



**Queensland University of Technology**  
Brisbane Australia

This is the author's version of a work that was submitted/accepted for publication in the following source:

Vu, Lan H., van der Pols, Jolieke C., Whiteman, David C., Kimlin, Michael G., & Neale, Rachel E. (2010) Knowledge and attitudes about Vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia. *Cancer Epidemiology, Biomarkers and Prevention*, 19(7), pp. 1784-1789.

This file was downloaded from: <http://eprints.qut.edu.au/38443/>

© Copyright 2010 American Association for Cancer Research

**Notice:** *Changes introduced as a result of publishing processes such as copy-editing and formatting may not be reflected in this document. For a definitive version of this work, please refer to the published source:*

<http://dx.doi.org/10.1158/1055-9965.EPI-10-0127>

**Knowledge and attitudes about vitamin D and impact on sun protection practices among urban office workers in Brisbane, Australia**

**Authors:** Lan H Vu<sup>1</sup>, Jolieke C van der Pols<sup>2</sup>, David C Whiteman<sup>2</sup>, Michael G Kimlin<sup>1</sup>, Rachel E Neale<sup>2</sup>

<sup>1</sup>Queensland University of Technology, Brisbane, Australia

<sup>2</sup>Cancer and Population Studies, Queensland Institute of Medical Research, Brisbane, Australia

**Grant support:** Lan Huong Vu is supported by the Australian Leadership Awards. Rachel Neale and David Whiteman are supported by NHMRC fellowships and Michael Kimlin is supported through a Cancer Council Queensland Senior Fellowship. This research was sponsored by Suncorp as part of their Sunwise initiative, which aims to promote sun safety in the Queensland community.

**Requests for reprints:** Rachel Neale

Queensland Institute of Medical Research

Post Office, Royal Brisbane Hospital

QLD, 4029, Australia

Telephone: 61 7 3845 3598

Fax: 61 7 3845 3502

Email: [rachel.neale@qimr.edu.au](mailto:rachel.neale@qimr.edu.au)

**Running title:** Vitamin D knowledge and attitudes and sun protection

**Key words:** vitamin D, sun exposure, sun protection, sunscreen

**Abstract**

**Background:** Sun exposure is the main source of vitamin D. Increasing scientific and media attention to the potential health benefits of sun exposure, may lead to changes in sun exposure behaviours.

**Methods:** To provide data that might help frame public health messages, we conducted an online survey among office workers in Brisbane, Australia, to determine knowledge and attitudes about vitamin D and associations of these with sun protection practices. Of the 4709 people invited to participate, 2867 (61%) completed the questionnaire. This analysis included 1971 (69%) participants who indicated that they had heard about vitamin D.

**Results:** Lack of knowledge about vitamin D was apparent. Eighteen percent of people were unaware of the bone benefits of vitamin D but 40% listed currently unconfirmed benefits. Over half of the participants indicated that more than 10 minutes in the sun was needed to attain enough vitamin D in summer, and 28% more than 20 minutes in winter. This was significantly associated with increased time outdoors and decreased sunscreen use. People believing sun protection might cause vitamin D deficiency (11%) were less likely to be frequent sunscreen users (summer OR=0.63, 95%CI=0.52-0.75).

**Conclusions:** Our findings suggest that there is some confusion about sun exposure and vitamin D, and that this may result in reduced sun protective behaviour.

**Impact:** More information is needed about vitamin D production in the skin. In the interim, education campaigns need to specifically address the vitamin D issue to ensure that skin cancer incidence does not rise.

## Introduction

Skin cancer is a significant problem particularly among Caucasian populations in many Western countries (1). The primary cause of most skin cancers is exposure to solar ultraviolet radiation, and for several decades public health education campaigns have promoted sun protective behaviours. There is evidence that adoption of these practices is beginning to reduce the incidence of skin cancers in Australia (2).

In contrast to its harmful effects, solar ultraviolet (UV) radiation also results in the production of vitamin D (3). Adequate vitamin D levels are essential for maintenance of bone health (4), but there has been increasing research in the past decade into its other possible health benefits (5). There has been growing media attention to these potential benefits (6), and there is concern that this might lead to reduced sun protective behaviours, with consequent increases in the risk of skin cancer (7-9).

The Cancer Council Australia (10) has released a position statement that attempts to balance the benefits and harms of sun exposure. It suggests that most fair-skinned people only need a few minutes of sun exposure per day on either side of the peak UV period in order to generate sufficient vitamin D in summer. Although sun protection may not be required in some regions in winter, in areas where the ambient UV remains high, consistent use of sun protective measures is warranted throughout the year (10).

In order to develop effective public education campaigns, better understanding about knowledge and attitudes of populations towards vitamin D and the effect that these may have on sun exposure behaviour is necessary. There have been previous surveys in Queensland which suggest that a high proportion of the population is unaware of the current recommendations (7, 11). However these surveys have had relatively low response rates and have not targeted a specific population. We therefore undertook a survey in a population of office workers in Brisbane, Australia, recruiting employees of Suncorp, a large banking and insurance organisation with employees from a broad range of backgrounds. Suncorp runs a

community education program, Sunwise, aiming to provide education to the general public, and was thus able to facilitate this project as part of its research support program. This study aimed to (a) understand knowledge and attitudes towards vitamin D, and determinants of these, and (b) explore associations between knowledge and attitudes and sun protection behaviours.

### **Material and Methods**

In March 2009, we conducted an online survey among Suncorp employees based in Brisbane, a city situated at 27 degrees south in Queensland, Australia. Ethical approval for this study was obtained from the Queensland Institute of Medical Research Human Research Ethics Committee.

The survey collected information about socio-demographic factors, skin cancer risk factors, and self-reported past history of skin cancers. To ascertain knowledge about vitamin D we asked about the sources of vitamin D, and the amount of time required in the sun in winter and summer for a fair-skinned person to obtain enough vitamin D (see supplementary material for the wording of the questions).

Attitudes were assessed by asking the participants about their level of agreement with two statements which were similar to those used in previous surveys (7, 11). These were: (a) If I regularly protect myself from the sun I am in danger of not getting enough vitamin D; (b) I am concerned that my vitamin D levels might be too low. Responses were measured using a five-level Likert scale.

We asked participants about the amount of time spent outdoors on typical non-work days and about their sunscreen use (see supplementary material). The sun exposure variables were dichotomized into 'less than two hours' versus 'two hours or more' and the sunscreen use variables into 'never, rarely or sometimes' versus 'usually or always/almost always' for the analysis of associations with knowledge and attitudes.

We analysed data using PASW Statistics version 17.0. Analyses were largely restricted to those people who said that they had heard or learnt about vitamin D, and therefore completed the vitamin D section of

the questionnaire (N=1971). Differences between this subgroup and those who had not heard about vitamin D were assessed using Chi-squared statistics. We used logistic regression to estimate associations with vitamin D knowledge and attitudes and then between knowledge/attitudes and sun exposure/sunscreen use.

## **Results**

Of 4709 eligible staff, 70% logged onto the online survey. Of these, 2867 people (61% of 4709) completed the questionnaire with full information on socio-demographic characteristics. Sixty nine percent (1971) of those who completed the questionnaire affirmed that they had some knowledge of Vitamin D. These were more likely to be female, somewhat older and to have a university education than those who had not heard about vitamin D (see Supplementary Table). There were no differences in phenotypic skin cancer risk factors between these two groups, but participants who did not know about vitamin D seemed more likely to spend more time outdoors in summer and less likely to use sunscreen than those who did know about it.

### *Knowledge about vitamin D*

The majority of the participants indicated that they had obtained information about vitamin D from the media (television, newspaper, and magazine) (67%) (table 1). Nearly one third indicated that they had no knowledge of the benefits of vitamin D (table 1), and this was more common in men than in women (OR=1.63, 95%CI 1.35-1.97, age adjusted). Among those who indicated some knowledge of the benefits of vitamin D, 18% did not indicate any of the confirmed benefits to bone health (table 1).

Approximately one third of respondents who said they knew the sources of vitamin D indicated an incorrect food source and 17% did not select exposure of the skin to the sun.

Over half of the participants indicated that more than 10 minutes in the sun was needed to attain enough vitamin D in summer, and 28% selected more than 20 minutes in winter. This belief was significantly more common in men than in women.

#### *Attitudes towards vitamin D*

The majority of participants (69%) disagreed with the statement “If I regularly protect my skin from the sun, I am in danger of not getting enough vitamin D”, while 11% agreed (table 1). Study participants over 50 and those with olive skin were more likely than younger and fair-skinned participants to feel that sun protection would cause vitamin D deficiency (table 2). Those who were unsure about this statement were more likely to be male (42% versus 36%,  $p=0.02$ ), and less likely to use sunscreen frequently in summer (51% versus 61%,  $p<0.001$ ) and in winter (14% versus 23%,  $p<0.001$ ) than those who either agreed or disagreed.

Fifty percent of people disagreed with the statement “I am concerned that my current vitamin D level might be too low” and 9% of people agreed. Women were more concerned about their vitamin D levels than men (OR 2.43 95%CI 1.67-3.54). Compared to those who agreed or disagreed with this statement, people who were unsure tended to have lower education levels (40% versus 48% with a degree,  $p<0.001$ ) and to be less likely to use sunscreen in summer (57% versus 61% usually or always,  $p=0.08$ ) and in winter (18% versus 24% usually or always,  $p=0.002$ ).

#### *Association between vitamin D knowledge & attitudes and sun exposure/ protection*

Approximately one-third of the population reported spending two or more hours outside on weekends in summer and 41% in winter. Fifty-nine percent of people used sunscreen frequently in summer compared with 21% in winter (supplementary table).

We found significant positive associations between the amount of time spent outdoors and the time thought necessary to ensure vitamin D sufficiency (table 2). People who believed that high levels of sun

exposure are required to generate vitamin D were less likely to be frequent sunscreen users (table 3).

Compared with those identifying only the benefits to bone, participants identifying other benefits reported spending more than 2 hours in the sun and using less sunscreen during the last year.

Participants who believed that sun protection might cause vitamin D deficiency reported a significantly lower frequency of sunscreen use (table 3). Those who expressed concern about their own vitamin D levels were significantly less likely to have spent more than 2 hours in the sun last summer and winter and were less likely to have used sunscreen often last summer.

## **Discussion**

We assessed knowledge and attitudes about vitamin D of office workers in Brisbane, and the influence of these on sun exposure and sunscreen use. There was clear evidence of a knowledge deficit in this population. A high proportion of participants did not know that vitamin D is vital for bone health, but a majority indicated that vitamin D has a range of other health benefits, which has frequently been the subject of media attention (8). Lack of knowledge about vitamin D is further illustrated by the high proportion of people who incorrectly identified foods as sources of vitamin D or were unaware that sun exposure leads to formation of vitamin D. Approximately 30% of participants reported that they had no knowledge of vitamin D at all, and were therefore asked no further questions. We can assume that the knowledge of this group of people would be poor.

It has been suggested that in an environment with high UV levels such as in Brisbane, 2-6 minutes of sun exposure per day during peak UV hours in summer and 4-17 minutes in winter would be sufficient for vitamin D production in a fair-skinned person, and that sun protection practices should be maintained all year (12). A high proportion of our sample was unaware of these recommendations and believed that substantially greater time is needed for vitamin D production. This lack of knowledge was associated with increased time outdoors and reduced sunscreen use. Due to the cross-sectional study design we could



not determine whether lack of knowledge about vitamin D resulted in reduced sun protection practices, or whether people justified reduced sun protection behaviour on the basis of perceived vitamin D requirements. However these findings are consistent with the results of a recent survey in Queensland (11), suggesting that increasing knowledge may lead to improved sun protection practices.

Sunscreen use appears not to affect vitamin D production in a population setting (5). However, 11% of our sample believed that sun protection might lead to a lack of vitamin D. This is lower than the 32% reported by Youl and colleagues (11) and might be due to the difference in sampling frame. Nevertheless, as in the previous study we also found that this attitude was more common among people with a lower frequency of sunscreen use. A relatively high proportion of people were uncertain about whether or not sunscreen use diminishes vitamin D production, further emphasising the need for public education about this issue.

Our study focused specifically on a population of office-workers in whom we were able to include a large sample size with a relatively high response rate. The participants in this study were recruited from an organisation that actively promotes sun protection to the public. Messages about vitamin D have not formed a core part of the promotional materials, and there is no fact sheet or clear position statement about vitamin D on the Suncorp Sunwise website ([suncorpsunwise.com.au](http://suncorpsunwise.com.au)). However, it is possible that this population has greater knowledge about vitamin D than the general community. If so, there would be even greater cause for concern about the possible effects of mixed messages about sun exposure than indicated here. Additional research in other populations in different areas, possibly with a prospective study design to gauge change in attitudes, would lead to a better understanding of public perception of this issue.

In conclusion, current knowledge regarding the health impacts of low vitamin D, and about how much sun exposure is needed to make vitamin D in different circumstances, makes it very difficult to balance the need to adopt a precautionary approach regarding the possible benefits of sun-induced vitamin D against

the known harms of overexposure to the sun. Substantial research is needed to address these issues. In the interim, evidence from this and other studies indicates that the public are confused and concerned and that public health messages need to specifically target the vitamin D issue in order to ensure that skin cancer rates do not increase in coming years.

**References:**

1. de Vries E, Bray FI, Coebergh JWW, Parkin DM; European Network of Cancer Registries. Changing epidemiology of malignant cutaneous melanoma in Europe 1953-1997: Rising trends in incidence and mortality but recent stabilizations in Western Europe and decreases in Scandinavia. *Int J Cancer* 2003;107:119-26.
2. Staples MP, Elwood M, Burton RC, Williams JL, Marks R, Giles GG. Non-melanoma skin cancer in Australia: the 2002 national survey and trends since 1985. *Med J Aust* 2006;184:6-10.
3. Holick MF. Sunlight and vitamin D for bone health and prevention of autoimmune diseases, cancers, and cardiovascular disease. *Am J Clin Nutr* 2004; 80:1678S-88S.
4. Bischoff-Ferrari HA, Giovannucci E, Willett WC, Dietrich T, Dawson-Hughes B. Estimation of optimal serum concentrations of 25-hydroxyvitamin D for multiple health outcomes. *Am J Clin Nutr* 2006;84:18-28.
5. International Agency for Research on Cancer, World Health Organisation. Vitamin D and cancer. Lyon: International Agency for Research on Cancer; 2008 Nov 25. IARC Working Group Reports Vol. 5.
6. Scully M, Wakefield M, Dixon H. Trends in news coverage about skin cancer prevention, 1993-2006: increasingly mixed messages for the public. *Aust N Z J Public Health* 2008;32:461-6.
7. Janda M, Kimlin M, Whiteman D, Aitken J, Neale R. Sun protection and low levels of vitamin D: are people concerned? *Cancer Causes Control* 2007;18:1015-9.
8. Janda M, Kimlin MG, Whiteman DC, Aitken JF, Neale RE. Sun protection messages, vitamin D and skin cancer: out of the frying pan and into the fire? *Med J Aust* 2007;186:52-4.
9. Kasparian NA, McLoone JK, Meiser B. Skin cancer-related prevention and screening behaviors: a review of the literature. *J Behav Med* 2009; 32:406-28.

10. Cancer Council Australia. Risks and benefits of sun exposure: Position statement [Internet]. 2007 May 3 [cited 2009 Jan 26]. Available from:  
<http://www.cancer.org.au/policy/positionstatements/sunsmart/risksandbenefitsofsunexposure.htm>.
11. Youl PH, Janda M, Kimlin M. Vitamin D and sun protection: The impact of mixed public health messages in Australia. *Int J Cancer* 2008;124:1963-70.
12. Samanek AJ, Croager EJ, Gies P, et al. Estimates of beneficial and harmful sun exposure times during the year for major Australian population centres. *Med J Aust* 2006;184:338-41.