmart surveys, that were nationally representative studies involving 1,000 New Zealanders aged 18 and over. Conducted online, these surveys explored various aspects of sun safety including the use of UV Index information, buying sunscreen, sunscreen use, and attitudes toward sun protection. Australians have now moved to observational studies due to limitations with telephone interviews.

There is little recent New Zealand data on awareness of the UV Index – on which much of the messaging is based. The 2023 Consumer New Zealand SunSmart Survey reported that fifty-nine percent of respondents sometimes or always consider the UV Index before spending time in the sun. One in three (35%) didn't consider it and six percent didn't understand what it meant (Castles, 2023). A survey conducted by Cosmetics New Zealand Suncare Initiative showed that people make decisions on sun protection based on temperature and 'sunny days' (Cosmetics New Zealand Suncare Initiative, 2021).

Due to a lack of funding, social marketing campaigns are not being evaluated past basic social media metrics.

Key organisational recommendations

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand recommend that prevention strategies include national and local government developing and implementing comprehensive policies and public awareness campaigns which support UV index awareness, sun protective behaviours and detection of melanoma at an early stage in a range of settings (MelNet, 2023).

6.5 Sun protection products and guidelines

Evidence of effectiveness in reducing skin cancer

Several personal protective behaviours reduce skin cancer risk by limiting or minimising UVR exposure that causes harm. Cancer Council Australia, Cancer Society of New Zealand, Melanoma New Zealand and MelNet share similar evidence-based guidelines on sun protection, including the use of sunscreen, sun protective hats and clothing, seeking shade, wearing sunglasses, and avoiding outdoor activities during extreme UVR periods. These guidelines recommend initiating sun protection measures when the UV Index (UVI) reaches 3.

The use of sunscreen has been shown to be effective in reducing the risk of skin cancer if used regularly and applied correctly (Autier 2009, Green 2011, Iannacone 2014).

Effective interventions

See relevant settings sections above.

There is an Australian/New Zealand consensus statement on sunscreen (Whiteman, 2019) which was published in 2019 before the change in the Standard for sunscreen in 2021 (Aotearoa SNZTMTo, 2008).

Regulatory environment

- **Sunscreen Standard (AS/NZS 2604:2021)** – sets out the requirements and guidelines for the manufacture and labelling of sunscreen products in Australia and New Zealand. This standard specifies the minimum level of sun protection factor (SPF) that a sunscreen product must provide, as well as requirements for labelling regarding application instructions, warnings, and precautions. Additionally, AS/NZS 2604:2012 outlines testing methods to determine a sunscreen product's SPF and water resistance. Compliance with this standard ensures that sunscreen products meet certain quality and safety standards, providing consumers with confidence in their effectiveness and protection against harmful ultraviolet radiation. This Standard was made mandatory under the Sunscreen (Product Safety Standard) Act 2022.
- **Sunscreen (Product Safety Standard) Act 2022** – Minister of Commerce and Consumer Affairs set mandatory regulation under section 29 of the Fair Trading Act (1986) that prescribe the product safety standard for sunscreen products.
- **Therapeutic Products Act 2023 –** This Act was intended to repeal the Sunscreen (Product Safety Standard) Act 2022 and classify sunscreen as a therapeutic good as it is in Australia. However, this Act was not due to come into effect until 2026 and the coalition Government has commenced the process to repeal the Act in its entirety.
- **Standards for sunglasses and fashion spectacles AS/NZS 1067.1 and 1067.2** – mandatory in Australia, voluntary in New Zealand (King, 2018).
- **Standard for sun protective clothing (AS/NZS 4399) –** mandatory in Australia and voluntary in New Zealand. Covers both clothing and hats (King, 2018).
- **Standard – knitted and woven shade fabrics (AS4174) –** Australia-only standard. Covers specifications for shade fabrics used in various applications include shade structures. It includes a human protection rating (King, 2018).

Prevention activities in New Zealand

Guidelines

Information and resources on prevention (e.g. posters, factsheets) are available from:

- Melanoma New Zealand
- Cancer Society of New Zealand which is contracted to maintain the Sunsmart website
- Melanoma Network of New Zealand (MelNet)
- Healthify – He Puna Waiora
- DermNet
- Environmental Health Intelligence New Zealand (EHINZ)
- National Institute of Water and Atmospheric Research (NIWA)
- Ministry of Education (MoE)
- Plunket – Whānau āwhina
- Consumer New Zealand
- Standards New Zealand – Te Mana Tautikanga o Aotearoa
- WorkSafe NZ
- HealthED (Ministry of Health)

The are some inconsistencies in messages across these platforms.

Guidance for sun protection and early detection messaging, as agreed by the national Skin Cancer Prevention and Early Detection Strategy Working Group are available separately.

Various electronic resources have been produced including:

- "How to apply sunscreen correctly" which was a collaboration between Melanoma New Zealand and Consumer New Zealand in 2020. This video is also linked from the Sunsmart website.
- Two online educational videos on being Sunsmart which was a collaboration between Nanogirl in 2022 (Michelle Dickinson) and the Cancer Society of New Zealand.

The UVNZ app is available free to download and provides real-time UVR measures (see Section 5 for more information).

The Sun Protection Alert tells you the time each day that you need to protect your skin and eyes and can be customised to specific regions and placed on websites (on request).

Products

In New Zealand, the price of sunscreen varies significantly between different brands and retailers. Access to free or subsidised sunscreen is available on prescription for individuals with particular immune-suppression diseases. In 2023, there were 3,624 prescriptions dispensed for just over 2000 patients. The cost of this was about $55K (Pharmac, 2024).

Since 2022, Consumer New Zealand has tested sunglasses, sun protective clothing and sun shelters for UVR protection, against the relevant Australian standards. The test results for each product are accompanied by a Buying Guide and are available on the Consumer New Zealand website.

Policies, practices and recent research in New Zealand

Source Information: *The data below is sourced from representative, online surveys of New Zealanders conducted by Cosmetics New Zealand (2021) and Consumer New Zealand (2023), with additional insights from the 2020 New Zealand Health and Lifestyles Survey.*

For the Cosmetics New Zealand survey, only respondents who answered 'yes' to the question, "Have you ever used sunscreen on yourself or others?" were eligible to complete the survey. A total of 96% of respondents met this criterion.

It is important to note that questions differed and were phrased in various ways across surveys, which may have contributed to differences in the results.

Sunburn rates

Despite 86% of New Zealanders recognising the cancer risk posed by ultraviolet radiation (UVR) (Peniamina, 2023), this awareness does not always lead to appropriate sun protection practices. Recent surveys reveal that sunburn is still common:

- **Consumer New Zealand (2023):** 16% of respondents experience sunburn annually, while 50% report occasional sunburn (Castles, 2023).
- **Cosmetics New Zealand (2021):** 60% of respondents experienced sunburn lasting a day or more, often due to inadequate sunscreen application or forgetting to reapply (Cosmetics New Zealand Suncare Initiative, 2021).
- **New Zealand Health and Lifestyles Survey (2020):** In the summer of 2020, 47% of New Zealanders reported sunburn-related reddening or soreness, and 6% experienced blisters or pain. Additionally, 18% actively sought to acquire a tan (NeilsenIQ, 2020).

Sun protection practices

Most New Zealanders employ some form of sun protection to prevent sunburn:

- **Consumer New Zealand (2023):** 65% seek shade and 61% limit sun exposure between 10 am and 4 pm from September to April or when the UV Index is greater than three. About half regularly use sunscreen (52%) and wear protective clothing (57%). However, 18% rarely or never use sunscreen, and 12% rarely or never cover up. 59% sometimes or always check the UV Index before sun exposure, while 35% do not consider it, and 6% do not understand what it means (Castles, 2023).
- **Cosmetics New Zealand (2021):** Sunscreen is the primary protection method for 90% of respondents, with 73% considering it among the best form of sun protection. 67% believe consistent use can reduce skin cancer risk (Cosmetics New Zealand Suncare Initiative, 2021).
- **New Zealand Health and Lifestyles Survey (2020):** In the summer of 2020, 97% of respondents reported using some form of sun protection to prevent sunburn (NielsenIQ, 2020).

Sunscreen use

Sunscreen is widely used, but practices vary:

- **Consumer New Zealand (2023):** Nearly half (48%) of respondents consistently use sunscreen, primarily for reducing skin cancer risk and preventing sunburn. 79% report

correctly apply sunscreen before going outside, however, only 13% reapply every two hours. 46% reapply occasionally and 9% do not reapply at all. Reasons for not reapplying include relying on other sun protection measures (28%), forgetting (45%), not being bothered (21%) and lack of perceived necessity (14%). 40% did not feel they were outside long enough to require reapplication (Castles, 2023).

- **Cosmetics New Zealand (2021):** 29% of respondents use sunscreen daily. Factors influencing use include "how sunny it looks" (74%), daily activities (62%), and outdoor temperature (61%). About 51% apply more than one teaspoon of sunscreen per body part, with 43% applying intuitively. Nearly 50% reapply 1-2 times on a regular summer day (Cosmetics New Zealand Suncare Initiative, 2021).

Considerations when buying sunscreen

- **Consumer New Zealand (2023):** Most people buy sunscreen at supermarkets (56%), pharmacies (25%), or large chain stores such as Kmart, The Warehouse or Farmers (12%). Seventy percent read labels, with SPF and broad-spectrum protection being the most important factors. Cost is a significant factor for 57%, and 60% consider sunscreens too expensive—a 6% increase from 2021. (Castles, 2023).
- **Cosmetics New Zealand (2021):** Sunscreen label claims are the most critical factor, with familiarity, and formulation suitability also being important in product selection. These factors outweigh price considerations. Sun protection factor (SPF) selection is often based on planned sun exposure duration (44%) and individual sun sensitivity (43%) (Cosmetics New Zealand Suncare Initiative, 2021).

Sunscreen safety, efficacy and knowledge

Despite high usage, there remains confusion about what sunscreen labels mean:

- **Consumer New Zealand (2023):** 85% believe it is safe to use sunscreen regularly on adults, and 82% think it is safe for children. However, only 58% consider it safe to use sunscreen regularly on babies, with 18% unsure about its safety for this age group. Misunderstandings about SPF are common: only 23% correctly know that SPF30 does **not** block twice as many UV rays as SPF15, and 38% are unaware that SPF50 requires the same frequency of reapplication as SPF30. Concerns about sunscreen include its effectiveness, ingredient safety, and potential allergic reactions. Trust in sunscreen labels is also a concern, with only 39% of people expressing trust, 43% remaining neutral, and 17% expressing distrust (Castles, 2023).
- **Cosmetics New Zealand (2021):** Only 11% claim extensive knowledge about sunscreen production, testing, and labelling. 49% acknowledge expiration dates. 24% doubt the effectiveness of sunscreen alone in preventing sunburn. New Zealanders express a collective belief that sunscreen brands and government regulators should bear responsibility for testing sunscreen products. New Zealanders most trust medical professionals (51%) and organisations like the Cancer Society of New Zealand and Melanoma New Zealand (37%) for sun safety guidance.

Knowledge gaps

New Zealand has no regular monitoring and reporting of the availability, accessibility and affordability of sunscreen (Te Aho o Te Kahu, 2022).

Public knowledge and understanding of the UV Index (UVI) which is frequently what sun protection messages are based around.

Public understanding of other sun protection messages.

Key organisational recommendations

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand (MelNet, 2023) recommends:

- Sunscreens being included as a therapeutic product to ensure quality standards of being fit for purpose (Standards Australia/Standards New Zealand 2604:2021)
- The use of UPF-rated clothing and sun protective hats (Standards Australia/Standards New Zealand 4399:2017) as a prevention strategy
- Information developed for or provided to patients and their families/whānau aligns with core messages in the New Zealand Skin Cancer Primary Prevention and Early Detection Strategy 2017 to 2022

Te Aho o Te Kahu's cancer prevention report recommends increasing access to affordable, high-quality sunscreen and regulating sunscreen to ensure all sunscreens meet accepted standards for safety, quality and effectiveness (Te Aho o Te Kahu, 2022).

6.6 Solaria

Evidence of association with skin cancer

Exposure to ultraviolet radiation (UVR) from sunbeds increases the risk of melanoma and keratinocytic cancer. The International Agency for Research on Cancer (IARC) of the World Health Organization (WHO) has classified UVR from sunbeds as "carcinogenic to humans" (group 1) (El Ghissassi, 2009). Sunbed use is associated with an increased risk of early-onset melanoma, with risk increasing with greater use and earlier age at first use (Cust 2011, Boniol 2012). Sunbed exposure is also associated with skin burns, premature aging, corneal burns, cataracts, ocular melanoma and photodermatoses (Lim, 2011). Therapeutic use of UVR should only be conducted in a medical unit under medical supervision and claims of health benefits should not be made in the promotion of sunbed use (Jopson, 2008).

Effective interventions

Australia, Brazil, and Iran have a complete ban on commercial solariums and 24 countries have age restrictions on use (Rodriguez-Acevedo, 2020). The total ban implemented on commercial sunbeds in Australia has been shown to be highly effective and has strong public support (Janda 2022, Gordon 2020). It is expected to avert approximately 4% of melanomas and 4% of keratinocyte cancers and save over A$64 million in health care costs (Janda, 2022). When the sunbed industry was given sufficient time to reform, they were able to reorientate their services to accommodate the new laws without substantial job losses (Gordon, 2020). To support the process there was a 'buy-back' scheme on sunbeds in some states (Gordon, 2020).

Regulatory environment in New Zealand

In 2016 The Health (Protection) Amendment Bill 2014 was passed which restricts access to commercial sunbeds to those aged 18 years or older. Breaches of the Act can result in fines of up to $10,000 for businesses and $2,000 for individuals. Of the 67 local territorial authorities only two have regulations with respect to commercial sunbed operation with both requiring licensure — Auckland Council's Health and Hygiene Bylaw (2013) and Wairarapa District Council's Consolidated Bylaw (2019).

There is a voluntary Standard AS/NZS 2635:2008 Solaria for Cosmetic Purposes with the procedures in the Standard intended to reduce the risk from exposure to UVR emitted by sunbeds.

Prevention activities in New Zealand

The Ministry of Health (MoH) takes a harm minimisation-based approach where it conducts inspections of commercial sunbed operators to encourage compliance with the voluntary Standard.

Prevention activities from other cancer prevention organisations are entirely focused on advocating for a total ban for sunbeds for commercial purposes.

Policies, practices and recent research in New Zealand

National Public Health Service staff regularly visit commercial sunbed operators to ensure they are familiar with best practice to reduce the risks from UVR from sunbeds (Ministry of Health, 2023). Nationwide there are 55 establishments that have sunbeds commercially available, a reduction of over two-thirds from 2013 (Ministry of Health 2014, Ministry of Health 2023). The majority (64%) are single bed operators who provide very few sessions per week (Ministry of Health 2023). Notably, only seven operators exclusively offer 'tanning services', yet they contribute to 38% of the sunbeds available and 70% of the sessions. There were 47 establishments with data available on the number

of sunbeds reporting availability of 82 sunbeds. Just six operators were providing more than 100 sessions per week. Compliance with the Standard is better with specialist operators and in Auckland where there is a bylaw in place.

Health New Zealand contracts Consumer New Zealand to conduct regular mystery shopper surveys of sunbed operators to determine whether they are complying with the voluntary sunbed standard and sunbed requirements of the Health Act, which restricts sunbed use to people 18 years and older.

In the most recent survey in 2024, of the 17 establishments visited, six allowed a customer with Type 1 skin to have a sunbed. This is despite a skin assessment being completed that gave a score equivalent to Type 1 skin (Castles, 2024). Three of these six operators had been found in previous surveys to permit access to a sunbed to a customer with Type 1 skin. Earlier surveys have demonstrated that staff had not been trained to determine skin type with many failing to advise clients against solaria use if they had high-risk skin types (Castles 2015, 2016, 2022). In the 2024 survey, one out of 23 operators permitted use by a customer under the age of 18 on two separate occasions at two different locations (Castles, 2024).

In terms of the availability of second-hand sunbeds for purchase, in 2016, there were 168 sunbeds listed for sale on Trade Me, New Zealand's largest auction site for second-hand goods (McNoe, 2016). Encouragingly, in April 2024 none were available for sale.

Almost all New Zealanders (94%) understand that using a sunbed increases the risk of developing cancer (Richards, 2017). Very few New Zealanders use sunbeds with the most recently available data from 2016 reporting that just 2% of adults reported that were likely to use a sunbed to get a suntan (McNoe 2016, Health Promotion Agency 2016). In a 2023 Consumer New Zealand survey, 47% of respondents supported a ban on sunbeds, 36% were unsure and only 17% did not support a ban (Castles, 2024).

Current research projects in New Zealand

Nil.

Knowledge gaps

Nil identified.

Key organisational recommendations

The following organisations' position on commercial artificial tanning devices is they should be banned – the National Melanoma Working Group, Melanoma Network of New Zealand (MelNet), Cancer Society of New Zealand, Melanoma New Zealand, Consumer New Zealand, Public Health Association and Australasian College of Dermatologists.

7. Early detection

For skin cancer, early detection means identifying lesions suspicious of malignancy at the earliest clinical stage.

Early detection of skin cancer enables timely intervention resulting in improved patient outcomes and reduced treatment costs. This is particularly true for melanoma which has a much higher death rate (proportionate to the number of diagnoses) than keratinocyte cancers. Research has primarily focused on melanoma because of its serious implications.

For melanoma, it is well documented that survival decreases with increasing tumour thickness. Patients with melanoma less than 1mm thick have a 92% 10-year survival compared with a 50% 10-year survival in patients with melanomas greater than 4mm thick (Balch, 2009).

This stark contrast underscores the importance of diagnosing melanoma in its earliest stages and reinforces the pivotal role of early detection in alleviating the burden of melanoma in New Zealand (Sneyd, 2006).

There is a continued need for strategies to encourage the identification of early-stage disease, particularly for:

- individuals at high risk of skin cancer
- those in older age groups where incidence rates of invasive melanoma are continuing to rise and mortality rates are much higher
- Māori who, are usually at lower risk of skin cancer[13], but when diagnosed with melanoma are 2.6 times more likely to die than non-Māori (Gurney et al 2020). This is the largest survival disparity of any cancer between Māori and non-Māori (Environmental Health Intelligence New Zealand, 2024).

In most countries, early detection of skin cancer occurs opportunistically, either when an individual or family member notices unusual changes on the skin or incidentally by a trained health professional (Janda, 2022). This unstructured approach to skin cancer early detection can often result in variable quality of care, sociodemographic inequalities in accessing skin checks and best practice care and achieving health outcomes, excision of many benign lesions, overdiagnosis, gaps in workforce training, and health system inefficiencies (Janda, 2022).

There is insufficient evidence for the use of population screening for melanoma to improve outcomes, therefore it is not recommended (Melanoma Institute Australia, 2024). However, research on the cost-effectiveness of routine screening or surveillance indicates that focusing on high-risk groups is more economical than an untargeted approach (Janda, 2022). Current recommendations from the US Preventive Services Task Force are that "future research on skin cancer screening should concentrate on assessing the effectiveness of targeted screening for individuals at higher risk for skin cancer" (Wernli, 2016). In Australia, a multidisciplinary Melanoma Screening project is underway to develop a roadmap toward targeted melanoma screening, with an aim to test the developed model against the current opportunistic approach in a randomized trial in future (Melanoma Institute Australia, 2024).

Diagnosis can only be confirmed by biopsy and histopathological examination.

Early detection by individuals

Research studies suggest that most melanomas are recognised by the person themselves or a family member. A Queensland study found nearly half (44%) of those with histologically confirmed

[13] Actual risk is dependent on the presence of risk factors including the level of skin pigmentation.

melanoma detected the melanoma themselves (McPherson, 2006). Similarly, a New Zealand population-based study of melanoma patients diagnosed between 1 July 1992 and 30 June 1994 showed that 45% of melanomas were first recognised as abnormal skin lesions by the patient, 31% by a family member or friend, and 20% by their GP (Sneyd 1999).

Individual self-examination involves people deliberately checking their skin for changes. Early detection through self-examination potentially reduces the risk of advanced melanoma by 63% through identification of thinner lesions (Berwick, 1996). It is also associated with increased detection of lesions less than 1mm thick, which are almost always survivable (Cancer Council Australia, 2020).

Smartphone applications intended for self-diagnosing skin cancers are becoming increasingly common. Research has shown that these applications are generally inaccurate and should not be a substitute for a skin examination by a trained health professional (MelNet 2023, Freeman, 2020).

Early detection by health professionals

Research has shown an association between clinical skin examinations by a health professional and a lower risk of being diagnosed with a thicker melanoma (Cancer Council, 2019).

Health professionals can detect skin cancers opportunistically during a skin examination or in the context of physical examinations performed for other reasons, or as part of a formalised skin surveillance programme for high-risk individuals.

Full-body skin checks undertaken by a health professional are considered international best practice for detecting lesions suspicious of malignancy.

Use of dermoscopy

International best practice recommends that health professionals conducting skin examinations to identify cancer be trained in and use dermoscopy (MelNet, 2023).

Dermoscopy is a technique that uses a hand-held magnifying device to visualise diagnostic features of pigmented skin lesions that are not seen with the naked eye.

It is well documented that, when used by trained professionals, dermoscopy improves diagnostic accuracy for skin cancer.

A meta-analysis of nine different studies compared melanoma diagnostic accuracy using dermoscopy with naked eye examination. Results showed that using dermoscopy was 15.6 times more accurate than using naked eye examination alone. Dermoscopy also showed higher sensitivity compared to naked eye examination but didn't seem to affect specificity (Melanoma Institute Australia, 2024).

Another study published in a primary care setting showed similar results, with a 42% increase in sensitivity and 5% increase in specificity with dermoscopy compared to naked eye examination. It also showed a significant improvement in confidence of diagnosis of both true melanoma (17% increase) and true non-melanoma (16% increase) using dermoscopy (Melanoma Institute Australia, 2024).

Dermoscopy has also been shown to reduce the number of benign lesions excised on suspicion of malignancy, and the number of patients referred for biopsy in both specialists and primary care (BPAC, 2021).

Use of risk assessment tools

Clinical risk assessment tools help predict the risk of an individual developing skin cancer and can help distinguish people at higher and lower risk. They utilise information such as age, sex, ethnicity, skin colour, tanning ability, freckling tendency, sunburns and past history of skin cancers (Whiteman, 2016).

In recent years, there has been considerable growth in the development and application of skin cancer risk-assessment tools (Janda, 2022). A 2018 study showed that risk-assessment tools are effective in determining an individual's likelihood of developing melanoma and in categorizing different levels of risk (Olsen, 2018).

Understanding level of risk enables interventions, such as skin cancer surveillance programmes and education on sun protective behaviour and the early detection of skin cancer, to be tailored to the individual. For early detection to be both effective and cost-efficient, risk-assessment tools must be accurately calibrated to estimate absolute risk and to identify those who are most likely to benefit from screening (Olsen, 2018).

Genetic risk scores, which incorporate the effects of multiple low-risk genes, are being developed to predict a person's lifetime risk of developing melanoma. They add additional predictive ability over traditional risk scores that incorporate clinical information including age, sex, pigmentary and nevus characteristics, and measures of sun exposure (including sunburns) (Olsen, 2019).

Use of artificial intelligence and automated diagnostic tools

Artificial intelligence and automated diagnostic tools are increasingly being incorporated into skin imaging technologies to assist with monitoring and diagnosing skin lesions. These tools typically work by digitally analysing and categorising clinical or dermoscopic images (Melanoma Institute Australia, 2024).

Many of these technologies have shown promise. A recent study compared the diagnostic accuracy of state-of-the-art machine-learning algorithms with human experts and found that the machine-learning classifiers surpassed human experts in diagnosing pigmented skin lesions (Tschandl, 2019).

However, these tools are best used in the hands of trained health professionals. Research has demonstrated that the diagnosis of skin cancer is most accurate when good-quality artificial intelligence is used by clinicians to support clinical decision-making (Tschandl 2020, Miller 2024). There is also evidence to suggest that less experienced clinicians benefit most from the use of artificial intelligence (Tschandl, 2020, Felmingham 2022).

Artificial intelligence has the potential to address equity issues by removing geographic, clinical, financial, and other barriers to care (Melanoma Institute Australia, 2024). However, many systems to date have lacked or had poor performance in individuals with skin of colour and non-pigmented melanomas (Melanoma Institute Australia, 2024). Further real-world evidence is required to ensure these tools are effective and safe in our population.

Early detection education

General public

Skin cancer mass media and social marketing public education campaigns have predominantly focused on prevention rather than early diagnosis. As such, there is little evidence to support mass

media campaigns effectively contributing to skin cancer early detection efforts. In Australia, it has been hypothesized that the relatively high prevalence of skin checks could, in part, be due to community-wide prevention efforts (Janda, 2022).

Non-medical professionals

Non-medical professionals like massage therapists, cosmetologists, and hairdressers often have the chance to regularly examine their clients' skin in non-clinical settings. Several studies have demonstrated the usefulness of these interactions in detecting skin cancer (Pearlman, 2021).

Health professionals

There is evidence to suggest that additional training for GPs in the diagnosis and management of skin cancer improves outcomes for patients and the wider health system.

According to the Australian State of the Nation report into melanoma, if general practitioners (GPs) reduce their rate of missed melanomas to match dermatologists', the incidence of thick melanomas would decrease, mortality rates would reduce and millions of dollars associated with late-stage melanoma treatment would be saved (Melanoma Institute Australia, 2022).

Research shows that skin cancer early detection education targeted at GPs has the potential to enhance detection of earlier stage disease, improve diagnostic accuracy and the quality of referrals, and reduce unnecessary tests and referrals to specialist services. Despite this, many GPs do not receive comprehensive training in skin cancer (Brown, 2022).

The Dermoscopy for Victorian General Practice Program is an example of how structured and coordinated training can positively impact the early detection practices of GPs. Delivered by Cancer Council Victoria and supported by the Australasian College of Dermatologists, the programme was targeted at Victorian GPs, particularly those in regional areas and those with no or limited access to a dermatoscope. It aimed to create more accurate diagnoses of skin cancer through providing comprehensive dermoscopy equipment and training (Jones, 2022).

In 2018 and 2019 the program reached 209 GPs, 63% of whom were based in rural or regional areas and 70% of whom had never previously participated in skin cancer education. Evaluation indicates the program increased the use of dermoscopy equipment in Victorian general practices, improved participants' confidence in diagnosing skin cancers and improved decision-making in referring patients to dermatologists. There was a significant increase in lesions excised from before program participation (5 to 10) and in confirmed keratinocyte cancers (3 to 5) (Jones, 2022). There was also an increase in the provision of skin cancer prevention information to patients.

According to research, other health professionals can be trained to successfully perform skin checks with the use of diagnostic aids (Melanoma Institute Australia, 2022). A scoping review exploring the involvement of nurses in early detection of skin cancer observed that brief education programmes can result in positive outcomes in nurses' knowledge, attitudes, and behaviours related to skin cancer prevention and detection. Spaced experiential learning offers the most effective approach for nurses to acquire practical skills (Beames, 2024).

Early detection in New Zealand

1. ***Public awareness of early detection***

   Information and resources on early detection and the importance of self-skin examinations are available from:

- Melanoma New Zealand
- Cancer Society of New Zealand
- SunSmart
- Healthify – He Puna Waiora
- DermNet
- Cancer Control Agency – Te Aho o Te Kahu
- Melanoma Network of New Zealand (MelNet)

Private skin cancer service providers promote early detection and self-skin examination through their marketing activities.

Most frequently the ABCDEFG and SCAN rules are promoted to aid in the recognition of lesions of concern, however exact messaging does vary between sources.

ABCDEFG rule	**SCAN rule**
Asymmetry **B**order **C**olour **D**ifferent **E**levated or **E**volving **F**irm **G**rowing	**S**ore **C**hanging **A**bnormal **N**ew

Melanoma New Zealand has run an annual Get Spotted public awareness campaign which encourages participants to raise awareness of melanoma prevention and early detection by 'getting spotted'. In 2021, Melanoma New Zealand also ran a "Don't Let a Spot Become a Full Stop" campaign which used melanoma full stops on social, digital and print media to drive awareness of how important it is to regularly check your skin for changes. From 2024, Melanoma New Zealand will be running a new public awareness campaign largely focusing on the importance of early detection, but with prevention messaging also incorporated.

Melanoma New Zealand maintains a list of skin check providers on their website which is searchable by geographic location. To be included on the list, current registration on the New Zealand Medical Council or Nurses Council and annual practising certificate must be provided in addition to evidence of successfully completing one of the following:

- Skin Cancer College of Australasia - Advanced Clinical Certificate in Dermoscopy.
- Skin Cancer College of Australasia - Certificate in Dermoscopy.
- Australasian College of Dermatologists - Certificate of Melanography Essentials.
- Cardiff University Introduction to Dermoscopy.
- Vocational training in Dermatology.

Equivalent qualifications from other institutions are considered on an individual basis.

Professionals who have achieved full membership accreditation with the New Zealand Skin Cancer Doctors Society are listed on their website. Full membership requires:

- Facilities Accreditation NZS8165:2005 office and rooms-based surgery or RNZCGP Foundation Accreditation
- Current New Zealand Medical Council Annual Practising Certificate
- Current Medical Indemnity Certificate
- Royal New Zealand College General Practitioners Fellowship Certificate
- Evidence of Advanced Dermoscopy Qualification
- Evidence of Advanced Skin Cancer Surgery Qualification
- Evidence of Surgery Audit Data (200 excisions per year)

Upon receipt of the credentialing documents, all Full Member applicants receive a visit from one of the New Zealand Skin Cancer Doctor Executive members to their clinic to evaluate the premises and systems, along with an observation of a full skin check and a surgical procedure.

2. ***Early detection services***

In New Zealand, skin examinations for the purpose of identifying skin cancer are carried out by a range of providers such as general practitioners (GPs), dermatologists, nurse specialists, surgeons and dermoscopists. Frequently, these examinations are also used as an opportunity to deliver primary prevention advice on sun protection to patients.

The availability of skin check providers can vary significantly between urban and rural areas. While New Zealanders in major cities can access skin cancer detection services through a range of providers, inequity of access exists across the country, particularly in regional and rural areas.

The cost of a full-body skin check varies significantly depending on the provider. This can create barriers for some, particularly those high-risk patients who require regular skin surveillance. Some providers offer spot checks for a select number of spots at a lower cost.

Since January 2021, Melanoma New Zealand's Nurse Educators have travelled nationally, providing education and awareness about melanoma and enabling New Zealanders to have free skin cancer spot checks. Suspicious lesions are referred to the individual's GP for further evaluation. Data on Melanoma New Zealand's spot check findings has been recorded throughout this period. As at 31 July 2024, 15,434 spot checks had been performed, with 382 suspected melanomas and 1577 other suspicious lesions identified and referred on for further evaluation.

Several other charities and community groups also offer free spot or skin checks as part of efforts to promote the early detection of skin cancer and support its prevention. At these events, patients are generally not given a diagnosis and those with lesions of concern are referred to their GP for further investigations.

New Zealand's healthcare system is currently facing significant challenges due to a shortage of healthcare professionals, including general practitioners and dermatologists, as well as lengthy wait times for both primary and secondary care services, especially in rural areas (Minister of Health, 2023; Ministry of Health, 2024). In many regions, telehealth services are becoming more prevalent, which may reduce chances for the opportunistic detection of skin cancer.

Skin cancer is the most common cancer managed by GPs. GPs are often the first port of call for patients seeking an examination for skin cancer, and in regional areas are the primary providers for patients. There is inconsistent uptake of dermatoscope use by GPs across the country, although most practices have one. GPs are responsible for around 80% of skin excisions, and

are increasingly performing surgical repairs such as flaps and grafts. Where lesions are difficult to manage or uncertain, common practice by GPs is to refer them to either a dermatologist or a public hospital.

Services and funding for skin cancer detection and management differ around the country. The Waitemata District Health Board Skin Service has demonstrated how appropriately trained GPs can better support the earlier detection and management of invasive skin lesions, helping to reduce patient wait times, treatment costs, and secondary/tertiary care workload (Wen, 2020). At this service, lesions are triaged by consultant surgeons through an e-referral system. If the consultant surgeon decides the lesion can be managed in primary care, it is referred to an appropriately trained GP and managed primarily at the GP facilities. GPs involved in the service have completed courses in skin cancer surgery and dermoscopy, and participated in a 6-month in-house training and mentor supervision programme. Comprehensive auditing processes are also in place. A retrospective audit of the performance of GPs involved in the service demonstrated an excision ratio of 70:30 malignant: benign, and a clear excision margin rate of 96.6% across keratinocyte cancer excisions. Median time to treat was 31 days across all lesions (Wen, 2020).

3. ***Training of primary health care professionals in the early detection of skin cancer***

There is relatively limited training in undergraduate medical school for dermatology and skin cancer specifically. Dermoscopy is not included in any curriculum.

The GP registrar programme run by the Royal New Zealand College of GPs and accredited through the Medical Council of New Zealand, includes a module on dermatology, 25% of which focuses on melanoma and keratinocyte cancers. Key competencies relating to skin cancer are:

- can identify common benign skin lesions, such as melanocytic naevi, benign keratoses, dermatofibromas and angiomas
- can recognise lesions that may be melanoma or keratinocyte skin cancer
- can appropriately monitor patients who have a high risk of skin cancer
- use appropriate investigations to diagnose dermatological conditions such as skin biopsy
- can recognise basic dermoscopy patterns and features in benign and malignant lesions.

The three-year programme requires the successful completion of formative and summative programme activities and clinical requirements. Formative assessments include activities such as seminar attendance, audits and mock examinations. Summative assessment include activities such as written and clinical exams, and fellowship assessment. Funding is provided to support attendance of first year registrars at educational events, but not for years two and three.

The College also has a Prior Specialist Training Pathway to Fellowship for doctors who have completed recognised general practice training programmes in other countries. 40% of GPs in New Zealand are overseas trained.

Competency in using a dermatoscope is not considered an essential skill for completing either programme.

Despite clinical best practice recommendations that clinicians working to detect skin cancer be trained in and use dermoscopy (MelNet 2023, BPAC 2021), after the registrar programme there is no standardised educational curriculum to further the incorporation of skin cancer examinations and procedures into general practice.

The number of GPs trained in and doing dermoscopy and minor skin surgery in New Zealand is not known. However, increasing numbers of GPs and nurses are choosing to undertake further training in skin cancer, and there is a growing number who now possess an advanced skill set in the use of dermoscopy and minor skin surgery.

Training courses and education in dermoscopy and minor surgery are offered by a range of providers:

Melanoma Network of New Zealand

Since its establishment in 2008, the Melanoma Network of New Zealand (charitable organisation) has offered a range of half-day, full-day and online introductory dermoscopy courses. Presented by Adjunct Associate Professor Amanda Oakley, an internationally regarded dermatologist, and endorsed by the Royal New Zealand College of General Practitioners for CME credit, these courses aim to improve participants' ability to identify typical benign skin lesions by their clinical and dermatoscopic characteristics and improve understanding of the common elements of dermoscopy.

Since 2017, MelNet has hosted 16 courses for over 850 health professionals, 69% of whom were GPs or GP registrars. 76% of those who completed post-event surveys reported having access to either the practice or their own dermatoscope – this rate remained relatively constant over the years. Evaluation indicates that these courses have increased participants' knowledge of skin lesions, and improved confidence and usage of a dermatoscope.

Skin Cancer Symposiums

Skin Cancer Symposiums (commercial provider) has been operating since 2017. They offer an in-person one day Introduction to Dermatoscopy course, a two-day Certificate of Dermatoscopy course and a one-day Certificate of Skin Cancer Management (minor surgery). They also offer an online Advanced Certificate of Dermatoscopy course which can be done at a delegates own pace and requires on average 100 hours to complete. The Dermatoscopy courses are taught by world leading experts - Professors Amanda Oakley and Cliff Rosendahl, in collaboration with a faculty of GPs, with advanced training in dermatoscopy and skin cancer surgery, and surgeons. To date over 3000 delegates (GPs, surgeons, dermatologists, and nurses) have attended the courses which have been offered in NZ and internationally. Evaluation indicates that these courses have helped to increase knowledge and confidence in using dermatoscopy to diagnose and manage lesions. All courses are endorsed by the Royal NZ College of General Practitioners for CME credit. Registration includes either a dermatoscope, text book or surgical training kit.

Skin Cancer College of Australasia

Founded in 2012, the Skin Cancer College Australasia (not-for-profit) provides both entry-level and advanced courses in dermoscopy and surgical techniques which are delivered online, in-person or in a blended format. These courses are recognised by the Royal New Zealand College of General Practitioners as an accredited academic component for the GPEP Fellowship qualification.

HealthCert

HealthCert offers a number of courses in dermoscopy and skin cancer surgery, ranging from beginner to advanced levels. Delivered predominantly online, with optional in-person

workshops held in Australia, these courses are recognised by the Royal New Zealand College of General Practitioners as an accredited academic component for the GPEP Fellowship qualification.

GPCME

The annual GPCME conferences offer four-hour beginner dermoscopy courses in Rotorua and Christchurch. Also presented by Adjunct Associate Professor Amanda Oakley, these courses cover the diagnosis of benign and malignant skin lesions and the basics of dermoscopy. Since 2010, around 1780 health professionals (predominantly GPs) have attended.

Feedback from several of these providers has highlighted that self-funding the costs associated with undertaking training courses and acquiring a dermatoscope and associated technology as significant barriers.

Online resources for clinicians on the early detection of skin cancer are also available on DermNet and BPAC.

Both Skin Cancer College Australasia and New Zealand Skin Cancer Doctors Society are not-for-profit membership organisations that offer professional development and peer support learning opportunities for members.

4. Risk assessment tools

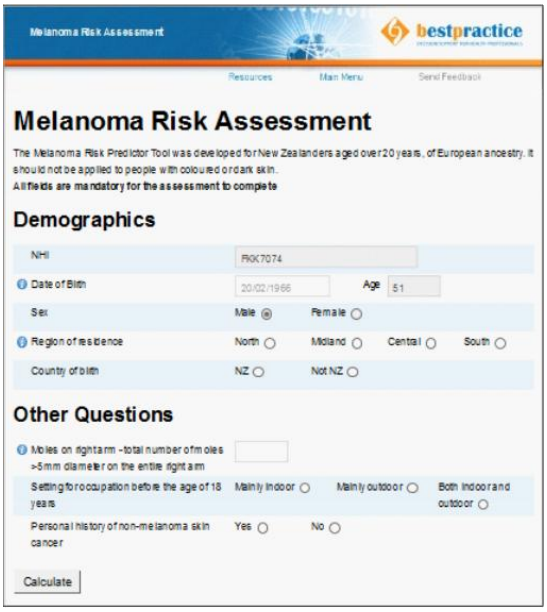
Use of risk assessment tools is encouraged by organisations such as MelNet and BPAC to help guide clinician-patient discussions on sun protection habits and skin cancer surveillance. Usage of risk assessment tools by primary care practitioners is not known.

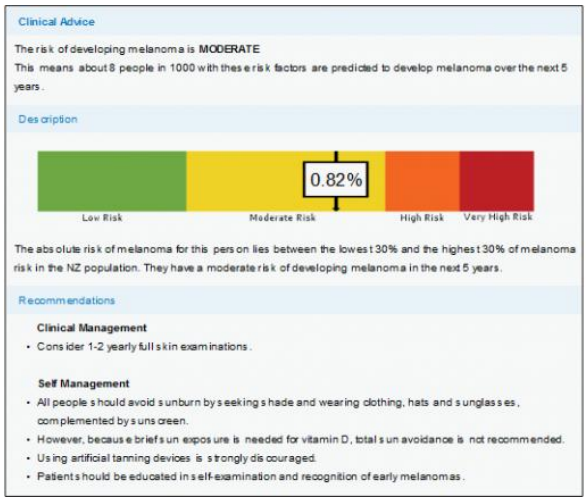
The Melanoma Network of New Zealand (MelNet) promotes the use of the following risk predictor tools:

New Zealand Melanoma Risk Calculator Clinical Decision Support Tool
This tool calculates a patient's risk of developing a first primary invasive melanoma in the next five years. It was designed for use by clinicians for asymptomatic New Zealanders who are aged 20 years and older, have fair, medium or olive skin and no current or past history of melanoma. It should not be applied to people with darker skin.

It is based on New Zealand data from the Hawkes Bay, Bay of Plenty, and Nelson-Marlborough regions (Sneyd, 2014).

Housed on BPAC, a bestpractice username and password are required for access. The questions are estimated to take less than five minutes to complete. Following this, a low, moderate, high, or very high risk of developing melanoma in the next five years will be provided, along with recommendations on clinical and self-management strategies.





Melanoma Institute Australia First Primary Melanoma Risk Calculator

This tool, developed by the Melanoma Institute of Australia is designed to generate a patient's risk of developing a first primary invasive melanoma during the rest of their life. It was designed for use by clinicians for those who have not had a previous primary melanoma.

It is based on data from Australian residents so may not be entirely accurate for a New Zealand population. Following testing, MelNet recommends New Zealanders select Tasmania as the region as this most closely correlates to New Zealand data. The model has been externally validated using four other case-control studies of melanoma and achieved reasonably similar results (Vuong ,2016).

The tool is easily accessible via the Melanoma Institute Australia website. The questions are estimated to take two to three minutes to complete. Following this, a lifetime and 10-year percentage risk of developing a primary invasive melanoma are provided, along with a statement on how this risk compares to others of the same age and sex in the selected location. Prevention and self-examination guidance are also provided.

Other tools

QIMR Berghofer Research Institute Melanoma Risk Predictor

This tool estimates a person's risk of developing melanoma over the next 3.5 years and is intended for those who have never been diagnosed previously with melanoma.

While New Zealand is available as a location option, the tool is based on a large Australian data set and has been validated in Australia. This means the performance of the predictor may not be entirely accurate for a New Zealand population.

Available on the QIMR Berghofer website, the survey contains 15 questions which are estimated to take less than five minutes to complete. Following this, a risk level of very much below average, below average, average, above average, or very much above average is provided. Advice on self-examination and Australian recommendations around clinical examination are given.

QIMR Berghofer Medical Research Institute keratinocyte cancer risk score

This tool estimates a person's risk of developing a keratinocyte cancer in the next three years. It is intended for those over 40 years of age.

The tool is based on a large Australian data set so may not be entirely accurate for a New Zealand population. The tool contains a series of 10 questions, which take less than five minutes to complete. Following this, a risk level of very much below average, below average, average, above average or very much above average is provided. Advice on self-examination and Australian recommendations around clinical examination are given.

Key organisational recommendations

The Quality Statements to Guide Melanoma Diagnosis and Treatment in New Zealand (MelNet, 2023) recommend:

[Public awareness]

- Public awareness campaigns supporting the detection of melanoma at an early stage in a range of settings
- Advising all adults, particularly those aged 50 years and over, to regularly examine their skin to improve awareness of any changes and seek advice on suspicious lesions from an appropriately trained healthcare professional.
- Smartphone applications are not used as a substitute for a skin examination by a medical practitioner.
- Information aimed at reducing melanoma deaths focuses on all adults; particularly males aged 50 years and over and raising awareness of melanoma in Māori and other ethnic minorities.

[Training of healthcare professionals]

- All primary health care professionals are knowledgeable about the most precise methods to estimate a patient's risk of melanoma, and subtypes of melanoma.
- All primary health care professionals are alert for skin lesions with malignant features in the context of physical examinations performed for other reasons.
- All primary health care professionals involved in the early detection of melanoma are trained in the use of the dermatoscope and regularly undertake refresher training.
- As part of diagnosing a skin lesion, clinicians arrange to carry out a full skin check by themselves or another healthcare professional
- All allied professionals who come into contact with people's skin have access to training in recognising skin changes suggestive of melanoma and in advising patients with suspicious lesions to see a health care professional

[Risk assessment and diagnostic tools]

- The use of teledermatology and e-referral systems to allow accurate triage and therefore expedite management of atypical pigmented lesions.
- The use of validated artificial intelligence tools alongside expert dermatoscopic analysis to enhance current clinical best practice.
- Health care professionals assess patients for future risk of melanoma using validated risk factors and a model that integrates personal risk factors into an overall index of risk.

- Individuals with a personal or family history of melanoma are examined carefully and are placed under the long-term care of a health care professional who is competent in dermatoscopy and digital dermatoscopy.

[Population screening]

- Population-based skin screening is not recommended at this time in the absence of substantive evidence as to its effectiveness in reducing mortality (Johansson et al 2019).

The Cancer Society of New Zealand position statement on Skin Cancer Screening and Early Detection (Cancer Society of New Zealand, 2020) does not recommend:

- Population screening for skin cancers
- Screening skin checks occurring outside clinical settings (such as at community events), as these can involve examination of single lesions without a full body examination and inadequate follow-up and referral.
- Opportunistic screening by health professionals as routine practice. However, general practitioners should remain alert for skin lesions with malignant features in the context of physical examinations performed for other reasons
- Smartphone applications by individuals to self-diagnose melanoma.

The Cancer Society of New Zealand position statement on Skin Cancer Screening and Early Detection (Cancer Society of New Zealand, 2020) recommends:

- The general public is encouraged to become familiar with their skin and should regularly check all body areas. If there are any new or changing spots, or other skin changes, then advice should promptly be sought from a doctor.
- Encouraging people to do regular (at least monthly) skin checks. People over the age of 50, particularly men, should be especially diligent.
- Individuals who are concerned about skin cancer discuss their skin cancer risk and need for medical checks or self-examination.

- General practitioners develop surveillance programmes for patients at high-risk of melanoma. Risk should be estimated using the NZ risk predictor tool.
- Clinicians/general practitioners who identify patients at increased risk for skin cancer provide advice on sun protection and offer a full body skin examination and an appropriate management plan with follow-up based on their individual level of risk.
- General practitioners assess patients who are concerned and develop appropriate management programmes based on their level of risk.
- Where opportunistic screening is undertaken, patients should be informed about the potential benefits and risks of screening and the likely implications of a positive or negative result as well as their right to a second opinion should they choose

New Zealand Skin Cancer Doctors Society SCC and BCC Follow-Up Guidelines (New Zealand Skin Cancer Doctors Society, 2023) recommend providing patient education on sun protection and skin self-examination during follow-up after diagnosing squamous cell carcinoma (SCC) and basal cell carcinoma (BCC).

8. Vitamin D

UVR is both the major cause of skin cancer and the best source of vitamin D. It is important to balance the risks of skin cancer from sun exposure with maintaining adequate vitamin D levels.

Achieving this balance is not the same for all New Zealanders. The amount of sun exposure needed to make vitamin D depends on UV level, skin type, amount of skin exposed, and lifestyle.

The Consensus Statement on Vitamin D and Sun Exposure in New Zealand, published by the Ministry of Health and the Cancer Society of New Zealand in 2012, offers guidance on vitamin D and sun exposure (Ministry of Health and Cancer Society of New Zealand, 2012). It recommends:

- The general population get some sun exposure to aid vitamin D synthesis.
- Using sun protection (shade, clothing, a hat, sunscreen, sunglasses) from September to April, especially between 10 am and 4 pm.
- Some sun exposure between May and August- preferably to the arms, hands and face in the hours around noon.
- Using sun protection year-round if you are at high altitudes and near reflective surfaces like snow or water, have a history of skin cancer, have sun-induced skin damage, or are on medications that affect photosensitivity.
- Considering vitamin D supplementation if you have naturally very dark skin, avoid sun exposure, spend little time outdoors (particularly those who live in the cooler southern regions), have low mobility, liver or kidney disease or are on medications that affect Vitamin D levels.

Since 2012, further research into the risks and benefits of sun exposure has been undertaken and more sophisticated recommendations to guide behaviour in diverse populations have been developed.

Recommendations based on latest Australian research (ASSC 2023, Neale 2024) are:

Adults who have pale skin that burns easily and never tans are at high risk of skin cancer. Sun protection should always be used when UV levels are forecast to reach 3 or above and time spent outdoors should be avoided. When UV levels are between 1 and 2, sun protection should be used when time spent outdoors exceeds two hours across the day. Anyone with a history of skin cancer is automatically considered high risk.

Adults who have light brown or olive skin that tans and minimally burns are at intermediate risk of skin cancer. Sun protection remains important and should be used when UV levels are forecast to reach 3 or above. A small amount of time spent outdoors most days will maintain adequate levels of vitamin D. When UV levels are between 1 and 2, sun protection should be used when time spent outdoors exceeds two hours across the day.

Adults who have darker skin that rarely or never burns are at low risk of skin cancer and greater risk of developing vitamin D deficiency. People in this group should spend time outdoors on most days of the week with some skin uncovered. Sun protection should be used for extended periods outdoors when the UV is 3 or above.

For adults who are unable to maintain adequate vitamin D levels, supplementation may be required.

For vitamin D production, the best approach is to expose as much skin as possible in as short a time as possible. Most adults will maintain adequate vitamin D levels from sun exposure during typical day-to-day outdoor activities. There is little evidence to suggest that sunscreen increases risk of vitamin D deficiency (Australian Skin and Skin Cancer Research Centre, 2023).

9. History of the Strategy

The Skin Cancer Prevention and Early Detection Strategy (the Strategy) has been instrumental in guiding skin cancer prevention and early detection efforts since its inception in 2001.

Facilitated by a dedicated steering committee comprising researchers and representatives from skin cancer-focused organisations, the Strategy has evolved through iterative improvements, strengthening New Zealand's approach to combating skin cancer.

Key milestone meetings in 2001, 2004, 2007, 2010, 2013, 2016, and 2024 have played pivotal roles in refining and enhancing New Zealand's strategies for prevention and early detection.

Funding to support the Strategy's development has been provided in past years by the Health Promotion Agency (formerly Health Sponsorship Council) and more recently Health New Zealand – Te Whatu Ora, with coordination efforts led by the Cancer Society of New Zealand (2001–2007) and MelNet (2010–present).

Contributors to 2024 Strategy

This body of work wouldn't have been possible without the hard work and robust discussion of the working group members.

Dr Bronwen McNoe (University of Otago)
Professor David Whiteman (QIMR Berghofer Research Institute)
Associate Professor Catherine Olsen (QIMR Berghofer Research Institute)
Katrina Patterson (MelNet)
Shayne Nahu (Health New Zealand - Te Whatu Ora)
Heather Walker (former Head of SunSmart, Cancer Council Victoria)
Mr Gary Duncan (MelNet)
Dr Chris Boberg (MelNet)
Dr Samantha Murton (Royal New Zealand College of GPs)
Professor Louise Signal (University of Otago)
Andrea Newland (Melanoma New Zealand)
Hannah Booth (Cancer Society of New Zealand)

Feedback from the following parties was evaluated by the working group and included where appropriate:

Institution

- Cancer Society of New Zealand
- Consumer New Zealand
- Cosmetics New Zealand
- Essential Touch New Zealand
- New Zealand Association of Plastic Surgeons
- New Zealand Dermatological Society Incorporated
- New Zealand School Boards Association

- New Zealand Skin Cancer Doctors
- Office of Early Child Education
- Royal New Zealand College of General Practitioners
- Royal Australasian College of Surgeons
- Sport New Zealand
- SunSmart Victoria
- WorkSafe New Zealand

Individual

- Christina Mackay, Adjunct Research Fellow, School of Architecture, Victoria University of Wellington
- Dr George Karageorge, General Practitioner with special interest in skin cancer, Porirua
- Dr Susan Seifried, General Surgeon, Te Whatu Ora Nelson Marlborough
- Emeritus Professor Richard McKenzie, Atmospheric Scientist, NIWA
- Hayley Apanowicz, Masters Student, Victoria University of Wellington
- Linda Buxton, previously worked in health promotion at the Cancer Society of New Zealand
- Martin Gledhill, EMF Services
- Professor Amanda Oakley, Dermatologist, Te Whatu Ora Waikato
- Sonya Bodley, General Practitioner with special interest in skin cancer, Wellington

Appendix 1: Tables

Table 1: Age–standardised invasive and *in situ* melanoma incidence in New Zealand, and average annual percentage change (AAPC) in the rates between 2000 and 2021.

	ASR (2000)			ASR (2021)			AAPC (95% CI) 2000-2021		
	Men	Women	Persons	Men	Women	Persons	Men	Women	Persons
Invasive (all)	46.3	45.3	45.7	50.0	43.9	47.3	0.4 (-0.3 to 1.0)	-0.4 (-0.7 to 0.1)	0.0 (-0.4 to -0.4)*
Age group[1]									
0-19 years	0.85	0.54	0.70	0.61	0.80	0.70	-3.1 (-5.7 to -0.4)*	-5.2 (-8.1 to -2.2)	-4.2 (-6.5 to -1.8)*
20-39 years	15.2	25.1	20.3	9.0	12.2	10.5	-3.9 (-4.9 to -3.0)*	-4.2 (-5.0 to -3.3)*	-4.2 (-4.8 to -3.5)*
40-59 years	57.8	64.3	61.1	50.9	56.8	53.9	-0.8 (-1.3 to -0.3)*	-1.0 (-1.4 to -0.6)*	-0.9 (-1.2 to -0.6)*
60-79 years	152	108	129	188	124	155	0.6 (0.2 to 0.9)*	0.6 (0.1 to 1.0)*	0.6 (0.3 to 0.9)*
80+ years	263	147	187	354	185	281	1.7 (0.9 to 2.6)*	1.0 (0.1 to 2.0)*	1.7 (1.0 to 2.5)*
In situ	30.6	27.0	28.7	77.5	66.0	72.4	4.5 (2.4 to 6.6)	4.1 (3.7 to 4.6)	4.4 (2.2 to 6.7)*

ASR – age-standardised incidence rate (Australia 2001 Standard Population), AAPC – average annual percent change, CI – confidence intervals

[1] Age-specific rates are crude

*AAPC is significantly different from zero at the alpha = 0.05 level

Table 2. Age–standardised invasive melanoma incidence in New Zealand, and average annual percentage change (AAPC) in the rates between 2000 and 2021, by prioritised ethnic group

Ethnic group	ASR (2000)	ASR (2021)	AAPC (95% CI) 2000-2021
Māori	3.11	14.0	4.3 (3.0 to 5.7)*
Pacific Islander	2.64	4.57	4.9 (-1.2 to 11.3)
Asian	1.15[1]	1.42	1.0 (-4.9 to 7.3)
European/Other	57.8[1]	60.7	-0.1 (-0.5 to 0.3)

ASR – age-standardised incidence rate (Australia 2001 Standard Population), AAPC – average annual percent change, CI – confidence intervals
[1] Rates are for 2006
*AAPC is significantly different from zero at the alpha = 0.05 level

Table 3. Age–standardised invasive melanoma incidence in New Zealand, and average annual percentage change (AAPC) in the rates between 2000 and 2021, by stage of disease.

Stage	ASR (2000)	ASR (2021)	AAPC (95% CI) 2000-2021
Local	40.8	40.1	-0.3 (-0.6 to -0.0)
Local invasion	1.70	1.38	-1.1 (-3.3 to 1.2)
Regional	0.66	2.30	4.6 (3.3 to 6.0)*
Distant	1.29	2.27	-0.9 (-2.0 to 0.3)
Unknown	1.19	1.25	1.2 (-4.0 to 6.8)

ASR – age-standardised incidence rate (Australia 2001 Standard Population), AAPC – average annual percent change, CI – confidence intervals
*AAPC is significantly different from zero at the alpha = 0.05 level

Table 4. Age–standardised melanoma mortality rate (ASMR) in New Zealand, and average annual percentage change (AAPC) in the rates between 2000 and 218.

Stage	ASMR (2000)	ASMR (2015)	ASMR (2018)	AAPC (95% CI) 2000-2015	AAPC (95% CI) 2015-2018
Men	8.86	9.44	6.45	0.6 (0.0 to 1.1)	-11.8 (-17.1 to -6.1)*
Women	5.34	4.89	3.79	0.6 (0.0 to 1.1)	-11.8 (-17.1 to -6.1)*
Persons	7.04	7.26	5.21	0.8 (0.2 to 1.4)*	-11.5 (-17.2 to -5.3)*

ASR – age-standardised incidence rate (Australia 2001 Standard Population), AAPC – average annual percent change, CI – confidence intervals
*AAPC is significantly different from zero at the alpha = 0.05 level

Table 5. Age-standardised incidence of keratinocyte cancer in New Zealand, from published reports.

Geographic region First author (year of publication)	Year/ time period	Persons/ lesions	Age standardised incidence rate (ASR) per 100,000		
			Men	Women	Persons
Bay of Plenty region					
Sneyd (2018)		**Persons**			
Keratinocyte cancer[a]	2013	non-Māori	822	755	786
	2013	Māori	45	57	51
BCC[a]	2013	non-Māori	647	573	608
		Māori	35	42	38
SCC[a]	2013	non-Māori	328	254	289
		Māori	13	18	15
		Lesions			
Keratinocyte cancer[a]	2013	non-Māori	2276	1533	1882
		Māori	102	108	101
BCC[a]	2013	non-Māori	1645	1135	1375
		Māori	69	75	70
SCC[a]	2013	non-Māori	631	398	506
		Māori	33	33	31
Auckland region					
Pondicherry (18)					
Keratinocyte cancer	2008	**Lesions**	2035[c]	1189[c]	1906[b]
BCC	2008	**Lesions**	1500[c]	868[c]	1385[b]
SCC	2008	**Lesions**	535[c]	321[c]	522[b]
Bay of Plenty region					
O'Dea (2000)					
Non-melanoma skin cancer[a]	1998	**Persons**	1466	890	1158
BCC[a]	1998	**Persons**	974	612	781
SCC[a]	1998	**Persons**	492	278	377
Hamilton region					
Freeman (1982)					
Non-melanoma skin cancer[a]	1978-1980	**Persons**			384
		Lesions			517

[a] Standardised to the WHO 2000 population
[b] Standardised to the Australian 2001 population
[c] Crude rate

Table 7: Projected increase in skin cancer healthcare costs over time

Year	Keratinocyte cancers	Melanoma	Total
2020	274.25	112.21	386.46
2021	281.89	117.61	399.50
2022	289.94	123.37	413.32
2023	297.90	129.36	427.26
2024	305.98	135.57	441.56
2025	314.02	140.56	454.58
2026	322.18	145.72	467.89
2027	330.65	151.10	481.75
2028	339.04	156.64	495.68
2029	347.29	162.27	509.56
2030	355.37	166.39	521.76
2031	363.32	170.53	533.86
2032	371.31	174.77	546.07
2033	379.23	179.07	558.29
2034	387.00	183.38	570.38
2035	394.47	186.07	580.54
2036	401.83	188.70	590.53
2037	409.14	191.32	600.46
2038	416.24	193.83	610.07
2039	423.17	196.23	619.40
2040	429.81	197.21	627.02
2041	436.31	198.05	634.37
2042	442.74	198.81	641.55
2043	448.95	199.41	648.36
2044	455.12	199.97	655.09
2045	461.53	199.90	661.43
2046	468.18	199.87	668.05
2047	475.09	199.87	674.96
2048	482.26	199.91	682.17
2049	489.71	199.99	689.70

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