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Farmers sun exposure, skin protection and public health campaigns: An Australian perspective

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ABSTRACT

Non-melanoma skin cancer is a common and costly cancer in agricultural populations. Prevention and early detection are an effective way to decrease the burden of disease and associated costs. To examine sun exposure and skin protection practices in agricultural workers and farmers a thematic review of the literature between 1983 and 2014 was undertaken. Comparison between studies was complicated by differences in study design, definitions of skin protection, and analytic methods used. Farmers are the most exposed to harmful ultraviolet (UV) radiation of all outdoor workers and the level of reported skin protection by farmers is suboptimal. Years of public health campaigns have failed to adequately address farmers' specific needs. Increased rates of skin cancer and subsequent higher costs are expected. Estimates of sun exposure and skin protection practice indicate that protective clothing is the most promising avenue to improve on farmers' skin protection. Early detection needs to be part of public health campaigns. This review explores the quantitative data about Australian farmers and their skin protective behaviours. We investigate what the documented measurable effect of the public health campaign Slip!Slop!Slap! has had on agricultural workers and farmers and make recommendations for future focus.

Contents

Introduction

Since the 1980s it has been known that ultraviolet (UV) exposure from the sun causes damage to the skin and increases the risk for developing skin cancer (Marks et al., 1990). In 1992 the International

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Agency for Research on Cancer classified solar radiation as a Group One carcinogenic hazard, that is, known to cause cancer in people (International Agency for Research on Cancer, 1992).

Australia has the highest rate of skin cancer in the world (Thursfield and Giles, 2007; Jelfs, 1999; Makin, 2011) and is increasingly vulnerable to higher rates of skin cancer in the future (Makin, 2011) with climate projections of hotter and longer heat waves. In Australia, 2036 people died from skin cancer in 2012, with 1515 due to melanoma, and 521 due to non-melanoma skin cancer (Australian Institute of Health and Welfare & Australasian Association of Cancer Registries, 2012). In the US nearly 5 million people are treated for skin cancer each year (Guy et al., 2015). According to Karia et al. (2013), the mortality for melanoma was 9710 and between 3900 and 8800 died from squamous cell carcinoma, a non melanoma skin cancer. Globally rural and agricultural populations are known to have higher risks for skin cancer (Blair and Zahm, 1991) due to the nature of their work and in Australia farm men have been shown to have a higher standardised mortality rate due to melanoma and other skin cancers (Fragar et al., 2011).

Early research from the 1980s showed that sunscreen cream use is an effective way to reduce the harmful effect of the sun on the skin and reduce skin cancers (van der Pols et al., 2006; Naylor et al., 1995). In 1981, the Anti Cancer Council of Victoria (1981) launched an extensive social marketing campaign to prevent high rates of skin cancer. The Slip! Slop! Slap! SunSmart Campaign[1] focused on multiple ways to avoid the sun, and protect the skin and eyes (Montague et al., 2001). The early Slip! Slop! Slap! Campaign (1981) promoted 'slipping on a shirt, slopping on sunscreen and slapping on a hat'. The original television advertisements[1] featured outdoor workers as well as outdoor recreational pursuits and included a farmer working in the sun using a tractor and plough. The Slip! Slop! Slap! message became part of the Australian language.

By the late 1990s numerous evaluations of these public health campaigns (Smith et al., 2002; Keeney et al., 2009) and their impact on knowledge, attitudes and skin protective behaviours reinforced the Slip!Slop!Slap! approach (Montague et al., 2001; Dobbinson et al., 2008). Although, more recently there has been criticism of the campaigns attributed success in reducing the rate of melanoma in young people in Australia (Czarnecki, 2014). In 2004, it was proposed that skin protection be mandatory for Australian outdoor workers to reduce UV exposures (Glanz et al., 2007; Woolley et al., 2004). However, farms as workplaces are by nature small, independent, geographically spread and mostly family run businesses, making both the implementation of workplace policies and targeted public health campaigns difficult (Strickland and Fritschi, 2014).

The later Slip!Slop!Slap! video advertisements promoted beach activities with the animated 'Sid the Seagull' at the beach. In 2005 these campaigns included the addition of new prevention messages of Seek! (seek shade) and Slide (slide on wrap around sunglasses). These additions extended the prevention message into Slip! Slop! Slap! Seek! and Slide!.[2] In the 2007 video campaign there was no reference or display of outdoor workers shifting to a more recreational and seaside approach to skin protection. In the USA different campaigns have been held by different institutions, such as 'be SunAWARE',[3] encouraging A-Avoid sun exposure, W-wear sun protective clothing, including a wide brimmed hat and sunglasses, A-apply broad spectrum sunscreen, R-routinely check your skin for any suspicious changes and E-educate others about the risks of sun exposure.

More commonly accepted in the USA is the adaptation to the Australian model in the 'Slip!Slop!Slap! and Wrap' campaign. The addition of 'wrap' is emphasising the need to wear wrap-around sunglasses.

[1] http://www.sunsmart.com.au/tools/videos/past-tv-campaigns/slip-slop-slap-original-sunsmart-campaign.html.

[2] http://www.cancer.org.au/preventing-cancer/sun-protection/campaigns-and-events/slip-slop-slap-seek-slide.html.

[3] www.sunaware.org and American Cancer Society: www.cancer.org.

Method

A literature search was undertaken in PubMed and primary articles were included in the review. The literature was examined from 1983 to enable inclusion of initial pioneering articles from that era. Search words included farmer sun exposure OR farmer UV exposure OR farmer skin protection OR slip, slop, slap OR farmer skin cancer. Articles were selected based on full text articles in English, and based on relevance to farmer health. They were journal articles, peer reviewed articles, including literature reviews, theses and editorials. Whilst the primary focus was on studies from Australia, articles from the United States (US) and Europe were included. The citations of these articles were screened for additional relevant publications using the snow balling technique. One more article was found that was not listed in PubMed, which was about human behaviour adaptation models in relation to farmers and promoting skin protection. Websites of the Australian and American Cancer Council and the Royal Australian College of General Practice were accessed for additional information relevant to the review. See Table 1.

Selected articles were analysed for themes such as UV exposure and farmers, skin protective behaviour, effectiveness of public health campaigns, early detection and cost of skin cancer. These themes are summarised in separate subheadings under findings. Thirty-three articles specifically about skin protective behaviours were included in a word frequency search to aid understanding of where most research focus has been.

Results

UV exposure and farmers

Little work has been done globally on the amount of actual UV exposure farmers receive. However, the work that has been done indicates

Table 1
Flow chart of literature search.

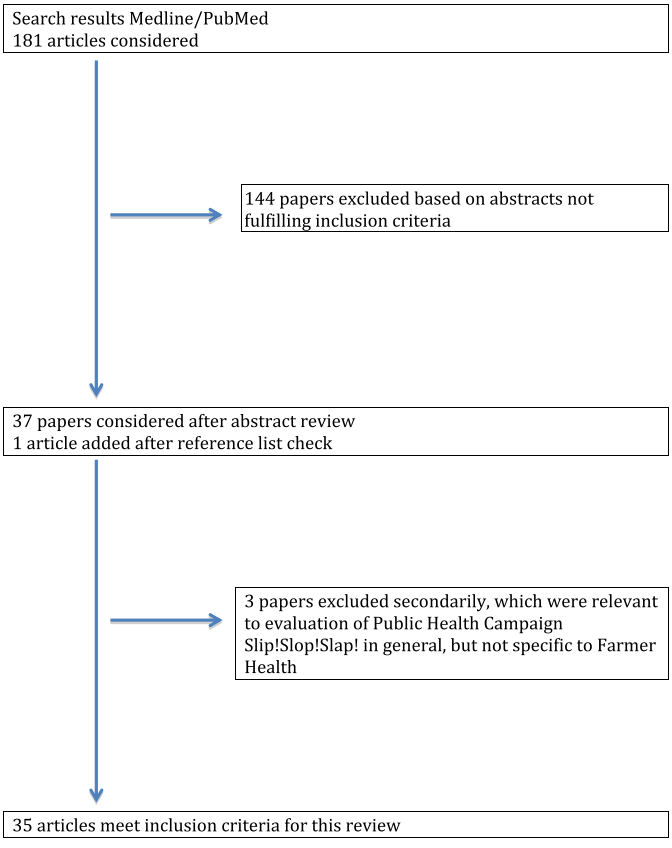

Table 2
Surveys conducted into the skin protective behaviours to reduce UV exposure amongst farmers.

Author, year of publication	Population (N), gender	Method, year of data collection	Skin checks	Sunscreen use	Re-applying sunscreen	Hat-wide brim and/or flap at the back	Peak cap (base-ball cap)	Sunglasses	Long sleeve shirt	Long trousers
Rosenman et al., 1995	USA farmers (662) and their spouses (680),	Surveys, 1992	Never 66.5% and 68.7% Yes 28.4% of total respondents	Unlikely 65% and 32% Somewhat likely 21.8% and 26.3% Very likely 13.2% and 41.8%		Unlikely 37% and 31.4%[a] Somewhat likely 25.8% and 27.6%[a] Very likely 37.3% and 41.0%[a]				
Mullan et al., 1996	USA farmers (1310), male 49.6% female 50.4%	Surveys, 1993	Yes 25.9%							
Robinson et al., 2004	USA farmers (686), male 70%, and their wives 30%	Surveys, 1998	Never 49.7% Seldom 20.1% Sometimes 17.1% Frequently 9.8% Always 3.4%	Never 48.8% Seldom 16.0% Sometimes 14.3% Frequently 11.2% Always 9.6%		Never 34.4% Seldom 11.5% Sometimes 15.6% Frequently 12.4% Always 26.1%			Never 34.5% Seldom 22.9% Sometimes 20.0% Frequently 8.3% Always 14.3%	
Dobbinson et al., 2005	Australian farmers (99) and outdoor workers (60) Gender not provided	Surveys, 2004	Never 47.5% and 39.7% Sometimes 21.2% and 37.9% 1/2 of the time 9.1% and 5.2% Usually 17.2% and 8.6% Always 5% and 8.6%	Never 67% and 45%	75% and 79%			Never 35% Usually + Always 38%	27% and 17%	75% and 52%
Makin et al., 2009	Australian farmers (705) Questionnaire, gender not provided	Questionnaire, 2006	Usually + always 21%	Never 54%	Usually + always 45.7%		Usually + always 85.6%	Usually + Always 44.5%	Usually + always 21%	Usually + always 59.3%
Gaetano et al., 2009	USA farmers (88), male 57% female 43%	Surveys, 2007	Never 37% Never 70%	Never 6% Rarely 16% Sometimes 59% Always 19%						
Kearney et al., 2013	USA farmers (397), male 71.8% female 19.9%	Surveys, 2012	Never 15.8% Rarely 28.9% ½ of the time 35.7% Always 19.6%		Never 23.9% Rarely 19.5% ½ of the time 29.4% Always 27.1%			Never 9.1% Rarely 5.9% ½ of the time 26.2% Always 58.8%		Never 22.4% Rarely 23.6% ½ of the time 35% Always 19.0%

[a] Including long sleeve shirt.

that farmers have at least three times the UV exposure compared to indoor workers (Schmalwieser et al., 2010). Work done by Holman et al. (1983) and (Hammond et al., 2009) suggest that this is a conservative estimate and that exposure is more likely to be an estimated six to eight times higher compared to indoor workers. A study undertaken by Schmalwieser et al. (2010) in Austria, asked farmers to wear a UV measuring device on their forehead during a whole European summer. He identified that the most exposure was between 12 and 4 pm and when working in an upright position in an open paddock, e.g. mustering cattle and fixing fences. This finding confirms the early Sun Smart advertisements approach of avoiding outdoor work in the middle of the day when UV rates are at their highest (Anti Cancer Council of Victoria, 1981).

Skin protective behaviours

A word frequency search through the thirty-three relevant articles to identify skin protective behaviours showed that sunscreen is the most mentioned word, at 372 times. A hat is mentioned 213 times, and the word 'long' (in relation to long pants and long sleeves) has 92 mentions. The word shade is counted 40 times and sunglasses 32 times. This finding suggests that sunscreen is the most studied, most reported, most promoted part of the SunSmart message.

Table 2 shows the results of surveys conducted into skin protective behaviours to reduce UV exposure amongst farmers and other populations. Six studies include farmers in USA and two studies include Australian farmers. Subdivisions about female and male farmers are provided where available. A brief discussion on some of these findings is below.

In 2005, Australian farmers and outdoor workers were surveyed during an agricultural event in Victoria. The respondents ($n = 159$) indicated that 75% of farmers wear a broad brimmed hat, although only 35% were observed to wear one at the time of attending the event. Seventy-five percent said they wear long trousers, 27% wear long sleeve shirts and 48% responded *never* to the use of sunscreen (Dobbinson et al., 2005). This rate was 19% higher (worse) than other outdoor workers of which 39% reported to never use sunscreen (see Table 1). A study undertaken by Kearney et al. (2013) in North Carolina showed 58.5% of farmers perceived wearing a baseball cap as part of good sun protection. The low use of sunscreen was similar to the Dobbinson et al. (2005) Australian study with 45% of farmers reporting rarely and never using sunscreen (Kearney et al., 2013). A proportion of hat-wearing farmers (85.6%) use baseball type caps—often handed out for free by agribusiness to promote their products—that offer no protection to the back of the neck and ears. Farmers appear to use less sunscreen than other outdoor workers, although they are more likely to wear long sleeves, trousers, sunglasses and a hat. As shown in Table 1 the use of UV protection clothing is not well described in the context of farmer sun protection behaviours as evidenced by the low level of word frequency (92 mentions compared to 372 for sunscreen) in regard to clothing and not all research papers reporting on its use.

All papers asked about sunscreen use, however, only two of the studies reviewed, Makin et al. (2009) and Dobbinson et al. (2005)—both Australian papers—surveyed the practice of reapplication of sunscreen. Both papers found low levels of reapplication with 54% and 67% respectively reported never reapplying. This is despite the importance of reapplying sunscreen every two hours to maintain its effectiveness being known for decades and recommended by both the Australian Therapeutic Goods Association (Australian Government, 2014) and the Federal Drug Administration (US Department Health and Human Services, 2011). This suggests that for farmers this message has not got through or it is a routine that does not fit farmers' daily schedule. There is a need to shift promotion focus onto protective clothing over sunscreen application and re-application.

Kearney et al. in the USA study reported no statistical significant difference in skin protection behaviours between farmers who had previously had a skin cancer and those who hadn't (Kearney et al., 2013). However, farmers with fairer skin reported higher use of skin protection (wearing a hat, using sunscreen, and wearing a long sleeve shirt) and rate it more important than farmers with darker skin who do not tend to burn. Importantly, Kearney reports a significant ($p < 0.05$) connection between having had a skin check for cancer and improved protective behaviour. Indicating that those who seek skin checks are also those who are likely to protect themselves or that those who have skins checks provided are more vigilant (Kearney et al., 2013).

The Department of Human Resources in Georgia USA has looked extensively into what factors determine farmers' ability to adopt effective skin protection strategies (Parrott et al., 1998). The message of encouraging hats, long sleeves and sunglasses seemed to work better than promoting the use of sunscreen. The advice to avoid sun exposure between 10 am and 3 pm or when the UV level is at its highest is not always a viable option for most farmers and is therefore likely to be ineffective (Parrott et al., 1998). Health messages for farmers work better when it advises farmers what they can do, rather than what they should not do.

Public health campaigns

The biggest campaign in Australia has been the Slip! Slop! Slap! Seek! and Slide! Campaign[b]. Public health campaigns are either aimed at the whole community or specific subgroups like schools and work places (Strickland and Fritschi, 2014). Studies done in large companies with many outdoor workers, show that workers provided education are more likely to show increased knowledge but not changed their attitude or practice towards skin protection (Girgis et al., 1994).

An article published in the Asian Pacific Journal of Cancer Prevention describes the improvement of knowledge and attitude, of farmers towards skin protection in a remote farming area of Turkey. Whilst this is not an Australian workforce, Malak et al. (2011) stated the observed lack of knowledge in participants complicated the perceptions of the significance of skin protection.

Studies done on the general Australian population such as Smith et al. (2002) into Australian campaigns, recommend that reinforcement must be repeated often to be effective. Three repeated intensive SunSmart campaigns initially improved knowledge (Smith et al., 2002) but lacked the power to have a sustained and cumulative effect on skin protection. The first ten years of campaigns in Australia showed positive results with less sunburn, more sunscreen use and less body exposure in the general population. Montague, however, reported protection behaviours dropping to baseline levels in between campaigns and skin protection behaviours plateauing or regressing (Montague et al., 2001). This is also reflected in no reduction in the incidence of melanoma and non-melanoma skin cancer, despite all the health campaigns. Primary prevention efforts in the general population to prevent sun damage appear to be inadequate (Weinstock, 2008). More recent articles by Buchanan (2013) and Strickland and Fritschi (2014) now question the effectiveness of the Slip, Slop, Slap SunSmart message and are asking if the message is getting through. Farmers have not been investigated as a separate occupational group in this branch of the research. No data is available how behaviours have changed since the introduction of the campaign, nor from the added Seek and Slide components since 2005. For the Australian farming population it is interesting to compare Dobbinson and Makin's studies. Dobbinson collected the data prior to in additional 'Slide' (on sunglasses) and reports 38% usually or always wearing sunglasses, whereas Makin reports from data collected in 2006 that the percentage who usually or always wear sunglasses is 44.5%. Both studies use convenience samples and self reported questionnaires in attendees to rural farm field days, trade shows and weekend cattle sales. Participant characteristics are not

included in either study, which makes drawing conclusions difficult, not knowing the proportion of women, mean age, education level and skin type for instance.

Cost of skin cancers in Australia

The cost of treating non melanoma skin cancer in Australia increased by 87% between 1997 and 2010 (Fransen et al., 2012). A cost–benefit analysis done in 1999 calculated that $AUD 0.28 cents per capita in Australia spent on primary prevention through health campaigns would prevent 4300 premature deaths over 20 years and would result in a net saving of $AUD 103 million (Dobbinson et al., 2008). Updated information from 2009 supports the cost effectiveness of the SunSmart campaign. Shih et al. (2009) looked at the disability adjusted life years and life-years saved since the introduction of the SunSmart campaign and calculated for every dollar invested in this campaign, there will be an estimated return of AUD$2.30. She called it 'excellent value for money' (Shih et al., 2009). Even though skin cancer incidence is rising, it is calculated that numbers would be worse if Australians had not been exposed to the public health campaign. Because UV radiation is listed as a foreseeable occupational hazard, payments for compensation claims have also been rising. It was calculated that a total of AUD$ 30 million was paid between 2000 and 2009 in workplace compensation claims related to skin damage (Strickland and Fritschi, 2014). Analysing Medicare item numbers, Fransen et al. reported that non-melanoma skin cancer is the most costly cancer in Australia: mounting to $93.5 million Australian dollars in 2010, and estimated to rise to $109 million in 2015 (Fransen et al., 2012). If the cost of diagnosis and pathology is included, these figures increase to a total cost of $511 million in 2010, expected to rise to $703 million by 2015. The yearly cost of treating skin cancers in America is estimated to be US$8.1 billion. This is split in US$4.8 billion for non-melanoma skin cancers and US$3.3 billion for melanoma (Guy et al., 2015).

Early detection of skin cancers

Multiple articles sourced in this review state that there is need for more aggressive education, sun safety counselling by GPs and making early detection part of the overall SunSmart message(Mullan et al., 1996; Steiner and Radosevich, 1986; Stanton et al., 2004). There is a lack of GPs advising about skin checks and/or offering this service as part of general health screening. Although general practitioners are aware of the need to educate their patients about skin protection, the key reason why it's often not done is the low self-efficacy of health care providers in the area of UV radiation and skin protection. Clearly, GPs should not start screening or providing advice if they lack the knowledge and skills on how to do so reliably (Sabri and Harvey, 1996). However, GPs who are making use of opportunistic counselling are more effective at achieving lasting behaviour changes compared to handing out written documents such as leaflets (Falk and Magnusson, 2011).

Farmers are known to be reluctant to seek health advice, often waiting until they have a serious health concern to consult their doctor(Brumby et al., 2010)—this includes skin cancers which has previously shown a higher mortality rate in farmers (Fragar et al., 2011). However, farmers are known to enjoy interacting in farming industry groups and networks and to discussing and undertaking health and wellbeing assessments issues in these groups. Well-trained occupational nurses could perform skin checks and interact with farmer groups. In the Australian setting, not only occupational nurses, but also practice nurses could play an important role in performing regular skin checks. The current Royal Australian College of General Practitioners' Redbook, which holds the National guidelines for GP's primary screening programs, states that general screening for skin health is not recommended, because it is not proven to be effective (Royal Australian College of General Practitioners, 2012). It suggests that GPs use opportunistic screening moments and provide SunSmart counselling in all age groups. Similarly the current opinion in America states that there is no evidence to warrant regular skin checks for the general population. However mention is made about screening high-risk populations, such as fair skinned people over the age of 65, patients with a history of skin cancer, people with Dysplastic Naevi Syndrome and patients with a known high UV exposure (US Preventive Services Taskforce, 2009). These recommendations from 2009 are currently under review.

Discussion

Based on the literature reviewed there is large group of farmers that use limited or nil skin protection at all. It is unlikely that promoting use of sunscreen will result in increased and adequate sunscreen usage amongst farmers. Estimates of sun exposure and skin protection practice indicate that protective clothing is the most promising avenue to improve on farmers' skin protection and prevent skin cancers; a part of the SunSmart message that has been under-reported and possibly under-promoted. To promote better health outcomes for farmers, increased use of information technology is also recommended, as well as up skilling health workers in performing skin checks. Agricultural events, and making use of health care partners, can also increase the availability of skin checks for farmers.

Early detection is currently not part of the Australian health campaign that promotes the SunSmart strategy of Slip, Slop, Slap, Seek and Slide. The availability of skin checks is low. General Practitioners and nurses can play a more active role in delivering appropriate SunSmart counselling (Vuong et al., 2014). However, apart from social marketing and health promotion funds there is no financial incentive to do so. New guidelines recommending yearly skin checks for farmers of 55 years and over should be implemented.

Limitations

The authors would like to comment that the inconsistency of international information gathering, analysing and reporting makes it difficult to draw conclusions on the data summarised in Table 1, a finding also confirmed by Kearney et al. (2014). Furthermore the use of surveys and convenience samples at agricultural events leaves room for self-selection bias of participants and self-reporting bias of behaviours. There was one well-designed study reported by Girgis et al. (1994) which used a calculated protection score, based on body parts protected from sun exposure. He asked his two groups of participants—outdoor workers—to keep a diary pre education intervention. To check the accuracy of the self reported protection levels, he had a team member from the research group, as well as a workplace safety manager directly observe the workers' protection levels for correlation to the diaries (Girgis et al., 1994). This level of accuracy is difficult to achieve with questionnaires.

Recommendations

The Authors highlight a number of steps to improve skin protection for farmers:

1. Promote the use of protective clothing, being long trousers and long sleeve shirts, wide brimmed or flap hats as the main primary skin protection strategy.
2. Include regular skin checks in the SunSmart campaign message for farm men and women and agricultural workers.
3. Stimulate GPs and nurses to up-skill in skin cancer screening.
4. Return of outdoor workers/farmers into the SunSmart Slip, Slop, Slap, Seek, Slide messages
5. Research of farmers' practices of applying sunscreen appropriately, effectively and adequately, especially the practice of re-applying sunscreen

6. An international and agreed sun protection scoring system to be used in further research to enable comparability between studies and countries.

Conclusion

This review shows that despite increased knowledge, skin protection behaviours in farm men and women have remained low. Differences in study designs and investigated behaviours make it hard to draw conclusions or detect a trend. Skin cancers have continued to increase and now form the most costly cancer in the Australian Medicare system. This review highlights a major challenge for preventive health with the goal of reducing harm and preventing injury. More research and importantly timely and appropriate action is needed if we are to prevent and detect skin cancers in farmers.

Conflict of interest

The authors declare that there are no conflicts of interests.

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