Acknowledgments

This paper was prepared as an input into the development of the ‘Reducing the impacts of skin cancer in NSW: Strategic Plan 2007-2009’. The document was developed by the NSW Skin Cancer Prevention Working Group, comprising representatives from The Cancer Council NSW (Anita Tang and Kay Coppa); the Cancer Institute NSW (Trish Cotter and Anita Dessaix) and NSW Health (Jenny Hughes and Nidia Raya Martinez), with support from Margaret Thomas from ARTD Consultants.

We would like to thank Dr Bruce Armstrong, Dr Diona Damian and Professor Bill McCarthy for their comments on the draft paper.

February 2007
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1 Introduction

This document summarises the current knowledge of skin cancer and skin cancer prevention in Australia. It was developed as an input into the strategic plan for skin cancer prevention, ‘Reducing the impact of skin cancer in NSW 2007-2009’. It is intended as a source document for practitioners working in the field and could be a useful reference to inform local action on skin cancer prevention.

The key areas covered by the document are:

- **Solar ultra violet radiation and impacts** (Section 2) – what is radiation, how it affects individuals and types of skin cancers
- **Skin cancer rates and trends** (Section 3) – incidence of melanoma and non-melanoma, by age, gender and region
- **Sun protection knowledge, attitudes and behaviours** (Section 4) – current knowledge of sun protection at the population level, which is important for considering priority groups
- **Interventions for skin cancer prevention** (Section 5) – current understanding of effective actions, and
- **Early detection** (Section 6) - a brief summary of current understanding of early detection.

For any further information, contact The Cancer Council NSW, Skin Cancer Prevention Unit, p. 02 9334 1900, or visit the websites for:

2 Solar ultra violet radiation and health

Australia’s proximity to the equator means that solar ultraviolet radiation levels in NSW are very high. Like radiowaves, visible light, infrared radiation and X-rays, UV radiation is a form of electromagnetic energy. Unlike visible light and the heat from infrared radiation, UV radiation cannot be seen or felt.

There are three energy bands of UV radiation distinguished by their wavelength ranges (Table 1.1):

Table 1.1 – Types of UV radiation

<table>
<thead>
<tr>
<th>UV type</th>
<th>Wavelength range</th>
</tr>
</thead>
<tbody>
<tr>
<td>UVA</td>
<td>315-400 nm*</td>
</tr>
<tr>
<td>UVB</td>
<td>280-315nm</td>
</tr>
<tr>
<td>UVC</td>
<td>1-00-280nm</td>
</tr>
</tbody>
</table>

* One nanometre(nm) =10^-9 m

Longer wavelengths of solar UV radiation are more likely to penetrate the earth’s atmosphere. Therefore, while most UVA transmits freely to the earth’s surface, most UVB (85–95%) and virtually all UVC is absorbed by ozone and atmospheric gases.

The biological effects of UV radiation also vary according to wavelength. Although only 5 to 15% of UVB penetrates the earth’s atmosphere, these shorter wavelengths of UV radiation carry larger amounts of energy and may cause more damage to human tissues than UVA. Recent research indicates that UVB causes more direct damage to DNA however UVA also causes gene mutations in the basal layer of skin and may significantly contribute to skin cancer.

Levels of UVB reaching the earth’s surface vary far more than UVA levels. This energy band is strongly influenced by changes in cloud cover and factors that influence the amount of atmosphere through which UV radiation passes before reaching the earth (such as time of day, season, and altitude – Table 1.2).

Table 1.2 - Factors affecting ambient solar UV radiation levels

<table>
<thead>
<tr>
<th>Factor</th>
<th>Impact on ambient UV levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geographic location</td>
<td>UV radiation levels (especially UVB) decrease with increasing distance from the Equator</td>
</tr>
<tr>
<td>Time of day</td>
<td>The single most important factor affecting UV radiation levels is the height of the sun in the sky. UV radiation levels are highest around solar noon. UVB varies more during the day than UVA.</td>
</tr>
<tr>
<td>Season</td>
<td>UV radiation levels are higher in summer than in winter because the sun is higher in the sky and the path UV radiation has to traverse through the atmosphere is shorter. Also, during the southern hemisphere’s summer, the earth’s orbit brings it closer to the sun than it does during the northern hemisphere’s summer. The effect is that the southern hemisphere receives 7% more UV radiation than the northern hemisphere does during its summer.</td>
</tr>
<tr>
<td>Clouds</td>
<td>The amount of cloud in the sky can have a substantial effect on UV radiation levels, particularly UVB. Heavy cloud can reduce UVB to less than 5% of that present under clear skies. Scattered cloud has a variable effect, with the levels rising and falling as clouds pass in front of the sun.</td>
</tr>
<tr>
<td>Surrounding environment</td>
<td>Environments that contain highly reflective surfaces such as snow and sand are usually characterised by high indirect UV radiation levels.</td>
</tr>
<tr>
<td>Altitude</td>
<td>UV radiation levels increase by approximately 4% with every 300 metres of altitude. Locations at high altitudes can have significantly higher UVB levels than those at sea level.</td>
</tr>
<tr>
<td>Stratospheric ozone</td>
<td>Ozone makes up only a small proportion of the earth’s atmosphere but is an important factor in the absorption of UV radiation, especially UVB. Ozone in the stratosphere (upper atmosphere) absorbs most of the UVB entering the atmosphere before it reaches the earth’s surface. UVA is not significantly affected by ozone levels.</td>
</tr>
</tbody>
</table>

2.1 Skin

Penetration of UV radiation into the epidermis (outer layer) and dermis of the skin may produce changes in the skin’s structure, function and appearance. Ultraviolet radiation stimulates production of the pigment melanin by specialised cells (melanocytes) in the epidermis. Small packets of melanin (melanosomes) are taken up by skin cells above the basal layer providing a degree of protection from UV radiation for the cells below. The genetically determined amount and distribution of melanin gives skin its characteristic colour or, as in the case of freckled skin, pattern of pigmentation. Skin type will also determine its response to UV radiation; how long it takes to redden and how early in life damage and ageing become apparent.

Exposure to UV radiation has both short and long term consequences for human skin. Acute exposure may cause sunburn that becomes evident as redness (erythema) accompanied sometimes by local inflammation or blistering. Over time, exposure to the sun may cause premature ageing of the skin characterised by wrinkles and altered pigmentation. UV radiation induced loss of skin tone is thought to be the result of damage to the collagen and elastin proteins that support the skin.5

The association between sunlight and skin cancer has been documented in medical literature for more than a century. Marks6 cites a German paper from 1894 in which sunlight was nominated as a factor contributing to non-melanocytic skin cancer (NMSC). Extensive epidemiological and clinical research in Australia and overseas has since confirmed that solar ultraviolet radiation is responsible for the vast majority of skin cancer.7,8

The most common types of skin cancer resulting from UV radiation exposure arise in cells in the basal layers of the skin (basal and squamous cell carcinomas), and, less frequently, from melanocytes (melanoma).

When UV radiation penetrates the epidermis, it is capable of damaging the genetic components (DNA) of the cells in the skin. Although the UVB band of the solar spectrum is thought to be primarily responsible for UV-induced DNA damage in the skin, both UVA and UVB have been recognised by the International Agency for Research on Cancer as possessing carcinogenic properties.9

It is thought that UV radiation probably plays a dual role in the pathogenesis of skin cancer producing both the original DNA mutation and subsequent tumour promotion.7 Mutations of the p53 tumour suppressor gene may be induced by UV radiation rendering the gene ineffective in its usual role of detecting and arresting abnormal cell growth. Studies from around the world have consistently revealed mutations of this gene in non-melanocytic skin cancer cells although alterations to p53 do not seem to be implicated in the causation of melanoma.

There are undoubtedly other genes and other factors involved in the development of skin cancer. Ultraviolet radiation is also thought to be responsible for the generation of short-lived but very destructive free radicals that may do further damage to the cell’s DNA. Also, with age, our ability to repair DNA damage induced by sunlight is reduced.10

2.2 Immune function

Recent research has also been examining the effect of UV radiation on the immune system. Although immunosuppression can be detected in the skin for several hours following exposure to UV radiation, the role of the immune system in preventing or managing skin cancer has not been clearly established by research.11 Current opinion is that UV immunosuppression is a contributing cause of skin cancer (e.g. Hanneman, Dermatol Clin 24:19, 2006)
2.3 Eyes

Eye disease caused by UV radiation may impair vision, and, in some cases, cause blindness. Damage to the tissues of the eye may also occur as a result of acute or prolonged exposure to UV radiation. Exposure to UV radiation may cause:

- painful eye inflammation eg. snow blindness
- a growth over the cornea (pterygium)
- cloudiness of the lens (cataract)
- cancer of the cornea and conjunctiva (surface of the eye) and melanoma of the eye.

2.4 Vitamin D

Vitamin D is produced in the skin through the photochemical effect of UV radiation on cholesterol. The vitamin plays a role in calcium absorption into bones contributing to normal bone growth and maintenance. People at risk of vitamin D deficiency in Australia can include elderly people (particularly those in residential care), people with skin conditions (such as skin cancer) who need to avoid sunlight, those with dark skin (particularly pregnant and/or veiled women) and their babies and people with malabsorption.

Most people in Australia will probably get sufficient Vitamin D from going about their usual daily activities. Prolonged or excessive sun exposure has no benefit in health outcomes related to Vitamin D. It is generally believed that short periods of unprotected sun exposure (2-14 minutes) three to four times per week outside of the peak UV period between October and March is sufficient to ensure recommended Vitamin D production in fair skinned people. Slightly longer periods are needed between April and September.

The Cancer Council NSW has developed a fact sheet for the community on Vitamin D sun exposure and the UV Index and recommends:

- Always protecting yourself from the sun when the UV Index is 3 (moderate) or above with hats, sun glasses, protective clothing and sunscreen
- Exposing face, hands and arms for 10 minutes in summer, 15-20 minutes in spring and autumn and 30 minutes in winter, outside peak UV times
- Short periods of exposure (outside peak UV times) are more efficient at producing Vitamin D than long or intense periods of exposure
- Exposure to UV radiation in a solarium produces little Vitamin D.
3 Skin cancer rates and trends

3.1 Melanoma
In NSW in 2004, melanoma was the fourth most common cancer overall and the most common for males aged 25-54 and females aged 15-29. Mortality rates for melanoma in males and females were ranked eighth and sixteenth respectively.\(^1\)

3.1.1 Incidence by age and gender
There were 3,402 new cases of melanoma of the skin diagnosed in NSW in 2004 (1,951 males and 1,451 females). Aged standardised incidence rates for new cases were 60 for males and 40.6 for females per 100,000.\(^2\)

Table 2.1 - Number of new cases of melanoma in NSW 2003 by age and gender

<table>
<thead>
<tr>
<th>Age (yr)</th>
<th>0-34</th>
<th>35-44</th>
<th>45-54</th>
<th>55-64</th>
<th>65-74</th>
<th>75-84</th>
<th>85+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>110</td>
<td>169</td>
<td>326</td>
<td>370</td>
<td>408</td>
<td>399</td>
<td>103</td>
</tr>
<tr>
<td>Female</td>
<td>128</td>
<td>187</td>
<td>242</td>
<td>259</td>
<td>236</td>
<td>207</td>
<td>95</td>
</tr>
</tbody>
</table>


The incidence of melanoma has increased steadily since the 1970’s and is continuing to rise, although there is some evidence that rates may be dropping or flattening out, particularly among women. From 1995 to 2004 the age-standardised incidence rate for melanoma in NSW rose by 18% in males and 21% in females.\(^3\) Since 1984 the largest increases were observed among males 75 years or more and females aged 80-84. Smaller increases were observed in men aged between 55 and 74 years.\(^4\)

Figure 2.1 - Melanoma – age standardised incidence and mortality rates

Figure 2.2 - Trends in melanoma incidence (by age for males)

Source: Cancer Institute NSW (data obtained September 2006)

Figure 2.3 - Trends in melanoma incidence (by age for females)

Source: Cancer Institute NSW (data obtained September 2006)
Incidence increases with age, rising from less than 10 per 100,000 in those less than 20 years to 323 per 100,000 among men aged 85+ and 131 per 100,000 for women aged 85+. Incidence rates increase significantly after 40 years of age and increase more rapidly among men than women.

3.1.2 Incidence by location
The incidence of melanoma in NSW is third highest in the country behind Queensland and Western Australia for males and lower than Queensland, Western Australia and Tasmania for females.

However, this increase is not consistent across the State. The highest incidence is found in the North Coast AHS where the incidence is significantly above all other AHSs for both males and females (Figure 2.5). Sydney South West and Sydney West areas have significantly lower rates for both males and females compared to all other areas. Males in Northern Sydney and Central Coast have higher rates and females in Hunter and New England also show higher rates. People who live in inner regional areas have higher rates than those living in outer regional or remote areas. Those living in metropolitan areas have incidence rates below that for NSW as a whole.

There has been a gradual increase in the incidence of melanoma in all Area Health Services since 1984, although Sydney West and Sydney South West have experienced only small increases and their rates appear to have stabilised. The incidence on the North Coast increased dramatically over this period. The Areas still showing sustained increases are Northern Sydney & Central Coast, Greater Southern and Hunter & New England. Additional years of data will show whether the falls in rates observed in the last two years in the North Coast, South East Sydney & Illawarra and Greater Western are maintained.

Figure 2.5 - Melanoma incidence by Area Health Service 1984-2004

Source: Cancer Institute NSW November 2006 (data request)
3.1.3 Melanoma mortality and survival rates

There were 388 deaths from melanoma in 2004 of which 281 were males and 107 were females. Death rates increase at around age 40 and rise dramatically from around 64 years of age, particularly in men.  

Figure 2.6 - Melanoma incidence and mortality 2002-2004 - males and females by age

Figure 2.7 - Trends in Melanoma mortality 1984-2004

Source: Cancer in NSW Incidence and mortality report 2004. Cancer Institute NSW

Source: Cancer Institute NSW November 2006 (data request)
Increases in rates of melanoma over the past 20 years have occurred in three AHSs (North Coast, Hunter & New England, Greater Southern) while rates in the other areas in 2004 were not significantly different from those in 1984. There have been considerable decreases in rates over the past few years in many areas with high rates, most notably North Coast, Greater Southern and Northern Sydney & Central Coast.

There is limited variation in incidence of melanoma among different socio-economic groups except that the least disadvantaged segment of the population has significantly higher rates. There is little variation in death rates in rural and remote areas compared to urban and regional areas.

### 3.2 Non-melanocytic skin cancer

Non-melanocytic skin cancer (NMSC) includes both basal cell carcinomas (BCCs) and squamous cell carcinoma’s (SCCs). Non-melanoma skin cancers are the most common cancers diagnosed in Australia but data on NMSCs are not collected by cancer registries, including the NSW Cancer Registry. Data on incidence of NMSC in Australia comes from the National Non-melanoma Skin Cancer Surveys that have been conducted in 1985, 1990, 1995 and 2002. In the 2002 survey, the age standardised incidence rates for BCC in NSW were 1428 per 100,000 males and 416 per 100,000 females. For SCC incidence rates were 328 per 100,000 for males and 312 per 100,000 for females (Table 2.2).

<table>
<thead>
<tr>
<th>Segment</th>
<th>BCC</th>
<th>SCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>All</td>
<td>1015</td>
<td>354</td>
</tr>
<tr>
<td>Males</td>
<td>1428</td>
<td>328</td>
</tr>
<tr>
<td>Females</td>
<td>416</td>
<td>312</td>
</tr>
</tbody>
</table>

The national data shows that incidence of both BCC and SCC increases with age being around 1,000 per 100,000 in those 70 years and over compared to 100 per 100,000 for females aged 40-44 and around 300 per 100,000 for males aged 40-44.

There has been an overall increase in the incidence of both basal cell carcinoma (29% from 1985 to 2002) and squamous cell carcinoma (127% from 1985 to 2002) in the 'central zone' of Australia, which includes NSW (Tables 2.9 & 2.10). These rates are likely to be similar for NSW alone.

The incidence of BCC overall is higher for males, although the percentage increase in the central zone was less than the percentage increase nationally and the percentage increase for females in the central zone was significantly higher. For SCC in the Central Zone, the percentage increase in incidence for females (194%) was more than twice the percentage increase for males (94%).

<table>
<thead>
<tr>
<th>Zone</th>
<th>Segment</th>
<th>% Increase 1985-2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central zone</td>
<td>All</td>
<td>29</td>
</tr>
<tr>
<td>(includes NSW)</td>
<td>Males</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>48</td>
</tr>
<tr>
<td>Australia</td>
<td>All</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>26</td>
</tr>
</tbody>
</table>
### Table 2.10: Change in age standardised incidence rates - Squamous cell carcinoma

<table>
<thead>
<tr>
<th>Zone</th>
<th>Segment</th>
<th>% increase 1985-2002</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central zone (includes NSW)</td>
<td>All</td>
<td>127</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>94</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>199</td>
</tr>
<tr>
<td>Australia</td>
<td>All</td>
<td>133</td>
</tr>
<tr>
<td></td>
<td>Males</td>
<td>139</td>
</tr>
<tr>
<td></td>
<td>Females</td>
<td>139</td>
</tr>
</tbody>
</table>

*Source: National Non-Melanoma Skin Cancer Survey (2002)*

The mortality rates for non-melanocytic skin cancer are around 2.0 per 100,000 for males and 0.6 per 100,000 for females, significantly lower than the death rates for other common types of cancer. In 2001 there were 587 deaths due to NMSC in Australia (in 389 cases it was the underlying cause and there were 198 additional deaths where the person had NMSC). Death rates from NMSC and actual numbers of deaths are not available for NSW.

#### 3.3 Burden and cost of skin cancer

Cancer is a leading cause of disease and disability in Australia, second only to cardiovascular disease. Skin cancers do not rate in the top 10 causes of burden of disease by themselves but are ranked fifth within the cancer group after lung, colorectal, breast and prostate cancer. The cost of treating all cancer and neoplasms in Australia is around $2.9 billion. Non-melanoma skin cancer (NMSC) was the most expensive cancer in 2000-2001, utilising $264 million dollars of health expenditure. This represents 12.3% of the $2.15 billion spent on malignant neoplasms in Australia. It is the most expensive cancer for males in the 25-64 year age group ($53 mill) and the second most expensive for females in that age group ($44 mill). NMSC was the second most expensive cancer for males and females aged over 65 years ($100 mill and $66 mill respectively). The health system costs related to melanoma totalled $30 mill, about 1% of the total costs of all cancer and neoplasms.

National monitoring of GP activity has found that basal and squamous cell carcinomas are responsible for over 40% of all GP patient encounters for cancer. GPs have over half a million patient encounters for basal cell carcinomas and over a quarter of a million for squamous cell carcinomas each year.

In addition, in 2002-2004 there were more than 90,000 encounters for melanoma per year. In addition to the direct costs mentioned above, there are considerable indirect costs (e.g. lost production in the economy due to illness and premature death) and impact costs or ‘intangibles’ (e.g. pain and suffering). These additional costs are difficult to quantify and are usually not included in disease costing exercises. However, AIHW estimated that the Disability Adjusted Life Years (DALY’s) for melanoma in Australia in 1996 were 20,010 and for NMSC were 4,560. This includes years of life lost due to premature mortality (YLL) and ‘healthy’ years lost due to disability.

While few economic evaluations of the benefits of skin cancer prevention initiatives have been undertaken, an economic analysis of the impact of the Victorian Sun Smart campaign estimated that the program potentially resulted in 699 fewer deaths from melanoma.
3.4 Risk factors

An individual’s risk for skin cancer appears to be determined by a combination of inherited characteristics and behaviour or lifestyle relating to exposure to UV radiation.

3.4.1 Skin type and colouring

Skin characteristics play a large part in determining risk of skin cancer. Skin with little melanin is more vulnerable to both acute and chronic damage by UV radiation. Light complexion (especially with a tendency for freckling), light or red hair, green or blue eyes, indicate a higher risk for both melanoma and non-melanocytic skin cancer. Typically, poor tolerance to the sun is indicated by skin that tends to burn and become freckled rather than tan in response to exposure to UV radiation. Skin type is usually graded as a four point scale from ‘Always burn, never tan’ to ‘Rarely burn, tan easily’. However, the National Sun Smart surveys described skin type as highly, moderately, or not sensitive.32

Although people with skin that never tans have five times the risk of NMSC compared to people whose skin always tans, skin cancer rates among the group whose skin always tans (at 407/100,000 person years) are still high enough to warrant regular sun protection measures.

People with black skin are well protected by their very high skin melanin levels. In the United States, skin cancer rates among black Americans are 20 times lower than those in whites and very low in people of Asian origin. In the Australian context, data on incidence of skin cancer in people from non-Caucasian backgrounds in extremely limited. Data on the incidence of skin cancer among the Indigenous population is also limited but some people who identify as Indigenous Australians may have lighter skin and are therefore likely to be at increased risk.

In areas with high UV radiation levels, it is sensible for most of the population (except for people with very dark skin and some Asian population groups) to take protective measures to minimise the risk of skin cancer.

3.4.2 Family history

Although the literature in this area does not consistently demonstrate a relationship between risk of melanoma and family history of the disease, much of the research involved has relied on anecdotal reporting for family members. Research has found that an individual’s risk of melanoma is approximately twice that of the general population if they have an affected first degree relative. This association is independent of age, naevus count, hair or eye colouring and freckling. Several relevant genes have been identified that may explain this association.35

In fact, only a small proportion of those with melanoma have a strong family history of the disease, however, people with a family history of skin cancer, especially melanoma should be encouraged to take effective personal protection measures and be alert for skin changes associated with cancer.

3.4.3 Age

The incidence of skin cancer (both melanoma and NMSC) increases exponentially with age. Over time, accumulated exposure to UV radiation (for the initiation and promotion of tumours) and declining ability to repair UV-damaged DNA are thought to contribute to an increased risk of skin cancer.37

3.4.4 Naevi

Naevi are benign focal proliferations of differentiated melanocytes. Genetic factors, in combination with exposure to UV radiation and, in particular, exposure during childhood, are thought to determine an individual’s number of melanocytic naevi (moles). Research using a variety of methods has consistently found that the number of naevi is strongly related to an increased risk of developing melanoma. A study in a Caucasian population in NSW aged 15–84 years found the risk of melanoma to be 12 times higher in those with more than 100 naevi than in people with less than ten.41
3.4.5 Solar keratoses
These lesions also indicate risk of skin cancer (especially NMSC). They are seen commonly in people with sun-sensitive skin and high sun exposure and a very small proportion of them probably go on to become SCCs.\(^{42}\)

3.4.6 Exposure to UV radiation
It has long been believed that skin cancer, particularly NMSC, is related directly to total cumulative exposure to UV radiation.\(^ {43}\) In 1992 the International Agency for Research on Cancer concluded that solar radiation did cause both cutaneous malignant melanoma and non-melanocytic skin cancer.\(^ {44}\) Increasingly, research indicates that amount of exposure, UV radiation dose per exposure, timing of exposure and skin type are all important factors in the pathogenesis of skin cancer.

A history of sunburn to the skin increases the risk of BCC and melanoma in particular (the relationship of sunburn with SCC is weaker). However, risk of SCC increases with increasing lifetime total exposure to the sun.

Childhood sun exposure contributes significantly to the total lifetime exposure to UV radiation and therefore sun protection in childhood is extremely important. Armstrong estimates that living in Australia for the first 15 years of life contributes about two thirds of the lifetime risk of melanoma for a lifelong resident.\(^ {45}\)

The intermittent exposure hypothesis postulates that the occurrence of some types of skin cancer is determined as much by the pattern of sun exposure as by total accumulated dose. Intermittent exposure to UV radiation (ie occasional, relatively high exposure), is an important factor in the causation of melanoma and probably BCC. The risks of both BCC and melanoma increase with increasing non-occupational or ‘intermittent’ exposure. These findings have implications for public health measures to reduce skin cancer if, for example, some members of the community shift when reducing their sun exposure move from a more continuous to a more intermittent pattern of exposure to UV radiation.

Although squamous cell carcinoma occurs most frequently amongst people with outdoor occupations and usually occurs on the sun-exposed areas of the head and neck,\(^ {46}\) both melanoma and BCC may occur on parts of the body with infrequent exposure to UV radiation. Kricker and associates\(^ {47}\) have replicated the findings of other researchers that fail to find an association between BCC risk and total lifetime exposure to UV radiation. Their results indicate that, in the dose-response relationship for UV radiation and BCC, a point is reached, beyond which, risk of BCC does not increase with further sun exposure. There was some evidence that risk of BCC was linked to higher levels of non-working days exposure.

Although the association between sun exposure and skin cancer is well established, further research is needed to clarify the precise relationships between genetic factors, skin type and patterns of exposure to UV radiation contributing to skin cancer. Discerning the relationship between exposure and skin cancer is frequently complicated by the difficulty in reliably documenting exposure.

Exposure during peak UV radiation periods (11am-3pm Daylight Saving Time) is a higher risk than exposure during periods of lower UV radiation due to the increased ambient solar irradiiance. The UV Index (UVI) is an internationally standardised index for reporting the maximum daily intensity of biologically effective solar ultraviolet radiation (UV). Cancer organisations have been promoting the use of the UV Index in weather forecasts and weather reports but more education of the public on the index is needed.

Use of solaria or tanning beds appears to increase the risk of developing all skin cancers.\(^ {48}\)
4 Sun protection knowledge, attitudes and behaviours

4.1 Knowledge and attitudes
Research conducted across Australia in 2006 to inform a national sun protection mass media campaign found that preventing skin cancer was not the primary motivation for avoiding excessive UV radiation exposure. People were more likely to be concerned about the pain, unsightliness and embarrassment of sunburn as the primary motivation for taking action.\(^5^9\)

In this research it was found that knowledge of the different types of skin cancer was poor and skin cancer was rated as less significant than other cancers except among those who had experience of skin cancer in their family. Most people were aware of the risk factors for the disease but believed that periods of intense exposure, especially if it resulted in sunburn, as being more of a risk than long term moderate exposure. Having tanned skin was associated with being active and healthy, although being tanned was just one factor, and not an essential one, that could contribute to attractiveness.

Preference for a suntan (of any type) is found among less than half of the NSW population, according to the National Sun Surveys.\(^5^0\) Only one in five adults desire a moderate tan, 7% want a dark or very dark tan, while 12% have a preference for a light tan. Fifteen percent of adults had attempted to get a suntan during the 2003-2004 summer. While no trend data is available for NSW adults, in Victoria, preference for a suntan went down over ten years from 25% in 1990 to 15% in 2000, although rose slightly in 2001.

Predictably, adolescents were much more likely to desire a tan with 60% desiring some type of tan, and 32% having tried to get a tan during the summer. Only one in ten preferred a dark or very dark tan, 40% a moderate tan and 9% a light tan. NSW school students were more likely to report in 2002 compared to 1993 (22% compared to 15%) that they didn’t like to get a tan, although more than 75% did want some type of tan. Fourteen and fifteen year olds were most likely to want a tan compared to younger and older adolescents.\(^5^1\)

There are strong social norms driving sun tanning and sun exposure behaviour among adolescents. Adolescents in general think a suntan is a good thing and one in five believe that a suntanned person is more healthy, while 40% believe a suntanned person looks more healthy. However, more adults (50%) think a suntanned person looks more healthy.\(^5^2\)

The vast majority of both adults and adolescents believe that sun protection could help them avoid skin cancer. Interestingly, more adolescents than adults agreed that they could prevent skin cancer by protecting themselves from the sun (adults 79%, adolescents 89%), probably reflecting adult beliefs that the damage is already done. Many older people know they should have their skin checked but younger people usually perceive skin checks as something older people need to do.\(^5^3\)

The national formative research for a mass media campaign found that in general, skin cancer is not prominent in people’s minds, even though everyone has reasonable knowledge about the dangers of sun exposure.\(^5^4\)

4.2 Adult behaviours

4.2.1 Staying out of the sun
Staying out of the sun, particularly during peak UV radiation periods (11am – 3pm) is the most effective strategy to prevent skin cancer.

Only a small proportion of NSW residents report that they were never in the sun in the previous summer between 11am and 3pm – 4.7% of men and 11.4% of women. NSW residents are increasingly staying in the shade during peak exposure periods in summer as a way of avoiding UV exposure. In 1997/98 66% of males and 74% of females reported that they often or always stayed in the shade when exposed to the sun during peak periods in summer.\(^5^5\) Data for 2004 is not currently publicly available.
Data from the 2003-2004 National Sun survey showed that 72% of NSW residents spent some time outdoors during peak times on the weekend before they were surveyed. The mean time spent outdoors during the peak UV radiation period was 116.5 mins or just under two hours. While they were outdoors, 27% said that they stayed primarily in the shade.

### 4.2.2 Hats, sun glasses and protective clothing

If unable to stay out of the sun, it is recommended that hats, sunglasses and protective clothing are used to reduce UV exposure.

The NSW Health Survey asked NSW residents about sun protective behaviour in state-wide population surveys in 1997/98 and 2004.

Often or always wearing a broad brimmed hat or cap with a flap decreased from 58% in men and 54% in women in 1997/98 to 47% for men and 43% for women in 2004. However, residents reporting that they often or always wore protective clothing when exposed to the midday sun in summer increased from 37% in 1997/98 to 43% for women and from 41% to 49% for men.

Fifty-four percent of NSW respondents in the National Sun surveys in 2003-2004 wore sunglasses when exposed to the sun in peak UV periods. Only 18% reported wearing a three-quarter or long sleeved top.

### 4.2.3 Sunscreen

Many more women than men use sunscreen when exposed to the sun during peak periods in summer – 59% of women and 41% of men – and this has not changed since 1997/98 (NSW Health Survey data). However, the National Sun Survey found that only 33% of NSW adults used sunscreen when outside in peak UV periods on summer weekends. This data may be a more reliable indicator of sunscreen use as the recall period is much shorter than that for the NSW Health Survey.

### 4.2.4 Sunburn

The National Sun Survey found that 17% of NSW respondents were sunburnt on the weekend before they were interviewed. Arms and hands (41%), head and face (39%), and shoulders (34%) were the areas most commonly burnt. Those with highly sensitive skin were more likely to report being burnt on the arms and hands, while those with the least sensitive skin were more likely to be burnt on the shoulders, chest, stomach and back. All three skin types (highly, moderately and not sensitive) were equally likely to report being burnt on the head, face and neck.

The national data show that of all people sunburnt on the previous weekend, most were burnt while at the beach or pool or near water, or engaging in passive recreation (Table 3.1). Incidence of sunburn was highly correlated with increasing temperatures. A high proportion of sunburn (28%) occurred whilst ‘gardening’ or ‘working around the house’ which are activities that the general population is less likely to link to a high risk of sunburn.

#### Table 3.1: Activities engaged in during peak UV period when sunburnt

<table>
<thead>
<tr>
<th>Activity</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beach, water, pool</td>
<td>20%</td>
</tr>
<tr>
<td>Passive recreation</td>
<td>18%</td>
</tr>
<tr>
<td>Gardening</td>
<td>15%</td>
</tr>
<tr>
<td>Work around house</td>
<td>13%</td>
</tr>
<tr>
<td>Active recreation</td>
<td>11%</td>
</tr>
<tr>
<td>(Sunburnt, but not during peak UV period)</td>
<td>11%</td>
</tr>
<tr>
<td>Sport</td>
<td>7%</td>
</tr>
<tr>
<td>Other</td>
<td>2%</td>
</tr>
<tr>
<td>Unknown</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
4.3 Adolescent behaviours

Data on sun protection behaviour in adolescents comes from the 2002 NSW survey of health behaviours among secondary school students (data from the 2005 survey will be released in 2007) and the National Sun Survey in 2003-2004. In the NSW Health survey, students aged 12-17 years were asked to report how often they engaged in different sun protection behaviours when outside between 11am and 3pm during sunny days in summer. In the National Survey, adolescents 12-17 years were interviewed by telephone in the days after eight summer weekends.

Overall, sun protective behaviour among adolescents is poor with only around a third adopting each of the main sun protective behaviours. That means that the majority of adolescents are poorly protected from the effects of sun exposure.

4.3.1 Staying out of the sun

The students’ survey found that there has been a significant increase in the last 10 years in the proportion of students who usually or always spent most of the time indoors during peak UV periods on sunny days in summer, from 18% in 1993 to 26% in 2002. More than a quarter of students who are outside during peak UV radiation periods report that they usually or always stay in the shade, but this has slightly decreased since 1993 (from 30% to 28%). The 2003-2004 National Sun Survey found that around one third of adolescents used shade when outside during peak UV periods.

4.3.2 Hats, sunglasses and protective clothing

Hat wearing amongst adolescents in NSW decreased substantially from 49% in 1993 to 41% in 2002. As they get older, both male and female students are increasingly less likely to report always wearing a hat. Males aged 12 years are the most likely to wear hats (63%) with females aged 17 years the least likely to wear a hat. The National Sun Survey found that 38% of adolescents in Australia wore some form of headgear, although only 5% wore a wide brimmed hat when outdoors during peak UV periods. Consistent with the NSW survey, this national survey also found that hat wearing was less common among older adolescents.

Both wearing protective clothing and wearing sunglasses decreased among adolescents between 1993 and 2002. In 2002, 14% of females and 26% of males usually or always wore protective clothing when out in the midday sun in summer, and a third of females reported deliberately wearing less or briefer clothing in order to get some sun on their skin. In 2002, sunglass wearing was usual only among 31% of students (down from 41% in 1993).

4.3.3 Sunscreen

In the last 10 years sunscreen use among adolescents has decreased from 63% (1993) to 41% (2002). Females are more likely than males to use maximum protection sunscreen when outside during peak UV periods in summer. In the 2003/04 summer, thirty-two percent of adolescents in the National Sun Survey used a maximum protection sunscreen when exposed to the sun during high UV periods.

4.3.4 Sunburn

The National Sun Survey found that 25% of adolescents were sunburnt on at least one day of the previous weekend. Males and females were equally likely to be burnt but slightly younger adolescents (12-14 years – 27%) were more likely than those 15-17 years (23%) to report being sunburnt. Those with moderately sensitive skin were most likely to be sunburnt with 47% of those burnt reporting they were burnt on the head and face.

In the 2002 NSW school students’ survey, 77% of students reported being burnt in the previous summer, an increase from 72% in 1996. Rates of sunburn were highest among 14 and 15 year olds, the groups most likely to desire a tan. Approximately one in six adolescents said they had been sunburnt four or more times during the previous summer.
4.4 Children

In general, children spend more time outdoors than adults, although the advent of more passive forms of recreation for children (e.g. television, computer games) means children now spend large amounts of time indoors participating in these activities.\textsuperscript{64}

4.4.1 Sun protective behaviours

The 2001 NSW Child Health Survey asked parents or carers of children 1-12 years about their use of sun protection measures for their children and whether their child had been sunburnt. While the majority of children were well protected when out in the sun during summer, 25% of children were not consistently wearing a broad brimmed hat or cap with a flap, 18% were not wearing protective clothing and 14% were not wearing sunscreen on exposed skin.\textsuperscript{65}

The National Sun Survey in 2003-2004 showed that over 70% of children spend more than 15 minutes outdoors during peak UV times on summer weekends. Of those children outdoors, 68% were not primarily in the shade during peak UV times. A higher proportion of children aged 0-4 years used shade during peak periods (43%) compared to 5-11 year olds (25%). Parents reported that the main reasons children did not use shade were that there was no shade available or that the activity could not be done in the shade.

The use of protective clothing varied, with 29% wearing ¾ or long leg cover, and 18% wearing a ¼ or long sleeved top. While 64% of children wore some form of headwear, only 42% wore a protective (broad brimmed or legionnaires) style hat. In general, older children were reported as having poorer sun protection behaviours than younger children, but also spent more time out in the sun.

The prevalence of sunscreen use was relatively high when compared to other forms of sun protection. Of those children who were outdoors on the weekend, 59% used some form of sunscreen, with 58% reporting using (SPF) of 15+ (or greater) when outdoors during peak UV times. Ninety-five percent of parents reported applying sunscreen before going outside.

4.4.2 Sunburn

Overall 8% of children were sunburnt, with 11% of 5-11 year olds burnt and a much lower proportion of 0-4 year olds burnt (5%). The higher incidence of sunburn in boys (10%) compared to girls (7%) is most likely due to boys spending greater proportions of their time outdoors during peak periods.

Most parents reported that their child’s sunburn was not due to intentional sun exposure, but was the result of oversight, through either forgetting to protect all exposed skin, poor application of sunscreen, or being caught in the sun too long. Activities in which children are most likely to be sunburnt were: spending time at the beach/water/pool; other active recreation and gardening (despite this being an activity involving the shortest amount of time outdoors). In the 2002 NSW Child Health Survey, one third of children had been sunburnt in the previous summer to the extent that their skin was still sore and tender the next day.\textsuperscript{67}

4.5 Use of solaria and tanning beds

Only a small proportion of the population use artificial sun tanning devices (solaria and tanning beds) to get a tan. About one in ten people have visited a solarium at some time according to results of the National Sun Survey, and only 2% had been to a solarium in the previous 12 months.\textsuperscript{68} Three percent of adolescents in the National surveys said they had ever been to a solarium and only 1% had visited one in the last 12 months.\textsuperscript{69} Not surprisingly, women and younger people were much more likely to have visited a solarium.\textsuperscript{70} Of the adolescents who had visited a solarium, only thirty percent indicated that they had been asked to sign a consent form.

A recent study in Melbourne showed poor compliance by solaria with a voluntary industry code. Fifty-two percent of centres gave underage teenagers access without parental consent and 90% allowed clients with poor tanning ability to use sunbeds.\textsuperscript{71}
5 Skin cancer prevention interventions

Skin cancer is a preventable disease. Skin cancer prevention interventions are designed to reduce exposure of the skin to UV radiation and to minimise risk of sunburn. There are a number of recommended strategies for reducing exposure to UV radiation (in order of importance):

- Always protecting skin when the UV Index is 3 or above and avoiding being in the sun in peak UV periods between 10am and 3pm
- Seeking shade
- Wearing clothing that covers shoulders, arms and legs
- Wearing a broad-brimmed hat that shades the face, neck and ears
- Wearing wrap around sunglasses that meet the Australian Standard
- Applying SPF30+, water resistant sunscreen every 2 hours.

There is good evidence that sunscreen use can prevent SCCs and actinic keratoses, but no direct evidence that it can prevent BCC or melanoma. Studies of sunscreen use and melanoma have raised concerns that sunscreen use may encourage longer periods of exposure to the sun and that this could increase risk. However, sunscreen can reduce risk of sunburn and use of sunscreen on exposed skin is recommended for people who work outdoors or participate in outdoor recreation and who live in areas with high insolation.

A recent review of sun protection initiatives in Australia and internationally concluded that promotional activities needed to focus on increasing use of clothing and seeking shade. The increased risk of NMSC makes it prudent to discourage use of artificial sun tanning devices.

A recent AIHW study predicts that the rise in melanoma incidence will slow as a result of prevention efforts over the previous 40-50 years, however, a decrease in incidence rates is unlikely for another 20 years. The 2002 national NMSC survey showed that although NMSC rates were still rising they had stabilised in those less than 60 years, indicating that prevention programs may be having an effect.

In 1999, a review by Marks concluded that skin cancer prevention programs have lead to:
- Favourable changes in knowledge and attitudes
- Improvements in behaviour relating to sun protection
- Reduced incidence of sunburn
- Declines in skin cancer incidence in some age groups
- Declines in mortality rates
- Improved early detection
- Substantial reduction in the average thickness of melanomas diagnosed (reducing the case fatality rate)

While the ultimate focus of skin cancer prevention is on reducing individual exposure to UV radiation, there are many initiatives that will support individuals adopting sun protection behaviours by addressing environmental, social or policy issues.

Australia is known for having the most extensive and comprehensive sun protection programs in the world. A recent review of sun protection in Australia and nationally concluded that health promotion interventions should primarily promote use of shade and wearing protective clothing.

Karen Glanz and colleagues recently conducted a systematic review of the effectiveness of skin cancer prevention initiatives for the US Task Force on Community Preventive Services and divided interventions into four broad categories:

1. Individual-directed strategies – includes information and behavioural interventions targeted at individuals or groups
2. Environment, policy and structural interventions – these interventions are designed to enhance sun protection conditions for populations, or groups of people in particular settings

Reducing the impact of skin cancer in NSW – Evidence paper
3. Media campaigns – designed to provide information to the population at large, and motivate individuals to change their behaviour
4. Community-wide multi-component interventions – large population-wide programs incorporating a range of interventions including individual-directed.

In practice, individual-directed strategies and structural or policy interventions are frequently incorporated in settings based interventions targeting particular parts of the population e.g. school children. The most common settings for sun protection initiatives in Australia have been childcare centres and preschools, primary schools, secondary schools, local government, workplaces, outdoor recreation and healthcare settings.

5.1 Early childhood services

Pre-school children and their parents and carers can be targeted through pre-school care and education settings. Interventions designed to improve sun protection for pre-school children have centred on child care centres or pre-schools. However, interventions can also be found in occasional care services, home based care and mobile services. The types of interventions suggested for childcare services are described in The Cancer Council NSW guide for childcare service providers that is designed to assist services with developing and implementing a sun protection policy and plan.

Studies of long day care centres and pre-schools in NSW have found that while high numbers of centres have a sun protection policy, few were comprehensive and practices were frequently not consistent with the policy. In 2005 a random sample of approximately 800 Early Childhood Centres (ECCs) were surveyed. All ECC must have a sun protection policy in place but the survey demonstrated wide variability in the quality and comprehensiveness of the policies. In Victoria, 44% of childcare centres and 49% of preschools had adopted comprehensive SunSmart policies and practices and were recognised as SunSmart centres in 2002.

The review by Glanz found that some studies showed improvements in sun protection knowledge among carers/teachers and parents but only one study in Sweden showed changes in sun protection behaviour. However, due to the small number of studies and inconsistent results they concluded that there was insufficient evidence to determine the effectiveness of educational and policy interventions in child care centres in improving sun protection behaviours, policies or structures.

While specific intervention studies may not have shown a direct relationship between programs in child care centres and change in sun protection behaviours, the high level of parental knowledge about protecting young children from the sun and the low incidence of sun burn in pre-school children found in the National Sun Surveys indicates that initiatives in pre-school settings in Australia have been effective.

Some mass media campaigns have targeted parents and carers of young children, for example the Seymour the Snowman campaigns in NSW between 1996 and 2000 (see 4.4.2).

5.2 Primary schools

The school setting provides a number of opportunities for sun protection initiatives such as:

- Increasing provision of shade, including shade design and permanent structural changes
- Development and implementation of sun protection policies – covering timetabling of outdoor sport periods, wearing of hats during lunch and recess
- Inclusion of sun protection/skin cancer education in curriculum
- Education and information for teacher, parents and carers.

The 2005 National Primary School Survey included two hundred and thirty schools from New South Wales and gathered data on sun protection in this setting. Sixty-six percent of schools in New South Wales
had a written sun protection policy with most (79%) reporting that their policy was easy to maintain. The existence of a written policy was associated with better sun protective practices.  

The majority of schools enforced hat wearing in Terms 1 and Terms 4 although only 60% enforced the wearing of broad brimmed or legionnaire style cap, a lower level of enforcement than found in schools in other states. Almost all schools (97%) had arranged for students to eat lunch inside or in shaded areas and 79% held assemblies outside of peak hours or indoors. Smaller number of schools had adopted other strategies to minimise time spent outside during peak times (eg. rescheduling sports periods).

School uniforms mostly included sun protective design and 35% of schools had made changes to school uniforms so that they offered more sun protection. Most schools (84%) reported having adequate shade for passive activities, with 63% reporting that they had increased their shade in the last three years and 57% planning to increase their shade in the next 3 years.

Over 95% if schools had incorporated sun protection into their curriculum although they were less likely to use teachers and PE specialists to introduce sun protection into the curriculum compared to other states.

A recent intervention to increase development of comprehensive sun protection policies in schools found that including a staff development module resulted in more adoptions of policy than a mail out strategy in primary schools. A study in Western Australia found that only a high intervention strategy was successful in increasing hat wearing but had no influence on increasing use of shade at lunchtime.

The international review for the US Task Force on Community Preventive Services concluded that there is sufficient evidence of the effectiveness of interventions in primary schools in improving covering-up behaviour.

5.3 Secondary schools

Since the sun protection behaviour of adolescents is the poorest of any sector of the population, designing and implementing skin cancer prevention initiatives for adolescents may be challenging. However, there are strategies that could improve protection from UV radiation in secondary schools. Providing more shade has potential as approximately 30% of students in NSW usually or always stay in the shade during peak UV radiation periods on sunny summer days. The 2002-2003 review of the SunSmart program in Victoria recommended that additional attention should be placed on reaching adolescents and that shade structures and policies should be promoted to secondary schools.

The 2002 Victorian SunSmart Review found that only 23% of secondary schools had comprehensive sun protection policies and only 20% were recognised as SunSmart schools. Only half reported that they had enough shade for passive activities. An intervention in NSW was unsuccessful in increasing adoption of a sun protection policy in secondary schools with a mail-out plus staff development strategy.

The review of evidence conducted by the Task Force on Community Preventive Services found that the evidence is insufficient to determine the effectiveness of sun protection interventions in secondary schools or colleges.

Mass media campaigns in NSW have been targeted at adolescents in the past with mixed results (see 4.4.2).

5.4 Population interventions

5.4.1 Mass media approaches

Mass media can be used to reach large segments of the population, raise the profile of public health issues and influence the knowledge, attitudes and behaviours of large numbers of people. Australia has a history of mass media interventions for sun protection, some initiated by Cancer Councils and others by federal or
state governments, while several have been collaborative efforts. NSW has had several major mass media interventions over the last few decades although less so in the last five years.

Many of the mass media campaigns conducted have been evaluated to assess whether people in the community:

- Recalled the campaign
- Remembered the messages of the campaign
- Increased their knowledge as a result of seeing the campaign
- Changed their attitudes or behaviour as a result of the campaign

In NSW, the Me No Fry campaign was conducted between 1991 and 1996 and was aimed at adolescents. Over this period, there was an increase in sun protection behaviour by 11-16 year olds and a decline in the proportion of teenagers who reported having sore or tender sunburn over the two summers between 92/93 and 94/95.93

The Seymour the Snowman campaign was targeted at parents and carers of children 0-11 years and was run in the summers of 1997/98, 1998/99 and 1999/2000. The campaign achieved a high level of awareness of campaign messages and some short term improvements in sun protection use by children, but no improvement in hat wearing. Sun protection practices among parents and carers were considerably poorer than those among children. Knowledge levels about appropriate sun protection behaviours were high and were not influenced by the campaign. However, sun protection behaviour in between campaigns tended to revert to baseline levels, indicating that sustained public education campaigns may be required to effect more entrenched changes in behaviour.94

The Task Force on Community Preventive Services concluded that there was insufficient evidence to support the use of mass media interventions on their own for changing sun protection practices. Their use in comprehensive community-wide programs may enhance the effectiveness of those programs.

General media coverage of issues also has a role to play in public health interventions. A study of media attention to skin cancer prevention in the US found that there were few stories about skin cancer prevention and early detection and the amount of media coverage had not increased since 1986.95

However, an analysis of tanned skin and sun protection in Australian media targeting adolescents found that a light tan was most predominant and the media were generally supportive of sun protection objectives.96

5.4.2 Community-wide interventions
The comprehensive programs conducted in Victoria were the most effective public health interventions identified in the international review for the Task Force on Community Preventive services, and have resulted in changes in attitudes and sun protection behaviours. A review of the Victorian SunSmart Program in 2002 concluded that the success of the program over 20 years could be attributed to the multi-faceted efforts to change sun protection attitudes, beliefs, values and behaviour. These efforts have encompassed a mix of strategies including mass media campaigns, advocacy within organisations, communities and government, and support, advice, resources and other incentives.97

However, since few of these types of programs have been extensively implemented and evaluated in other parts of the world there is still limited evidence available on the effectiveness of these types of interventions.

A review of skin cancer prevention for children concluded that comprehensive, community-wide programs can increase solar protection behaviours and they may be more effective than smaller scale interventions as they are delivered through multiple channels.98
5.4.3 Local government
Local government has the potential to affect large sectors of the population through:
• provision of shade in public places and local facilities
• advocacy or requirements for sun protection in developments
• incorporation of sun protection into Municipal Health Plans
• as large employers, sun protection policies for outdoor workers
• including sun protection consideration or education in community events
• influence of local elected members in the community

The NSW Health Survey asked people about how easy it was to find shade at sporting areas and swimming pools in 1997 and again in 2004. There have been substantial increases in the proportion reporting that shade was easy to find at these venues between 1997 and 2004, indicating that local government has played a part in improving local environments for sun protection. About two-thirds of the population now believe it is easy to find shade at sporting areas and swimming pools, up from around 60% for pools and 50% for sporting areas in 1997. However, there is still considerable room for further improvement.

A survey of NSW local governments in 2004 found that 71% of respondents were involved in cancer prevention through having a sun protection policy. Some policies covered sun-protection for staff, whilst others extended to shade provision at child care centres, playgrounds, sports facilities, pools, and requirements for groups using council facilities. However, only 11% of Councils had a Development Control Plan that included consideration of sun protection.

In Victoria a survey of local government found that 49% had a sun protection policy included in their Municipal Public Health Plan, 37% had a sun protection policy for swimming pools and 25% had a shade policy for parks and gardens.

5.5 Other settings specific interventions

5.5.1 Outdoor recreation
Opportunities exist for sun protection interventions when people are involved in outdoor recreation.

The US Task Force on Community Preventive Services found there was sufficient evidence to recommend interventions in recreational or tourism settings as interventions in these settings have been shown to improve adult sun protection behaviour. These settings also have the potential to influence people of many ages including parents and their children.

From 1997 to 1999 increases in the proportion of state sporting organisations in Victoria with sun protection policies increased from 8% to 16% and a review in 2002 found that 34% of clubs had a written sun protection policy. However, only around one quarter provided portable shade for players, spectators or officials and half sold or provided sunscreen.

Surf life saving organisations have taken on sun protection practices with lifesavers on duty at beaches wearing long sleeved tops, sunscreen and legionnaire style caps or broad-brimmed hats, thereby providing a good model of practice to beachgoers. In Victoria, 81% of Surf Life Saving Clubs have a sun protection policy in place.

In NSW, the increase in the number of people saying that shade is easy to find at swimming pools or local sporting areas is indicative of increased availability of shade in these locations.

5.5.2 Workplaces
Local government as a workplace has been the focus of several workplace-based interventions in Australia. In Victoria, it was found that in 2003 76% of local governments had a written policy for council outdoor workers and 26% had a policy for contract outdoor workers. In the 2004 NSW Local Government
survey some Councils reported that they had health promotion policies for a variety of health promotion issues, including sun protection policies for outdoor workers.\textsuperscript{105}

The Cancer Council NSW has worked with several large industries and the NSW Labour Council in the development of sun protection policies and programs. It is not known what the impact of these programs on sun protection practices has been.

The Glanz et al international review of interventions in occupational settings concluded that there were too few studies and inconsistent evidence of the effectiveness of interventions in these settings.

5.5.3 Health care settings and health care providers
Health care settings can provide an opportunity for either patient-directed interventions or provider-directed interventions. Most of the provider-directed interventions have been around continuing education for doctors and health professionals aimed at improving knowledge, skin cancer detection skills and skin cancer prevention counselling practices and some have found improvements in these.\textsuperscript{104}

Few studies of patient-directed interventions have been implemented or evaluated, and most focussed on those with high risk for skin cancer. One program with mothers of newborns found short-term benefits of reduced sun exposure of infants in the intervention group.\textsuperscript{105} However, the lack of interventions resulted in the Task Force on Community Preventive Services concluding that there was insufficient evidence of the effectiveness of interventions in health care settings.

While a large proportion of general practice encounters are related to skin cancer, there is a lack of evidence on the impact of training GPs on improvements in sun protection behaviours of patients.

6 Early detection
It has been stated that there has been an increase in the rate of early diagnosis and low and falling morbidity from melanoma in Australia indicating that efforts to increase early detection have had an impact.\textsuperscript{106} At this stage, population-based or mass screening is not recommended except for patients identified as being at high risk of melanoma. As 70% of melanomas are detected initially by people themselves or their families, regular skin examination may increase the probability of detecting melanoma at an early and treatable stage.\textsuperscript{107}

Recently, concerns have been raised over the quality of services provided in skin cancer clinics, including skills of medical practitioners and over-servicing and this will need to be monitored. A recent review for Medicare has indicated instances of overservicing in skin cancer treatments.\textsuperscript{108}

General practitioners play a crucial role in early detection as over 70% of the population visit a GP at least once a year and about 40% of all GP consultations for cancer are related to NMSC. In a recent survey by the Cancer Council, 69% of GPs in NSW have diagnosed a melanoma and 94% have diagnosed a non-melanoma skin cancer in the last 12 months.\textsuperscript{109} A recent study of US physicians found that lack of time was the most common barrier to skin checks for high risk patients, although physicians whose patients requested a check were more likely to carry out an examination.\textsuperscript{110} In Australia, barriers of poor remuneration for longer consultations and poor access to GPs in some outer metropolitan and rural areas need to be addressed.

Further study and review of the costs and benefits of early detection are required to demonstrate that a population-based screening campaign would lead to improved rates of early detection and overall benefits before it would be appropriate to recommend screening for the whole population.
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