ASSC Australian Skin and Skin Cancer Research Centre

Meeting Report for

The Sunscreen Summit

19-20 March, 2018

The University Of Queensland AUSTRALIA

QIMR Berghofer Medical Research Institute

The Sunscreen Summit

Meeting Report

19-20 March, 2018

Venue: QIMR Berghofer Medical Research Institute, Brisbane, Australia

Host: The Australian Skin and Skin Cancer Research Centre www.assc.org.au

Organising Committee: David Whiteman, Adele Green, Rachel Neale, Louisa Gordon, Catherine Olsen, H. Peter Soyer, Monika Janda, Joanne Aitken

10:30	**Introduction and welcome**	David Whiteman, QIMR Berghofer
10:40	**Health economics of skin cancer**	Louisa Gordon, QIMR Berghofer
Session I:	**Sunscreens: policies, effectiveness and use** *Chair: Prof Joanne Aitken*	
11:00	**Sunscreen testing & formulations**	John Staton, Dermatest Pty Ltd
11:20	**Current sunscreen policies**	Monika Janda, University of Qld
11:40	**Effectiveness of sunscreen in humans**	Adele Green, QIMR Berghofer
12:00	**Molecular studies of sunscreen in humans**	David Whiteman, QIMR Berghofer
12:15	**Use of sunscreen in the Australian population**	Suzanne Dobbinson, Cancer Council Victoria
12:30	Lunch Break	
Session II:	**Barriers to use of sunscreen**	*Chair: Dr Catherine Olsen*
1:30	**Safety of sunscreens**	Stephen Shumack, Aust College of Dermatologists
1:45	**Sunscreen regulations**	Cheryl McCrae, TGA
2:00	**Consumer concerns about sunscreen**	Belinda Castles, Consumer NZ Karina Bray, CHOICE
2:20	**Sunscreen and (social) media**	Hollie Jenkins, Cancer Council Australia
2:40	**Sunscreen and Vitamin D**	Rachel Neale, QIMR Berghofer
3:00	**Studies of sunscreen penetration**	Tarl Prow, University of South Australia
3:20	**Studies of Nano-particles**	Brian Gulson, Macquarie University
3:40	Afternoon Tea	
Session III:	**Sunscreen - Challenges and Opportunities** *Chair: Prof David Whiteman*	
4:00	**Panel Discussion**	Terry Slevin, Adèle Green, Stephen Shumack, Cheryl McCrae and Karina Bray
5:00	**Wrap-up of Sunscreen Summit**	Dallas English, University of Melbourne
5:15	Day 1 of Sunscreen Summit closes	
Session IV:	**Closed session (Day 2 – invitation only)**	
8:30 – 12:30	**Policy forum** **By invitation only**	*Facilitator:* Dallas English

Background

Cancers of the skin, including melanomas and keratinocyte cancers (basal cell carcinomas and squamous cell carcinomas) are the commonest cancers in man. These cancers occur predominantly (though not exclusively) in fair-skinned people, for whom the principal modifiable causal factor is solar ultraviolet (UV) radiation. The populations of Australia and New Zealand have the highest incidence and mortality from skin cancer in the world. These two nations also lead the world in efforts to control the impact of these cancers. Primary prevention is one of three complementary approaches to skin cancer control (alongside early detection and better treatment) and by far the most cost-effective. Sunscreen application is a major component of the primary prevention advice, although agencies differ in their advice to the public about when and how to apply sunscreen. Given the importance of skin cancer to the Australian population, a **Sunscreen Summit** was held in Brisbane (19-20 March, 2018) to review the latest evidence regarding sunscreen and its effectiveness and adopt a consensus approach to policy. The summit was convened by the Australian Skin and Skin Cancer Research Centre (www.assc.org.au) and brought together more than 100 representatives from cancer control agencies, government departments, specialist medical colleges, research institutions, policy makers and consumers. **Day 1** of the Summit involved a series of invited talks; Day 2 was a closed forum attended by policymakers from key organisations with existing position statements on skin cancer prevention. A summary of the meeting follows.

Session I: Sunscreens: policies, effectiveness and use

The Summit opened with an address by **Associate Professor Louisa Gordon** (QIMR Berghofer Medical Research Institute) on the health economics of skin cancer. A/Prof Gordon reminded the audience that melanoma is diagnosed in more than 13,000 Australians each year, and it is estimated that some 700,000 people annually are treated for keratinocyte cancers. She presented analyses documenting the steeply rising costs of new treatments for melanoma, adding to the high costs of treatments for keratinocyte cancers (>600, 000 excisions per year; 12,053 excisions per week; direct medical costs exceed $700 million per year). Moreover, more than 1.2 million skin biopsies occur each year, at an annual cost of more than $40 million. In contrast to the ongoing investment in treating skin cancer, there has been no national funding of skin cancer prevention for more than a decade. A/Prof Gordon also described trends in sunscreen sales in Australia. The market value of sunscreens in Australia (worth $159 million) has on average increased by 7% over the last five years but is slower than double-digit growth in self-tanning products (11%). Manufacturers of sunscreen are investing in new products offering convenience, moisture and light feel. A/Prof Gordon concluded with a review of the cost-effectiveness for primary prevention of skin cancer, citing evidence that this strategy is cost-saving.

Dr John Staton (Dermatest Pty Ltd) addressed sunscreen testing and sunscreen formulations. The current standard in Australia (AS/NZS 2604 -2012) adheres to ISO methods (ISO 24444 and ISO 24443) for primary and secondary sunscreens, and imposes additional criteria for water resistance that are more exacting than criteria used in other countries. Dr Staton reminded the audience that under test conditions, sunscreen is applied at 2 mg/cm^2 15-30 mins prior to exposure to the solar simulator; this level of sunscreen application is seldom observed in general use. He explained that the sun protection factor (SPF) used to rate sunscreen performance is a product of the proportion and efficiency of the

active ingredients within a given formulation, as well as the thickness of the film that forms on the skin surface and the substantivity (water resistance). The importance of film thickness on sun protection ability was stressed. Sunscreen sticks or balms that contain 100% non-volatile agents applied at 2 mg/cm^2 will coat the skin to a thickness of 20 microns, whereas lotions or creams with volatile vehicles (typically 50%) will evaporate leaving a dried film of only 10 microns and consequently reduced protection. Aerosols, being 80 percent volatile, will evaporate such that the dried film thickness may be only 4 microns. Some of the challenges in extrapolating information from laboratory-derived, solar-simulated exposures to use in the natural environment were also discussed. During question time, Dr Staton discussed the variability in testing results demonstrated across laboratories, highlighting the need for standardisation in this area.

Professor Monika Janda (The University of Queensland) presented an overview of existing sunscreen policies. To put her presentation in context, she gave the audience a background on WHO definitions of health policy, and then explained the methods underpinning her policy review. She identified five key themes relating to sunscreen policy; specifically, they should describe (1) features of sunscreen (2) how sunscreen is applied (3) awareness (4) supply and (5) storage of sunscreen. Prof Janda identified 13 international and 62 national policies, of which 69 policies were available for formal evaluation. Overall, there was high level of concordance regarding the degree of protection recommended, with 83% of policies advising at least SPF 30. There was great variability across the policies with respect to whether or not advice was given on when to apply or re-apply sunscreen, and how much to use.

Professor Adèle Green (QIMR Berghofer Medical Research Institute) reviewed the evidence regarding the long-term effectiveness of sunscreens in humans. She highlighted the particular challenge of 'confounding by indication' faced by traditional epidemiological studies, whereby use of sunscreen is greatest among those at highest risk of skin cancer by virtue of either their phenotype, their patterns of sun exposure, or both. The only interpretable data therefore come from randomised controlled trials, of which there have been three (1) the Maryborough (Victoria) trial with actinic keratoses (AK) as the endpoint (2) the Nambour (Queensland) trial with AK, BCC, SCC and melanoma as endpoints and (3) the Vancouver (British Columbia) trial with naevi as the endpoint. All three trials showed significant reductions in development of primary endpoints (except BCC) among those assigned to the sunscreen intervention. Professor Green also examined the various arguments proposed against advocating use of sunscreen, including concerns about unintentionally increasing sun exposure ('compensation hypothesis'), reducing Vitamin D production, inducing skin allergies, or reducing use of hats or clothing. There was no evidence from the trials that any of these concerns were valid.

Professor David Whiteman (QIMR Berghofer Medical Research Institute) focussed on the short-term effectiveness of sunscreens in preventing acute damage to DNA arising from exposure to UV radiation. He presented data from a small clinical trial in which 57 volunteers were exposed to solar-simulated UV radiation on two patches of skin, one of which was pre-treated with SPF 30+ sunscreen and one not. Skin biopsies taken before UV exposure, at 24 hours and at 14 days were compared for a variety of biomarkers. The skin pre-treated with sunscreen was essentially indistinguishable from the control skin (not treated, not exposed to UV radiation) for all biomarkers. He then presented the findings of a systematic review of all studies that had performed similar experiments in human subjects. Eight studies met the inclusion criteria (*in vivo* studies; in humans; pre-treatment with sunscreen; exposure to solar-simulated UV radiation; biopsies of exposed, treated and unexposed sites; assessment of DNA damage). In all studies, the skin treated with sunscreen and then exposed to UV radiation had markedly lower

DNA damage than unprotected skin exposed to the same dose. He concluded that modern sunscreens prevent not only erythema, but also the biological damage that initiates carcinogenesis.

Professor Suzanne Dobbinson (Cancer Council Victoria) provided an update on the current patterns of sun protection behaviours in the Australian population. Presenting data from the most recent National Sun Protection Survey (2016-2017, n=3614 adults and 894 adolescents) and comparing with equivalent data from previous surveys, she reported an overall increase in the proportion of people using sunscreen, but concerning trends regarding numbers of sunburns reported on the previous weekend.

Session II:	**Barriers to use of sunscreen**

Professor Stephen Shumack (Australasian College of Dermatologists) spoke on sunscreen safety, addressing issues of public concern including adverse reactions, nanoparticles, oestrogen absorption, free radicals and cancer and environmental concerns (e.g. marine life, corals). He noted that sunscreen intolerance was uncommon and mostly due to irritation True allergic contact dermatitis to sunscreen actives are rare and allergies to sunscreen are more often due to the other ingredients (excipients) such as fragrances and preservatives. Some sunscreen actives need to be photo converted into an allergen by UV exposure thereby causing a photo allergic contact dermatitis. Community concerns about nanoparticles in sunscreens were also addressed, with Professor Shumack pointing to extensive reviews conducted by the Therapeutic Goods Administration (TGA) in 2017 finding no evidence of harm from nanoparticles. Concerns that oxybenzone absorbed through the skin might disrupt oestrogen synthesis, or that retinyl palmitate might generate free radicals upon exposure to UV, were also shown to be unfounded. More recently, some have questioned whether sunscreen ingredients may cause biological damage to coral reefs; very few studies have been performed, and none was of high quality. This remains an open question, although arguably of low importance for the majority of sunscreen usage.

Dr Cheryl McCrae (Therapeutic Goods Administration, TGA) gave an account of sunscreen testing from the perspective of the regulator. She commenced with an overview of the Australian regulatory environment, stating that sunscreens are regulated as therapeutic goods and are required to be included on the Australian Register of Therapeutic Goods (ARTG) prior to being supplied. The TGA defines primary sunscreens as having the primary purpose of protecting against UV radiation, in contrast to secondary sunscreens, which have a primary purpose other than sunscreen (e.g. cosmesis) but also contain a sunscreening agent. (Secondary sunscreens with SPF of 15 or greater also have to be listed in the ARTG). Cosmetic sunscreens are regulated separately by the National Industrial Chemicals Notification and Assessment Scheme (NICNAS) and the Australian Competition and Consumer Commission (ACCC). The vast majority of therapeutic sunscreens are considered listed (low risk) medicines and must comply with AS/NZS 2604:2012. In Australia, sunscreens must contain only approved ingredients (titanium dioxide, zinc oxide and 27 approved organic compounds), and this applies both to therapeutic and cosmetic sunscreens. Sunscreens must be manufactured in accord with Good Manufacturing Practice (GMP) and must perform pre-market testing according to the relevant standard. Dr McCrae explained that TGA monitors compliance through targeted reviews and laboratory testing of listed sunscreens, and found very high compliance standards in terms of manufacture. (TGA does not conduct SPF testing). Dr McCrae concluded with some areas of concern, notably, the emergence of recipes for ‘natural’ or ‘home-made’ sunscreens; where products are found to be in breach of legislation, then TGA will take appropriate action.

Belinda Castles (Consumer NZ) and **Karina Bray** (Choice) outlined consumer perspectives on sunscreens. Belinda informed the audience that regulations regarding sunscreen differ markedly on each side of the Tasman; in contrast to Australia's position that sunscreens are listed therapeutics, all sunscreens are classified as cosmetics in New Zealand. With essentially no regulatory protection for the public from government agencies, Consumer NZ has taken on responsibility for conducting laboratory testing of sunscreens sold in New Zealand. In their most recent audit, 9 of 20 sunscreens failed to meet SPF claims. Consumer NZ pursued action through the NZ Commerce Commission, which subsequently found that manufacturers had breached the Fair Trade Act (NZ). Karina Bray presented the findings of recent consumer surveys eliciting barriers to sunscreen use. She found that the commonest reasons for not wearing sunscreen were simply forgetting to apply sunscreen, followed by a preference for other methods of sun protection. The main barrier to use was that some people did not like the feel of sunscreen on their skin. When questioned directly about safety of sunscreens, consumers expressed uncertainty about use on babies, toddlers and pre-schoolers. Concerns about chemicals and nanoparticles were minority views.

Hollie Jenkins (Cancer Council Australia) spoke to the theme of sunscreens and the media. She noted that sunscreen has become increasingly topical and newsworthy, as evidenced by significant increases in online searches for sunscreen with two clear spikes in January 2017 and January, 2018. This parallels an increase in the number of inquiries to Cancer Council Australia about sunscreen, with 87 in 2016 and 161 in 2017. The topics for which the media sought information included nanoparticles, vitamin D and sunscreen SPF testing. Hollie observed that social media is playing an increasing role in shaping community attitudes. She noted that there is increasing public interest in natural sunscreens and toxic ingredients, with individual adverse experiences disseminating rapidly – often labelled as 'sunscreen failures' or 'sunscreen hazards'. Such episodes are usually misinformed, yet they undermine public confidence in sunscreen and serve to perpetuate myths. Hollie suggested that the best approach to dealing with such misinformation is for leading agencies to monitor and engage in social media activity, and to use traditional media outlets to dispel sunscreen myths.

Associate Professor Rachel Neale (QIMR Berghofer Medical Research Institute) addressed a widespread concern that sunscreen might influence Vitamin D levels. A/Prof Neale described the physiology of vitamin D production in humans, outlining the role of UVB in catalysing the synthesis of active vitamin D. She then summarised the findings of a large body of literature investigating whether sunscreen inhibits the synthesis of vitamin D. A distinction was drawn between small laboratory experiments (in which human subjects applied sunscreen prior to exposure to various regimens of solar-simulated UV radiation) and large-scale clinical trials (in which free-living humans were randomised to interventions requiring participants to apply moderate SPF sunscreens on a daily basis, and then followed for long periods). Whereas the laboratory experiments found that vitamin D levels were lower among those who received sunscreen prior to artificial UV exposure, the field trials found no difference in vitamin D levels between sunscreen users and controls (but did find large differences in various measures of actinic skin damage, including cancers). She concluded that while there is a theoretical risk that regular sunscreen use could lead to low vitamin D concentrations, in practice this has not been observed. A/Prof Neale did caution that the trials were done with sunscreens with SPFs <20, and the effects of daily SPF 50 sunscreens on vitamin D levels are not known with certainty.

Professor Tarl Prow (University of South Australia) and **Professor Brian Gulson** (Macquarie University) addressed the topic of nanoparticles and the extent to which they penetrate the skin. In a series of

experiments in human volunteers, Professor Prow examined whether nanoparticles in sunscreen reach living cells, and if so, what happens. The team used electron microscopic techniques to scan the various layers of the epidermis for evidence of nanoparticle penetration at specified intervals after sunscreen was applied. In normal skin, very small quantities of nanoparticles could be detected in the stratum spinosum at 4 hr and 24 hr after application, but the vast majority remained in the stratum corneum. In patients with psoriatic or atopic lesions, there was some penetration into the epidermis. In further experiments, they showed that all of the nanoparticles were removed following washing of the skin with soap and water. Professor Gulson tested whether nanoparticles could be detected in blood and urine after sunscreen had been applied to the skin under both laboratory and 'real world' conditions. The sunscreens used in the experiments (one using zinc nanoparticles and one using 'bulk' zinc) were formulated using a stable, naturally occurring, non-radioactive, zinc isotope (^{68}Zn) to permit tracing. The amounts of Zn entering the body over the 5 day study (mean 15µg) were around 0.1% of the concentration of Zn already in the volunteers' bloodstream (~12mg). Prof Gulson concluded that there is no evidence that the very small amounts of zinc entering the body via sunscreen have any adverse effects.

Session III: Sunscreen - Challenges and Opportunities

Following the formal presentations, a panel of experts comprising **Terry Slevin** (Cancer Council Western Australia), **Adèle Green, Stephen Shumack, Cheryl McCrae** and **Karina Bray** discussed a range of issues relating to sunscreen, particularly focussing on safety, regulations and effectiveness. While some members of the public express concerns about sunscreen ingredients, consumer surveys suggest that most Australians (about 85%) believe sunscreens are safe and effective. The Cancer Councils echoed this perception based on their independent experiences. Cheryl McCrae noted that Australia's regulatory environment probably helps underpin the public's perception of sunscreen safety, with Australia being at the high end of oversight for sunscreens. The situation in Australia contrasts to New Zealand where the market is much less regulated; as a consequence New Zealand consumers are confronted with a range of products, some of which are demonstrably non-compliant with the AS/NZS 2604:2012. The panel was asked about the differences between incidental (everyday, unintentional) sun exposure and intentional (e.g. recreational, occupational) sun exposure, and how sunscreen advice should be tailored for these situations. There was consensus that protection from incidental UV exposure is best achieved by daily sunscreen application (consistent with the intervention arms in the Nambour and Maryborough prevention trials), with some on the panel expressing the caveat that this advice should apply only when the maximum UV index is predicted to be 3 or more. Barriers to sunscreen use, including concerns about vitamin D, adverse reactions, and formulations were also discussed. Panel members reminded the audience that sunscreen is only one component of a comprehensive sun protection strategy and, while important, sunscreen should not be used in isolation. The panel discussion closed with a call to arms to continue primary prevention and work with the commonwealth and state governments to invest, noting that sunscreens prevent not only skin cancer, but also other forms of photodamage for which many consumers are willing to invest in protection.

Day 2 – Closed Workshop

Facilitator: Professor Dallas English, University of Melbourne

Attendees

Stephen Shumack	Former President	Australasian College of Dermatologists
Sanchia Aranda	CEO	Cancer Council Australia
Anita Dessaix	Manager	Cancer Council NSW
Joanne Aitken	Head of Research	Cancer Council Queensland
Craig Sinclair	Manager	Cancer Council Victoria
Terry Slevin	Manager	Cancer Council Western Australia
Mark Strickland	Policy Officer	Cancer Council Western Australia
Linda Buxton	Policy Officer	Cancer Society of New Zealand
Megan Chapman	Manager	Health Promotion Agency New Zealand
Georgina Long	Director	Melanoma Institute Australia
Victoria Beedle	CEO	Melanoma Patients Australia
Rachel Neale	Epidemiologist	QIMR Berghofer
Louisa Gordon	Health Economist	QIMR Berghofer
Catherine Olsen	Epidemiologist	QIMR Berghofer
Adele Green,	Epidemiologist	QIMR Berghofer
David Whiteman	Epidemiologist	QIMR Berghofer
Jodie Antrobus	Policy Officer	Queensland Health
Mai Tam	President	Skin & Cancer Foundation
Keith Monnington	President	Skin Cancer College Australasia
Heather Walker	Manager	SunSmart
Peter Soyer	Dermatologist	The University of Queensland
Monika Janda	Psychologist	The University of Queensland
Cheryl McRae	Manager	Therapeutic Goods Administration
Victoria Mar	Dermatologist	Victorian Melanoma Service

The closed policy workshop had one goal: to develop an evidence-based consensus statement about when to apply sunscreens. Dallas English opened proceedings with an invitation to each delegate to introduce themselves and present the position statement or policy pertaining to sunscreen use from their own organisation. (Hyperlinks to policies / position statements are collated in Appendix 1). Following each introduction, other delegates were invited to question the speaker to clarify particular points. At the close of the first session, the panel identified areas where policy advice was concordant across organisations (i.e. advice to use high SPF sunscreens; apply before outdoor exposure) followed by a discussion about areas where policy advice varied (i.e. when to apply; frequency of reapplication; volume to apply) or was lacking (i.e. intentional vs recreational/occupational exposure).

The second session opened by presenting delegates with a new draft statement on when to apply sunscreen. The Organising Committee developed the draft statement prior to the Summit and had not shared the statement with any external parties. The draft statement differed from existing policies by explicitly distinguishing incidental sun exposure from intentional sun exposure, and providing separate advice for each circumstance. The draft statement acknowledged that advice regarding incidental exposure would need to be tailored for seasonal and geographic differences in ambient UV radiation,

and made these distinctions at arbitrary geographic and temporal cutpoints. Overall, delegates were in favour of providing separate advice for incidental vs intentional sun exposure, but the panel preferred to define a threshold for action using the UV index, which is a standalone measure and obviates the need for geographic or seasonal distinctions. There was lengthy discussion about levels of public awareness of the UV index and whether low awareness could inhibit adherence to the advice. After further discussion, it was resolved that sunscreen should be applied for incidental exposure when the predicted maximum UV index is 3 or above. The suggestion was made to include a table as an appendix that displays the predicted daily maximum UVI for each month in the major cities of Australia and New Zealand. Delegates also debated whether sunscreen advice should differ by skin type or ethnicity, but the prevailing view was that the position statement should be silent on this matter to avoid potential confusion. In discussion, the workshop also came to the view that the new statement would be incorporated as a new section within existing policies, to be entitled "*When to apply sunscreen*". The final statement is presented below.

WHEN TO APPLY SUNSCREEN

DRAFT POSITION STATEMENT

Following discussion at the Sunscreen Summit, Brisbane, 20 March 2018

Skin cancers are caused by exposure to sunlight:

- During **everyday** activities which add up over time (e.g. travelling to and from work; doing household chores; shopping etc)
- During **planned or prolonged outdoor activities** (e.g. doing outdoor work; gardening; playing or watching sport; going to the pool or beach; exercising outdoors etc)

When applied correctly and used regularly, sunscreen is effective in reducing the incidence of skin cancer.

In the statement below, "sunscreen" means sunscreen with an SPF of 30 or more and listed on the Australian Register of Therapeutic Goods (indicated by "AustL" on the label).

Sunscreen for everyday activities

Sunscreen should be applied every day to the face, ears, scalp if uncovered, neck and all parts of the body not covered by clothing. Ideally, this would form part of the morning routine. This protects the skin from the harmful effects of everyday sun exposure.

This advice applies when the daily maximum UV index is forecast to be 3 or more (see Table below for the average daily maximum UV index for cities in Australia and New Zealand, by month).

Sunscreen for planned or prolonged outdoor activities

During planned or prolonged outdoor activities, sunscreen should be used along with other sun protection measures (i.e. clothing to cover as much of the skin as possible; broad-brimmed hats; sunglasses; shade; scheduling outdoor activities to avoid the middle part of the day).

Sunscreen should be applied to the face, ears, scalp if uncovered, neck and all parts of the body not covered by clothing. Sunscreen should be re-applied every 2 hours. Sunscreens should not be used to promote suntanning or sunbathing.

This advice applies when the daily maximum UV index is forecast to be 3 or more (see Table below for the average daily maximum UV index for cities in Australia and New Zealand, by month).

Table: Average daily maximum UV index for Australia and New Zealand, by month and city

Shaded cells show months when the average maximum UV index does not reach 3. Sunscreen should be applied to exposed body sites daily when the maximum UV index is forecast to be 3 or more.

City	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Australia												
Darwin	12	13	13	11	9	8	9	10	12	13	12	12
Brisbane	12	11	10	7	5	4	4	5	7	9	11	11
Perth	12	11	9	6	4	3	3	4	6	8	10	11
Sydney	11	10	8	5	3	2	3	4	5	7	9	10
Canberra	11	8	7	5	3	2	2	3	5	7	9	11
Adelaide	11	10	8	5	3	2	2	3	5	7	9	11
Melbourne	10	9	7	4	2	2	2	3	4	6	8	10
Hobart	8	7	4	3	1	1	1	2	3	4	6	7
New Zealand												
Auckland	10	8	7	4	2	1	2	2	3	6	8	9
Wellington	9	8	6	3	1	1	1	2	2	5	7	8
Christchurch	8	7	5	2	1	1	1	1	2	4	7	8
Invercargill	7	6	4	2	1	0	0	1	2	3	5	6

Data Credit: Dr Richard MacKenzie, NIWA.

Citation: AIP Conference Proceedings 1810, 020003 (2017); doi: 10.1063/1.4975499

Appendix 1: Sunscreen policies and position statements from participating organisations

Australasian College of Dermatologists	https://www.dermcoll.edu.au/wp-content/uploads/ACD-Position-Statement-Sun-protection-and-sunscreen.pdf
Cancer Council Australia	https://wiki.cancer.org.au/policy/Fact_sheet_-_Sunscreen#_ga=2.68156435.349208434.1523335816-1679282881.1498445657
Cancer Society of New Zealand	https://auckland-northland.cancernz.org.nz/reducing-cancer-risk/what-you-can-do/sunsmart/sunscreen/
Health Promotion Agency New Zealand	https://www.sunsmart.org.nz/hpa-and-skin-cancer-prevention
Melanoma Institute Australia	https://www.melanoma.org.au/preventing-melanoma/how-do-i-protect-my-skin/
Melanoma Patients Australia	https://melanomapatients.org.au/lifestyle-risk-reduction/prevention/
Queensland Health	https://www.qld.gov.au/health/staying-healthy/environmental/sun/how#sunscreen
Skin & Cancer Foundation	https://www.skincancer.asn.au/page/2207/sunscreen-explained
SunSmart	https://www.sunsmart.com.au/protect-your-skin/slop-on-sunscreen
Therapeutic Goods Administration	https://www.tga.gov.au/publication/australian-regulatory-guidelines-sunscreens-args https://www.tga.gov.au/sunscreens