Determinants of Sun-Related Behaviours in Young Adults: The Role of Knowledge, Sociocultural Influences, and Appearance Ideals

Ashley Kathryn Day

Bachelor of Psychology (Hons)

School of Psychology, The University of Adelaide

A thesis submitted in partial fulfilment of the requirements for the combined degree of

Master of Psychology (Health) and Doctor of Philosophy

August, 2014

TABLE OF CONTENTS

ABSTRACT

Skin cancer is one of the most common cancers in Australia (Australian Institute of Health and Welfare, 2013). The aim of this research was to test and validate predictors that contribute to young adults' sun-related behaviours (namely tanning behaviours, sun-protective behaviour, and incidental sun exposure), and therefore skin cancer risk.

A systematic review of 34 quantitative studies assessed the correlation between skin cancer knowledge and sun-related behaviours in the general population. A positive relationship between higher skin cancer knowledge and greater sun-protective behaviour was found in the majority of cases. Overall, the capacity to determine the impact of skin cancer knowledge on sun-related behaviours was compromised by heterogeneity in measurement of the construct, and results indicated the need for a standardised, multi-item measure of skin cancer knowledge.

Study two describes the development and testing of the 25-item Skin Cancer and Sun Knowledge (SCSK) scale in a sample of 514 young adults reporting Western heritage. Skin cancer knowledge was associated with sun-related behaviour, with the final model accounting for 12.3 to 23.2% of variance in female sun-related behaviours, however relationships were not significant among the male sample. Thus, consideration of additional factors, beyond skin cancer knowledge, was recommended.

Tanning behaviour was considered from a body image perspective in the third study. In a sample of 246 young adults of Western heritage, predictors based on the Tripartite Influence Model (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999b) successfully explained tanning behaviour among young women, but not young males. Although both genders internalised a tanned ideal, influences on the decision to engage in tanning behaviour were gender specific.

The final two studies in this thesis explored the role of Asian heritage in the sun-related behaviours of young adults. The fourth study assessed predictors of sun-related behaviours among 140 young adults of Asian heritage. Tanning behaviour was common, and was more likely among those who endorsed Western sociocultural tanning norms. Skin cancer knowledge levels were low, and were not associated with sun-related behaviour. The fifth and final study considered the role of sociocultural variables, including Australian-acculturation, in the prediction of sun-related behaviours among young adults with Asian heritage ($N = 399$). Skin tone perceptions and endorsement of sociocultural tanning norms that value tanned skin were significantly associated with tanning behaviour, however acculturation was not. These results indicate the pervasiveness of the effect of social normative influences and skin tone attractiveness perceptions on tanning behaviour, among diverse cultural samples.

The series of studies presented in this thesis improve understandings of young adults' sun-related behaviour. There is a need for consistent measurement of skin cancer knowledge and improvement of knowledge levels, beyond awareness, and improving skin cancer knowledge may be a key area to target for Asian Australians. Sociocultural tanning norms and skin tone preferences are central to understanding tanning behaviour across cultural groups, and the results suggest that conceptualisation of female tanning as a body image behaviour may be appropriate. Importantly, results suggest the role of these predictors differs across genders, and suggestions for future research addressing young men's sun-related behaviour are discussed.

DECLARATION

I, Ashley Day, declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person, except where due reference has been made in the text. I certify that this work contains no material that has been accepted for the award of any other degree or diploma in my name in any university or other tertiary institution. No part of this work will, in the future, be used in a submission in my name for any other degree or diploma in any university or other tertiary institution without the prior approval of the University of Adelaide and where applicable, any partner institution responsible for the joint award of this degree.

I give consent to this copy of my thesis, when deposited in the University Library, being made available for loan and photocopying, subject to the provisions of the Copyright Act 1968.

I also give permission for the digital version of my thesis to be made available on the web, via the University's digital research repository, the Library Search and also through web search engines, unless permission has been granted by the University to restrict access for a period of time.

I acknowledge that copyright of published works contained within this thesis resides with the copyright holder(s) of those works.

Published works

Chapter 2: Paper One

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2013). The role of skin cancer knowledge in sun-related behaviours: A systematic review. *Journal of Health Psychology*. Advance online publication. doi: 10.1177/1359105313485483

Chapter 3: Paper Two

Day, A. K., Wilson, C., Roberts, R. M., & Hutchinson, A. D. (2014). The Skin Cancer and Sun Knowledge (SCSK) scale: Validity, reliability, and relationship to sun-related behaviors among young Western adults. *Health Education and Behavior, 41*, 440-448. doi: 10.1177/1090198114529129

Ashley Day

Signed: _____ Date: _____

ACKNOWLEDGEMENTS

This thesis represents the culmination of three and a half years work, and marks the end of a challenging but enjoyable period of my life. There are a number of people who contributed time, knowledge, and support throughout this process, and for that I am truly grateful.

My supervisors, Carlene Wilson, Amanda Hutchinson, and Rachel Roberts, have been invaluable throughout this process, and I am enormously thankful to have had such wonderful support. Thank you for working with me to develop my skills as an academic researcher and writer, and for your enduring encouragement. Additionally, I want to thank Rachel for choosing me as the recipient of a summer research scholarship back in 2008, an instrumental experience in fostering my interest in research.

I would like to acknowledge the support of my ever-patient mother. Thank you for graciously giving your time, advice, and support. Not many students are lucky enough to have a recent PhD for a parent – and not many parents are unlucky enough to be in that position!

I am also very grateful to have shared this journey with a wonderful group of PhD and Masters students, as well as my people - my cherished fellow "combineds". A particular thank you to Nylanda, who has most closely shared this experience with me, and has shaped my own journey in more ways than any other. I am forever grateful for our (countless!) conversations, and the simultaneously valuable, practical, motivational, and supportive academic and nonacademic advice that was always only a phone call away.

OVERVIEW

Outline of Thesis

This research explored determinants of sun-related behaviours (tanning behaviours, sun protection, and incidental sun exposure) that influence skin cancer risk. There are key gaps in the literature with respect to our understandings of the relationship between skin cancer knowledge and sun-related behaviours. As skin cancer knowledge accounted for modest amounts of variance in sun-related behaviours, additional influencing factors were also considered. The role of skin tone based appearance ideals and sociocultural tanning norms were explored due to the significance of appearance motivations underlying sun-related behaviour. Specifically, the aims were to 1) determine the extent to which skin cancer knowledge predicts sun-related behaviours, 2) examine tanning behaviour from the theoretical perspective of the Tripartite Influence Model, and 3) examine the sun-related behaviours of Asian Australians.

This research represents one of the first attempts to explore sociocultural influences on tanning behaviour from a body image theoretical perspective. Furthermore, this research is among the first in Australia to consider specifically the factors contributing to sun-related behaviour in not only those with Western heritage but also those with Asian heritage, a group with rising skin cancer incidence, poor prognostic outcomes, and a social endorsement of fair, rather than tanned, skin (Bellew, Del Rosso, & Kim, 2009; Kim, Del Rosso, & Bellew, 2009; Li, Min, Belk, Kimura, & Bahl, 2008). Young adults were the target group due to their high levels of participation in behaviours that impact skin cancer risk (D. B. Buller et al., 2011; Heckman et al., 2013; Wickenheiser, Baker, Gaber, Blatt, & Robinson, 2013). Findings from one systematic review, three cross-sectional studies, and one retrospective cohort study are

presented in five papers reported here as chapters. Of these papers, two have been accepted for publication and the remaining three have been submitted for publication.

Chapter 1 provides an introduction to the issue of skin cancer in Australia, sun-related behaviours, and factors that contribute to our understanding of these behaviours. The aims of the thesis are also outlined. Chapters 2 to 6 contain the five papers produced as parts of this thesis, with statements outlining author contributions, as well as opening and closing sections that outline the rationale for each study in the context of the broader research goals, and provide information beyond the scope of the papers. Chapter 7 synthesises the findings of each of the studies and presents a discussion of the broader thesis conclusions. Limitations of the project are addressed, as are the implications of the conclusions reached. Suggestions for future research are also discussed.

References for all chapters are provided at the end of the thesis and a copy of the published manuscripts (reported in Chapters 2 and 3) are included as Appendices (Appendix A and B, respectively). Tables and figures are numbered consecutively within each chapter.

Outline of Candidature

The current thesis was undertaken to fulfil the requirements of a combined Doctor of Philosophy/ Master of Psychology (Health) degree undertaken at the University of Adelaide, South Australia. This program (*4 years fulltime*) combines a full Psychology Masters (Health) course load (*equivalent 2 years fulltime*) and a full research program for a Doctor of Philosophy (*equivalent 3 years fulltime*), and stipulates that the research undertaken has to adopt a health psychology focus. The five papers that form the body of this work, along with nine masters subjects and three placements (with a combined total of 1,098.5 placement hours) were completed within

3.5 years of fulltime study. A total of $3,750 in funding over and above the standard support provided to Doctor of Philosophy students was received from the School of Psychology to fund conference travel as well as website hosting for online data collection. All subject and practical requirements of the Masters component of the program were completed successfully. The following thesis is submitted to fulfil the requirements of the Doctor of Philosophy degree.

CHAPTER 1. INTRODUCTION AND LITERATURE REVIEW

1.1. Preamble

This first chapter reviews the current literature on skin cancer and sun-related behaviours and establishes the basis for this research. This is followed by a review of literature relating specifically to skin cancer knowledge, and a discussion of research regarding the social context of sun-related behaviour, including cultural considerations. The broader theoretical models frequently used in sun-related behaviour are considered, and a key theoretical model used in the body image literature is introduced. Finally, the thesis aims are outlined.

1.2. Skin Cancer and Australia: Types, Prevalence, Consequences, and Causes

Skin cancer is the most common form of cancer in Australia (Australian Institute of Health and Welfare, 2011b; Cancer Council Australia, 2013). It is estimated that one out of every three people who spend their childhood or adolescence in Australia will develop skin cancer by the age of 70 (Staples et al., 2006). The International Classification of Diseases Code (ICD-10) classifies skin cancers under three categories: Malignant melanoma of the skin, merkel cell carcinoma, and other and unspecified malignant neoplasm of skin, referred to as nonmelanoma skin cancer (NMSC; World Health Organization, 1992). Melanoma develops in cells (melanocytes) that create pigment, and is the most life threatening form, whereas the more common, and less dangerous NMSCs, basal cell and squamous cell carcinomas, form on the surface of the skin. Merkel cell carcinomas form internally in neuroendocrine cells and are uncommon, but potentially lethal (National Cancer Institute, 2013). Cases of basal cell carcinoma and squamous cell carcinoma, the most common types of NMSCs, are not required to be reported to the Australian Cancer Database, and are thus not recorded by state and territory cancer registries throughout

Australia, with the exception of Tasmania (Australian Institute of Health and Welfare, 2011b). Thus, there are no records of the incidence and deaths caused by these common NMSCs in Australia. Information provided by the Australian Institute of Health and Welfare and Cancer Council of Australia estimates over 750,000 cases of basal and squamous cell carcinomas are diagnosed and treated annually (Australian Institute of Health and Welfare, 2011b; Cancer Council Australia, 2014a).

In 2008 melanoma accounted for 9.8% of all Australian cases of cancer (excluding basal and squamous cell carcinomas; Australian Institute of Health and Welfare, 2011a). Melanoma is highly prevalent in Australia, with one in 27 people at risk of receiving a diagnosis of melanoma before the age of 75, rising to one in 18 by the age of 85. Across all ages, males were 50% more likely to have an incidence of melanoma than females, however females had higher incidence than males across ages 20 to 44 (Australian Institute of Health and Welfare, 2011a). Over 1,200 Australians who died in 2007 had melanoma listed as the main cause of death. The reported risk of dying from melanoma before the age of 85 (that is, the risk of contracting and dying of melanoma) was one in 137 across genders. Thus, the threat of melanoma is a concern for both genders.

Ultraviolet radiation (UVR) plays a role in the development of every form of skin cancer (Narayanan, Saladi, & Fox, 2010; Whiteman, Whiteman, & Green, 2001). When skin is exposed to the carcinogenic UVR wavelengths ultraviolet A and especially ultraviolet B, the DNA becomes damaged, a reaction of the DNA repair mechanism in the skin occurs, and this is linked to pigment production (Hunt, Augustson, Rutten, Moser, & Yaroch, 2012; Lessin, Perlis, & Zook, 2012). This pigment production gives skin a tanned appearance – that is, skin is darkened through exposure to UVR. If the DNA repair fails, skin cancers can develop (Lessin et al.,

2012). Between 65 and 90% of melanomas, and up to 90% of NMSCs are associated with UVR exposure (B. K. Armstrong & Kricker, 1993; H. K. Koh, Geller, Miller, Grossbart, & Lew, 1996). Development of squamous cell carcinoma is strongly associated with total sun exposure, and risk of developing basal cell carcinoma or melanoma is associated with intermittent sun exposure and sunburn at any age (B. K. Armstrong & Kricker, 2001; Elwood & Jopson, 1997; H. K. Koh et al., 1996).

There are a range of risk factors associated with the development of skin cancer in addition to UVR exposure. These include fair skin tone, light hair, blue or green eye colour, a large number of freckles, family history of skin cancer, and childhood sun exposure (B. K. Armstrong & Kricker, 2001; H. K. Koh et al., 1996). Skin cancer is among the most common cancers in a number of countries in addition to Australia, including Canada, New Zealand, the United Kingdom, and the United States. However, there are a range of factors that are particularly relevant to the Australian population. Australia experiences some of the highest UVR levels in the world due to the country's proximity to the equator, ozone depletion, and the large proportion of "clear sky" and high UVR days (Bernhard, Mayer, Seckmeyer, & Moise, 1997; Kripke, 1988; Udelhofen, Gies, Roy, & Randel, 1999). In addition to these geographical and environmental factors, Australian culture and lifestyle encourages large amounts of time spent outdoors leading to engagement in sun exposure and tanning (Booth, 2001), increasing the risk of skin cancer among the Australian population.

The economic burden of skin cancer has been explored, however the vast majority of this research has been conducted in the United States and Europe (e.g., Donaldson & Coldiron, 2011; Higashi, Veenstra, & Langley, 2004; Tsao, Rogers, & Sober, 1998). In 2005, $264 million was spent on NMSC in Australia, with a further

$30 million spent on melanoma, making it the nation's most expensive cancer (Australian Institute of Health and Welfare, 2005). These costs included expenditure related to public hospital admittance and care, out of hospital medical expenses, prescription pharmaceuticals, and other assorted costs. The figures do not include indirect costs such as prevention programs and/or loss of income due to illness. Fransen and colleagues (2012) used retrospective Medicare (an Australian Government subsidised healthcare program) data to predict the total costs of treating NMSC in Australia for 2011–2015, and reported a total predicted cost (with inflation) of $703 million, 95% CI [$674.6, $731.4] in 2015. The authors stated that these figures are likely an underestimation, suggested that NMSC will continue to be the most expensive cancer in Australia, and recommended continuous attention to prevention strategies (Fransen et al., 2012).

1.3. Sun-Related Behaviours

The term sun-related behaviour refers to a variety of activities. These are: Tanning behaviours (specifically, outdoor tanning, fake tanning, and solarium use), sun-protective behaviours, and incidental sun exposure. Consequently, it is difficult to model sun-related behaviour as one outcome, and each of these behaviours will be considered separately.

1.3.1. Tanning

It has been widely reported that having tanned skin is desirable, due to the broadly held Western belief that a tan enhances personal physical attractiveness (e.g., Börner, Schütz, & Wiedemann, 2009; Hunt et al., 2012; Murray & Turner, 2004). This current perception contrasts with attitudes in the past when a fair complexion was considered a sign of beauty and high social standing because it indicated not needing to undertake outdoor labour (Hunt et al., 2012; Randle, 1997). However, during the

period of industrialisation, perceptions of ideal skin tone began to shift, and a tanned complexion became synonymous with time spent at leisure and, accordingly, high social status, and was thus perceived as desirable and attractive (Hunt et al., 2012; Randle, 1997). Facial attractiveness goes beyond shape of features, with evenness of complexion and tanned versus lighter shade skin tone also being pertinent factors (Fink, Grammer, & Thornhill, 2001; Fink et al., 2008). Further, empirical results demonstrate that tanned skin is perceived to indicate good health, to increase general physical attractiveness, and give a more slim appearance than lighter skin (Banerjee, Campo, & Greene, 2008; Jackson & Aiken, 2000; Lupton & Gaffney, 1996; Smith, Cornelissen, & Tovée, 2007). Consequently, individuals who value a tanned appearance have decreased motivation to engage in the sun-protective practices that are promoted in skin cancer-related health campaigns (see Williams, Grogan, Clark-Carter, & Buckley, 2013).

Tanning behaviour can refer to more than exposing oneself to the sun for the purposes of getting a tan; solarium use and fake tanning allow individuals to achieve a tanned appearance without sun exposure. Solaria equipment use concentrated forms of UVR delivered through artificial means, sun beds or sun lamps, allowing individuals to receive UVR exposure at any time. Solaria minimise levels of UVB, enabling individuals in many cases to receive a tan without burning, luring some individuals into a false sense of security that they are not damaging their skin (Lessin et al., 2012; Miyamura et al., 2011). Solarium use has been reported to be associated with risk of skin cancer because solaria utilise both ultraviolet A and B radiation, both of which are associated with skin cancer (Lessin et al., 2012; Miyamura et al., 2011). Further, it has been reported that individuals who use solaria suggest that by doing so they are "preparing" their skin for summer, indicating they falsely believe a tan provides

protection from outdoor UVR (e.g., Cokkinides, Weinstock, O'Connell, & Thun, 2002; Levine, Sorace, Spencer, & Siegel, 2005).

By contrast, fake tanning enables individuals to dye the outer layer of the skin with chemicals that give the skin a tanned appearance without exposure to UVR. Most frequently, fake tanning formulae includes dihydroxyacetone, a vegetable-derived sugar that interacts with dead surface cells to give the outer skin layer a tanned appearance for approximately one week, and has not, to date, been associated with increased cancer risk (Pagoto et al., 2009). Of note, although dihydroxyacetone has been approved for external application to the skin by the U.S. Food and Drug Administration (2006), application to areas near the eyes, mouth, or nose has not been approved. This is not commonly known, as fake tanning solutions do not state on their packaging that contact with these areas should be avoided. "Spray tans" (fake tanning solution either in aerosol cans or applied using a spray "gun"/air machine) make avoiding these facial areas more complicated, and it is common practice for spray tans to be administered to the face of individuals receiving the cosmetic treatment.

The literature is inconsistent in its use of terminology and discussion of tanning. Behaviour referred to in this thesis as *outdoor tanning* refers to exposure to UVR directly from the sun for the purpose of achieving a tan, rather than *incidental sun exposure*, where procuring a tanned appearance is not the main reason for UVR exposure. Previous literature has referred to outdoor tanning as "tanning", "outdoor tanning", "sunbaking", and "sunbathing" (e.g., Boldeman et al., 2001; Sayre & Dowdy, 2003). Behaviour referred to in this thesis as *solarium use* is best described as the use of tanning beds, booths, and/or lamps that provide an artificial source of UVR that can be used to obtain a tan indoors at any time (Lazovich et al., 2008). *Solarium use* has been referred to as "nonsolar tanning", "indoor tanning", "indoor UV

tanning", "artificial tanning", "solarium use", "solaria use", and "sun-bed use" in the literature (Beane Freeman, Dennis, Lynch, Lowe, & Clarke, 2005; Boldeman et al., 2001; Lazovich et al., 2008; Stapleton, Turrisi, & Hillhouse, 2008). *Fake tanning* has previously been labelled "sunless tanning", "fake tanning", "artificial tanning", "non-solar tanning", "chemical tanning", and "self tanning" (Beckmann, Kirke, McCaul, & Roder, 2001; Brooks et al., 2006; Lazovich et al., 2008; Pagoto et al., 2009). *Fake tanning* is best described as "the application of creams, foams, sprays that dye skin a tanned colour, or spray tans. These do NOT include bronzing powders and creams which can be washed off with soap and water." (Pagoto et al., 2009, p. 3). *UVR tanning* refers to both solarium use and outdoor tanning behaviours, which can be distinguished from fake tanning in terms of UVR-related skin cancer risk.

The range of terms used to describe tanning behaviour can make research interpretation difficult. For example, the term indoor tanning has previously been used to refer to both solarium use and fake tanning, two distinct behaviours that carry significantly different skin cancer-related risks; solarium use is associated with skin cancer, whereas fake tanning is an alternative that enables people to achieve a temporary tanned appearance without exposure to UVR. Inconsistency in the skin cancer literature is not limited to tanning behaviour; there is significant irregularity in the measurement of the other forms of sun-related behaviours (e.g., sun-protective and sun exposure behaviours). Care must be taken when discussing tanning behaviour to be specific about the behaviour being described. The definitions provided above are used throughout this thesis.

Just as an individual's risk of skin cancer varies based on their skin tone, so too does their capacity to tan (Fitzpatrick, 1988). There are two common types of melanin that are responsible for human skin tone: Eumelanin, which produces brown to black

pigment, and pheomelanin, which produces yellow to red pigment (Lessin et al., 2012). Those individuals with light skin and blonde or red hair have larger proportions of pheomelanin and are at higher risk of developing skin cancer. Those with greater amounts of eumelanin have darker skin, and can tolerate larger amounts of UVR exposure without burning, minimising their risk for some forms of skin cancer (Lessin et al., 2012). It has been reported that young women in America who have fair skin are more aware of their susceptibility to skin cancer, but not less likely to sunbathe than others (Heckman et al., 2012). However, a recent Australian study involving young women found that those with fair skin had higher skin cancer knowledge, and were more likely to engage in fake tanning, whereas those who engaged in outdoor tanning had naturally darker skin (Day, Oxlad, & Roberts, 2013). These findings suggest that the desire for a tanned appearance is prevalent regardless of skin tone, however fake tanning may be considered a viable alternative for those who have difficulty tanning naturally, and who are also a group at higher risk of developing skin cancer. Thus, it is important to account for natural skin type when predicting sun-related behaviours.

1.3.2. Sun Protection and Exposure

Sun protection behaviours include avoiding sun exposure (staying indoors, seeking shade), wearing sun-protective clothing (e.g., hats, sunglasses) and applying sunscreen. Recommendations regarding adequate sun protection have changed over time due to the availability of new products and technologies. For example, over recent decades, sunscreens have been available that protect the skin from "burning" under the sun. The Sun Protection Factor (SPF) in sunscreens provides an approximate indication of the multiplicative protection from burning provided by sunscreen use; if a person takes 10 minutes to burn from any particular episode of sun exposure and they utilise a lotion with an SPF of 15, they should be protected for about 150 minutes

(i.e. 10 minutes x SPF15; Ramirez & Schneider, 2003). The SPF available in sunscreens has increased as technology has advanced; although SPF15 sunscreens were previously the highest protection readily available, now SPF50 sunscreens are available (Ramirez & Schneider, 2003). Similar to sunscreens, clothing has also been developed with SPF to provide additional UVR protection (Gambichler, Dissel, Altmeyer, & Rotterdam, 2010).

Sun-protective behaviours have been previously defined in a systematic review by Kasparian, McLoone & Meiser (2009, p. 407), as including:

> … avoidance of direct sunlight exposure, particularly between the hours of 10 a.m. and 2 p.m.; use of sun protective clothing, hats, and sunglasses when exposed to direct sunlight for periods greater than 15 min; and, as an adjunct to sun avoidance, use of broad spectrum sunscreens.

It is important to note that this definition of sun-protective behaviour includes sunscreen only as an adjunct to other sun-protective behaviours. This is because sunscreen use alone does not provide adequate UVR protection (Glanz, Buller, & Saraiya, 2007). Despite this, a number of studies have used sunscreen utilisation as the main indicator of sun-protective behaviour (e.g., A. Armstrong, Idriss, & Kim, 2011; Coups, 2011; Pichon, Corral, Landrine, Mayer, & Adams-Simms, 2010). Sunscreen utilisation as the main indicator of sun-protective behaviour may therefore jeopardise the practical significance of such research as it relates to skin cancer, because skin cancer may occur despite sunscreen use. Further, adherence to sunscreen guidelines is often low; frequently insufficient sunscreen is used, it is not applied to all exposed areas, and is not reapplied at the frequency required (Diffey, 2009; Neale, Williams, & Green, 2002).

Although sun exposure appears to be a clearly defined behaviour, there has been inconsistency in its measurement. A workshop, convened in 2005 by the National Cancer Institute of America and the Emory Prevention Research Center, addressed this issue (Glanz et al., 2008). The key features of sun exposure were defined to include the number of hours spent outside between 10 a.m. and 4 p.m. and existence of sunburn, described as "red OR painful sunburn that lasted a day or more" (Glanz et al., 2008, p. 220).

The lack of consensus about what constitutes sun tanning and sun protection behaviours has been highlighted in past research (e.g., Glanz et al., 2008; Kasparian et al., 2009; Lazovich et al., 2008), and attempts have been made to standardise measurement of such behaviours (e.g., Glanz et al., 2008; Lazovich et al., 2008). However, all previous definitions should be taken into account when reviewing the skin cancer prevention literature. Failure to use standardised measures makes meaningful comparisons difficult, and, consequently, there has been little review work done in the area (for an exception, see Kasparian et al., 2009).

1.3.3. Demographic Considerations

The importance of targeting young adults in regards to sun-related behaviour is made clear by a number of research findings. Young adults tend to expose themselves to large amounts of UVR, experience a greater prevalence of sunburn, are the group most determined to develop a tan, and are least likely to practice sun-protective behaviour compared to other age groups (D. B. Buller et al., 2011; Heckman et al., 2013; Wickenheiser et al., 2013). Sun-protective behaviours begin to decline in early adolescence, reportedly reaching the lowest level in late adolescence (Olson et al., 2007), with UVR exposure increasing as teenagers move into adulthood (MacNeal & Dinulos, 2007). Young adults of both genders have similar attitudes towards outdoor

tanning and desiring a tanned complexion (Gillen & Markey, 2012). As stated earlier, UVR exposure is implicated in up to 90% of skin cancers, and exposure during early years of life is strongly implicated in later development of skin cancer (B. K. Armstrong & Kricker, 1993; Kennedy, Bajdik, Willemze, de Gruijl, & Bouwes Bavinck, 2003; Whiteman et al., 2001). Thus, it is particularly important to conduct research involving both male and female young adults.

Although young adult females are often the focus of skin cancer research due to their levels of tanning behaviour, their male counterparts have a risk profile that makes them a key target group for skin cancer prevention. It has been reported that young adult males have lower levels of skin cancer knowledge, engage in less sun protection, and have higher levels of UVR exposure than females of comparable age (e.g., Abroms, Jorgensen, Southwell, Geller, & Emmons, 2003; D. B. Buller et al., 2011; Cottrell, McClamroch, & Bernard, 2005; Paul, Tzelepis, Parfitt, & Girgis, 2008; Wickenheiser et al., 2013). Although young adult females have much higher rates of solarium use, young adult males typically engage in higher levels of outdoor or traditional UVR exposure (see review by D. B. Buller et al., 2011). Further, the incidence of melanoma in Australia shows an incidence pattern that indicates differences in sun-related behaviours across genders. In 2008, melanoma incidence was approximately 30% higher in females than males among young adults aged 20 to 24 (Australian Institute of Health and Welfare, 2011a). However the incidence in that same year was higher for males than females in each age group over the age of 45. Melanoma frequently occurs later in life as a result of earlier exposure and burns (B. K. Armstrong & Kricker, 2001; Whiteman et al., 2001), indicating the need to focus skin cancer risk behaviour prevention in young adult males as well as females.

1.4. The Role of Knowledge

Commonly utilised theories of health psychology recognise the importance of disease knowledge as a determinant of perceived disease susceptibility and severity, as well as actions that can be taken to reduce risk (e.g., the Health Belief Model, Becker, 1974; the Theory of Reasoned Action, Fishbein, 1975; the Transtheoretical Model, Prochaska & Velicer, 1997; and the Protection Motivation Theory, Rogers, 1975). Increasing public knowledge is one of the key goals of most health promotion campaigns, which are often based on such behavioural models. Skin cancer prevention efforts commonly involve educational programs or media campaigns aimed at increasing awareness of the link between skin cancer and the sun, and of protective strategies to reduce risk (Cancer Council Australia, 2014b; Montague, Borland, & Sinclair, 2001). Despite this, limitations that exist with regard to the measurement of skin cancer knowledge have restricted the conclusions that can be drawn from research on the role of skin cancer knowledge in sun-related behaviour.

It is widely understood in the literature that knowledge alone is often insufficient to predict behaviour. Unfortunately, this has resulted in the omission of knowledge measures from many studies of sun-related behaviour predictors (e.g., Cafri et al., 2006; Cokkinides, Bandi, Weinstock, & Ward, 2010; Dissel, Rotterdam, Altmeyer, & Gambichler, 2009; Heckman, Egleston, Wilson, & Ingersoll, 2008). Recent literature reviews, however, have suggested that knowledge is suboptimal rather than noninfluential across a range of health issues (e.g., Dreier, Borutta, Toppich, Bitzer, & Walter, 2012; Fylan, 1998; Hussainy & Dermele, 2011). If individuals do not possess a level of knowledge that enables them to accurately perceive disease severity, understand their own susceptibility to the disease, or know about the actions to reduce risk of disease, then we cannot expect their existing

knowledge to influence behaviour.

Research that has measured skin cancer knowledge indicates that the general population's level of knowledge is low. For example, a sample of American parents reported nonchalance regarding skin cancer "spots" due to a belief that removal was always curative (Garside, Pearson, & Moxham, 2010). Further, many individuals in that study appeared to have clear misconceptions about the early clinical signs of melanoma; however this was not assessed using a validated measure. Other studies have reported participants' low skin cancer knowledge regarding the effects of UVR on physical appearance (Kakourou et al., 2006), and the future impact of severe sunburns (Felts, Burke, Vail-Smith, & Whetstone, 2010). Additionally, research has reported that some study participants were not convinced of the utility of protective methods (de Vries, Lezwijn, Hol, & Honing, 2005), or felt that sun protection behaviours were not necessary (Spradlin, Bass, Hyman, & Keathley, 2010). Nevertheless, research among young people indicates receptivity to education about skin cancer (Hay, Coups, Ford, & DiBonaventura, 2009).

Skin cancer prevention research has failed to achieve a consensus on what constitutes skin cancer knowledge adequate to motivate the desired attitude and behaviour changes. Consequently, when reviewing studies examining the relationship between knowledge and behaviour, inconsistent results are evident (e.g., Hay et al., 2009; Kristjánsson, Bränström, Ullén, & Helgason, 2003; Sjöberg, Holm, Ullén, & Brandberg, 2004). Often studies measure skin cancer knowledge with specific true-false awareness questions such as "Does the sun cause skin cancer?" without asking questions about other key areas of skin cancer knowledge such as sun protection, tanning, signs of skin cancer, or demographic risk factors. Some studies have found small correlations between skin cancer knowledge and sun-related behaviours (e.g.,

Hart & DeMarco, 2008; Kristjánsson et al., 2003; Sjöberg et al., 2004), although it is important to note that these studies have used measures that lack demonstrated validity and reliability.

In addition to the measurement issues and the paucity of studies addressing knowledge as a predictor of tanning overall, there is also a lack of research regarding knowledge differences between people who use different strategies to tan (i.e. outdoor tanners, solarium users and fake tanners). Although it is important to note that knowledge is almost certainly not the only determinant of sun-related behaviours, the failure to incorporate measures of knowledge, or the failure to measure it adequately, results in a significant problem for those wanting to predict and influence skin cancer incidence.

1.5. The Social Context of Sun-Related Behaviours

Skin cancer knowledge is an important determinant of health behaviour, but it is not the only relevant factor. The broader social context must also be considered if we are to more fully understand the sun-related behaviours of young adults. Australia has a significant "outdoor" culture, with a large proportion of the population regularly engaging in sport through participation or spectating. In addition, time outdoors with family and friends in parks and at the beach takes up a large proportion of the population's leisure time (Booth, 2001; Jackson & Aiken, 2006; Lupton & Gaffney, 1996; Zwemer, Mahler, Werchniak, & Recklitis, 2012). Thus, the sun exposure levels of Australians are among the highest in the world, and are associated with a high prevalence of skin cancers (Cancer Council Australia, 2013; Youl, Janda, & Kimlin, 2009). Despite the large amount of time spent outdoors, young adults' sun-protective behaviours are reported to be inadequate, with many failing to use, or insufficiently using, sun-protective methods (Diffey, 2009; Heckman, Wilson, & Ingersoll, 2009;

Kasparian et al., 2009; Neale et al., 2002). Research indicates that the key barriers to adequate sun-protection in young adults include perceived difficulty or inconvenience of engaging in sun-protective behaviours, and perceived social undesirability of such behaviours (e.g., Alberg, Herbst, Genkinger, & Duszynski, 2002; Lowe, Balanda, Gillespie, Del Mar, & Gentle, 1993; Lupton & Gaffney, 1996; Shoveller, Lovato, Peters, & Rivers, 2000).

A further, and related, challenge in altering unhealthy sun-related behaviour in young adults is the perception that tanned skin is largely considered the ideal in Western society. The perceived physical benefits of tanned skin include the belief that a tanned complexion makes you appear thinner, fitter, and healthier, as well as decreasing visibility of skin imperfections, and increasing perceptions of overall physical attractiveness (e.g., Cafri et al., 2008; Murray & Turner, 2004; O'Riordan, Geller, Brooks, Zhang, & Miller, 2003). Indeed, it has been reported that appearance enhancement is the primary motivation for tanning behaviour (e.g., Abar et al., 2010; Heckman et al., 2009; Hillhouse, Stair A. W., & Adler, 1996; Kasparian et al., 2009). Further, research has suggested that appearance motivations are a stronger predictor of UVR tanning behaviour than health orientation such as perceived skin cancer risk (Hillhouse, Turrisi, & Kastner, 2000).

It is clear that appearance-based factors are key determinants of sun-related behaviour. Studies involving young adult females have found appearance reasons for tanning and perceived attractiveness of tanned skin to be associated with outdoor tanning and solarium use intentions and behaviour (Cafri, Thompson, Jacobsen, & Hillhouse, 2009; Cafri et al., 2006). Research suggests that those who choose to engage in UVR tanning disregard health messages, and are less concerned with health outcomes than those who choose not to tan. For example, in a study of 1,602

American adults, participants who reported that tanned skin was of high personal importance were significantly less likely to report being concerned about future skin cancer and wrinkles from UVR exposure (Cathcart et al., 2011). This may be due, in part, to the immediacy of the appearance-based "benefits" of tanning, versus the delayed perceived benefits of sun protection for future health (Heckman et al., 2009).

As a consequence, researchers have developed appearance-based interventions to increase sun protection and decrease UVR tanning intentions and behaviour. Such interventions focus on the negative impact UVR exposure has on appearance, such as the development of sunspots and wrinkles (Cafri et al., 2008; Cafri et al., 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008). This is often achieved through the use of UV photography, or the provision of photoaging information (Mahler et al., 2008; Williams et al., 2013). A recent review of the appearance-based interventions literature found that such interventions have a moderate positive effect on sun-protection intentions and solarium use, however the influence on incidental sun exposure was nonsignificant (Williams et al., 2013). This nonsignificant result may be attributed to the broader social context in which incidental sun exposure takes place. If participants perceive social pressure to be tanned and engage in activities that result in sun exposure, awareness of delayed negative appearance effects of such exposure may be insufficient to alter behaviour. That is, the perceived benefits of failing to use sun protection during incidental sun exposure activities (i.e. procuring a tanned appearance, social acceptance) may outweigh concerns about the future development of skin cancers, sunspots, or wrinkles. Thus, it is important to consider the potential broader sociocultural influences on sun-related behaviour when designing such interventions.

1.5.1. Cultural Considerations

Despite the desire for a tanned appearance being widespread in Western Caucasian populations, the opposite is often observed in Asian populations including in the Philippines, Korea, Japan, India and China, where light skin is considered desirable and there is a large market for skin lightening products (e.g., Glenn, 2008; Jang et al., 2013; Li et al., 2008). Australia is a multicultural country with a growing proportion of Asian heritage migrants, and it is important not to generalise societal ideals across diverse cultural groupings. Despite reported preference in some Asian cultures for light skin, the incidence of both melanoma and nonmelanoma skin cancers in people of Asian heritage are rising (Bellew et al., 2009; Ishihara, Saida, & Yamamoto, 2001; Kim et al., 2009; Sng, Koh, Siong, & Choo, 2009). Of further concern, those of Asian heritage who do receive a skin cancer diagnosis typically have advanced cancer and worse diagnostic outcomes than other ethnic groups (Bellew et al., 2009; Kim et al., 2009). It is therefore important to consider the attitudes and sun-related behaviours of young people of Asian heritage in order to develop health promotion programs that will translate across different cultural groups.

1.6. Theoretical Frameworks

A large number of health behaviour theoretical models have been applied in attempts to explain reasons for sun-related behaviours. There is no consensus on the most appropriate model(s) to predict sun-related behaviours, and few papers have tested complete versions of theoretical models (Hillhouse & Turrisi, 2012). Some of the commonly used models of health behaviour include the Health Belief Model, the Transtheoretical Model, and the Theory of Planned Behaviour/ Reasoned Action. Most frequently, these models have been used to explain sun-protective behaviour or solarium use. This section will summarise the use of theory in predicting sun-related

behaviours.

The Health Belief Model (Becker, 1974) is one of the oldest theories of health behaviour. In brief, the model posits that if a person perceives themselves to be at serious risk of developing a condition (e.g., skin cancer) that they believe has significant undesirable consequences (e.g., invasive surgical procedures, secondary cancers, death), they believe they can reduce this risk by a adopting a specific behaviour change (i.e. sun protection, limiting UVR exposure), and if they are confident they can implement this behaviour (i.e. can overcome barriers to change), that person will make the necessary behaviour change. In applying this model, Jackson and Aiken (2006) found that beliefs regarding susceptibility to UVR-induced skin aging and perceived benefits of sun protection were associated with intentions to protect themselves from UVR.

The Transtheoretical Model (Prochaska & Velicer, 1997) suggests that the decision balance between the pros and cons for behaviour change, as well as self-efficacy, mediate health change behaviours. This model involves progressing through five stages of behaviour change: Pre-contemplation (where there is no intention to change behaviour in the foreseeable future), contemplation (where understanding problematic elements of behaviour begins, and the merits of continuing or changing behaviour are assessed), preparation (intention to take action in the immediate future is formed, and small steps towards change may begin), action (the stage in which specific positive modifications in behaviour have been made), and maintenance (working to prevent relapse). Kristjansson and colleagues (2003) found that Transtheoretical *stage of change* accounted for 21% of variance in the sunbathing behaviour of 1,200 18 year olds.

The Theory of Planned Behaviour (Ajzen, 1985) is an extended version of the Theory of Reasoned Action (Fishbein, 1975). The Theory of Planned Behaviour considers attitudes, behavioural intentions, norms, and perceived behavioural control as key components of behaviour prediction. Perceived behavioural control is a similar concept to self-efficacy, featured in both the Health Belief Model and the Transtheoretical Model (Jackson & Aiken, 2000). A notable component of the Theory of Reasoned Action is the consideration of the role of subjective norms, that is, perceptions of the societal standard, or what others would like them to do. A study by Hillhouse and colleagues (2000) explored the model with respect to solarium use in a sample of 197 university students. The authors found that the motivation to maintain an attractive appearance was a stronger predictor of tanning attitudes than health orientation.

Most frequently, studies in the sun-related behaviour space include variables from each of these three aforementioned models as predictors of sun-related behaviours (e.g., risk perception, response-efficacy perceptions, and costs and benefits of behaviour change), rather than explicitly testing the full models. The literature has revealed conflicting findings in terms of predictors of behaviour. For example, Kasparian and colleagues (2009) reported that key factors in successful interventions to increase sun-protective behaviour were risk perception, attitudes to protective methods, beliefs, knowledge, and intentions. Conversely, Grubbs and Tabano (2000) found no relationship between perceived skin cancer risk and sunscreen use in a sample of health care professionals. Of even greater concern, a survey of 28,235 United States adults found perceived skin cancer risk to be associated with increased levels of solarium use (Coups, Manne, & Heckman, 2008). Cafri and colleagues. (2006), also in the United States, found perceived risk of skin aging to be negatively

correlated with solarium use, suggesting that risk of appearance impacts was more salient to a young adult sample than the cancer risk associated with solarium use.

De Vries and colleagues (2005) explored factors associated with three different sun-protective behaviours: Sunscreen use, use of protective clothing, and shade seeking. The measured predictors were risk perception, response efficacy, self-efficacy, outcome expectations, perceived benefits and barriers, and the role of social influences with data collected from a group of 500 Dutch adolescents aged 15 to 20. After considering multiple factors, attitude towards the protective behaviour, and perceived family and peer protective behaviour were consistent predictors of sunscreen use, protective clothing, and shade seeking behaviours.

Cafri and colleagues (2009) also considered predictors from a range of theories including the Health Belief Model, the Theory of Reasoned Action, the Protection Motivation theory, and the Tripartite Influence Model (discussed in section 1.7) for explaining outdoor tanning and solarium use behaviours in a prospective 6 month study of 311 young women. This study found evidence for the support of multiple theoretical pathways. The authors found that appearance reasons to tan and intentions to tan mediated the relationship between sociocultural influences and tanning behaviours, which is consistent with the Tripartite Influence Model, a theory that has been well researched in the body image domain, particularly regarding weight and thinness.

1.7. Tanning Behaviour from a Body Image Theoretical Perspective

Empirical results derived from studies utilising theories of health behaviour have highlighted how health concerns impact on sun-related behaviours. Despite some influence from these health predictors, other data suggest the centrality of appearance considerations in deliberate tanning and decisions to engage in sun protection.

Consequently, recent research has suggested that body image theory may be useful in understanding deliberate tanning behaviour (Cafri et al., 2009; Yoo & Kim, 2012). Given that appearance concerns appear to be a more important predictor than health outcome factors in young adults (Hillhouse et al., 2000), considering theoretical models where body image is central is appropriate.

Body image refers to an internal representation of one's own physical appearance (Garner & Garfinkel, 1981), that is, a person's beliefs about their own bodily attractiveness. There is a large amount of body image research regarding weight and body shape, however there are many other aesthetic factors that make up one's body image (Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999c). For example, dissatisfaction with facial features, hair, teeth, aging, scars, and skin tone have all been reported by individuals with body image disturbance (Thompson et al., 1999c). There is evidence that tanning behaviour is linked to other body image behaviours. For example, tanning behaviour is associated with weight and body shape concerns (O'Riordan et al., 2006; Yoo & Kim, 2012). Further, those who engaged in tanning behaviours were more likely to be on a diet than those who did not (Demko, Borawski, Debanne, Cooper, & Stange, 2003).

The dangerous and harmful lengths that individuals will go to in order to alter their physical appearance in an attempt to improve body image has been well documented (see Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999a). It is clear that people are willing to make large investments in attempting to alter aspects of their physical appearance. Thus, given the social ideals for a tanned appearance, the risks of engaging in tanning behaviour, and research that indicates that perception of social ideals is a strong motivator for engaging in unhealthy behaviours, it is important to explore tanning behaviour from a body image perspective.

One of the key theoretical models used in the area of body image and eating dysfunction is the Tripartite Influence Model (Thompson et al., 1999b). This model posits that perceived family, peer, and media norms influence the development of body image and eating dysfunction (see Figure 1). It has been proposed that this relationship is mediated by both internalisation of societal ideals of appearance and tendencies to engage in appearance comparison (van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002). This model has wide support in the area of eating disturbance in Western cultures (e.g., Keery, van den Berg, & Thompson, 2004; Shroff & Thompson, 2006; Tiggemann & Miller, 2010; van den Berg et al., 2002), as well as in Japanese, Hungarian, and Portuguese cultures (e.g., Conti, Scagliusi, Queiroz, Hearst, & Cordás, 2010; Papp, Urbán, Czeglédi, Babusa, & Túry, 2013; Yamamiya, Shroff, & Thompson, 2008). Further, the model has also been shown to relate to male behaviour; being adapted to measure aspects of male body image including body fat dissatisfaction, muscularity ideals, and dietary supplement use (e.g., Karazsia & Crowther, 2009, 2010; Smolak, Murnen, & Thompson, 2005; Tylka, 2011).

A number of studies in the skin cancer literature have assessed the role of family, peer, and media influence in the prediction of sun-related behaviour. For example, it has been found that perceived family preference for a tanned appearance increases tanning intentions (Hoerster et al., 2007), that sun protection, outdoor tanning behaviour, and solarium use are more likely if your friends engage in these behaviours (Banks, Silverman, Schwartz, & Tunnessen Jr, 1992; Geller et al., 2002; Hoerster et al., 2007; Keesling & Friedman, 1987; Yoo & Kim, 2012), and that exposure to magazine images of tanned individuals predicts beliefs about and attitudes to tanning (Cho, Lee, & Wilson, 2010). As mentioned above, research has begun to emerge exploring the utility of the Tripartite Influence Model for explaining tanning

behaviour (Cafri et al., 2009). The early results suggest support for the model, however further research is needed to validate the use of the model across a range of participant groups.

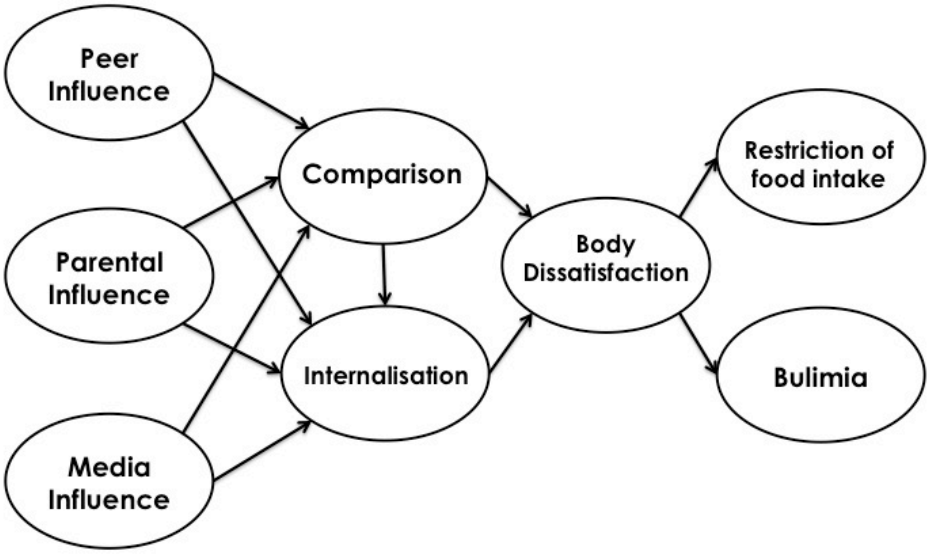


Figure 1. Tripartite Influence Model as proposed regarding the development of body image disturbance. Three sources of influence (peers, parents, media) lead to social comparison and internalisation; these two factors, in turn, lead to body dissatisfaction which influences both bulimia and restriction of food intake (adapted from Thompson et al., 1999b).

1.8. Aims of this Thesis

The overarching aim of this research was to further understand sun-related behaviours of young adults. The prior work reviewed in this chapter emphasises the need for a clearer understanding of the role skin cancer knowledge in the prediction of sun-related behaviours. Due to the large amounts of time and money invested in increasing skin cancer awareness in Australia (Australian Department of Health, 2010) it is important to evaluate the impact of educational approaches. This is particularly difficult due to the haphazard measurement of skin cancer knowledge in the literature.

In summarising the literature involving skin cancer knowledge, and through the subsequent creation of a new measure of skin cancer knowledge, it is hoped that future researchers will consider measuring skin cancer knowledge in a more comprehensive manner. Therefore, the first aim of the research is to review the literature to determine the relevance of skin cancer knowledge in sun-related behaviours (sun protection, tanning behaviours, and incidental sun exposure).

The second aim of the research is to examine tanning behaviour from the theoretical perspective of the Tripartite Influence Model. Research in the skin cancer field has reported key factors of the Tripartite Influence Model to be relevant to sun behaviour, such as sociocultural influences and appearance motivation. Further, the evidence summarised in this chapter suggests that skin tone is a component of body image, and exploring sun-related behaviour from such a perspective is likely worthwhile.

A final research aim is to examine the sun-related behaviours of Asian Australians. The skin tone attractiveness perceptions in some Asian countries, where pale skin is considered desirable, is the reverse of Caucasians. However, skin cancer rates are rising in Asian populations and it is therefore important to consider how established predictors of sun-related behaviours among Western populations influence the behaviours of those people of Asian heritage who live in Australia. Thus, this thesis seeks to determine if perceptions of fair skin as a beauty ideal is sun-protective, and the role of skin cancer knowledge and sociocultural tanning variables in explaining sun-related behaviour.

CHAPTER 2. PAPER ONE

2.1. Preamble

This first paper reviews the literature examining the relationship between skin cancer knowledge and sun-related behaviours in order to establish the nature and size of the associations. Skin cancer knowledge was chosen as the variable of interest due to the significant investment in increasing skin cancer awareness in Australia (Australian Department of Health, 2010) and the lack of cohesion in reports of its relationship to sun-related behaviours. It was hypothesised that when skin cancer was measured with a valid, reliable, multi-item scale, it would be associated with sun-related behaviours; specifically skin cancer knowledge would be positively associated with sun protection, and negatively with incidental sun exposure and deliberate tanning. The appendices relating to this paper are included within the current chapter to make it easier for the reader to refer to the information contained within them.[1] These are the literature search strategy (Appendix A), log of the electronic database searches (Appendix B), and study inclusion criteria checklist (Appendix C).

[1] As a note to the reader, similarly to the table numbering system used throughout the thesis, the Appendices presented within chapters will be numbered consecutively, beginning at Appendix A.

The role of skin cancer knowledge in sun-related behaviours: A systematic review

- PAPER ACCEPTED FOR PUBLICATION[1] -

Ashley Day, University of Adelaide

Carlene Wilson, Flinders University and Cancer Council South Australia

Amanda Hutchinson, Flinders University and Cancer Council South Australia

Rachel Roberts, University of Adelaide

2.2. Statement of Authorship

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2013). The role of skin cancer knowledge in sun-related behaviours: A systematic review. *Journal of Health Psychology*. Advance online publication. doi: 10.1177/1359105313485483

Ashley Day (*Candidate)*

I was responsible for the design and implementation of the systematic review, including development of the search strategy, collection of the included studies, data extraction, data analysis, and writing the manuscript. I served as corresponding author and was responsible for manuscript submission, revisions, and responses to journal reviews.

Signed: Ashley Day _____ Date: _____

[1] Please see Appendix A at the end of this thesis for a reprint of the accepted paper

Prof Carlene Wilson, Dr Amanda Hutchinson, and Dr Rachel Roberts (*Co-authors)*

We were the supervisors of the research programme that led to this publication and there was ongoing collaboration between Ashley Day and us in refining the direction of the research. The realisation of the idea, collection of data, and analysis of data were the work of Ashley Day. Ashley Day was responsible for writing this paper; our role was to comment on drafts, make suggestions on the methodology and presentation of material in the paper, and to provide editorial input. We also provided advice on responding to comments by the journal reviewers and editor. We hereby give our permission for this paper to be incorporated in Ashley Day's submission for the degree of Doctor of Philosophy from the University of Adelaide.

Signed: Carlene Wilson _____ Date: _____

Signed: Amanda Hutchinson _____ Date: _____

Signed: Rachel Roberts _____ Date: _____

Abstract

Skin cancer is the most commonly diagnosed cancer in many Western countries. This systematic review provides a comprehensive overview of the relationship between skin cancer knowledge and sun-protective, exposure and tanning behaviours in the general population. A total of 34 studies, published in peer-reviewed journals over three decades, were reviewed and synthesised. Sun-protective behaviour was positively associated with skin cancer knowledge in most cases. Findings were inconsistent regarding other sun-related behaviours. Heterogeneity in measurement compromised the capacity to definitively link knowledge and sun-related behaviours. There is a need for development and utilisation of a standardised skin cancer knowledge scale, and guidelines are suggested.

Of all the cancers diagnosed in the United States, Australia and Great Britain, skin cancer is the most common, causing over 16,000 deaths annually in these three countries (American Cancer Society, 2012; Cancer Council Australia, 2011b; Cancer Research UK, 2011a; Glanz et al., 2007). Ultraviolet radiation (UVR), particularly exposure in childhood years, appears to play a role in the development of all forms of skin cancer (Kennedy et al., 2003; Whiteman et al., 2001). Despite nearly 30 years of public health messages, the skin cancer diagnosis rate continues to rise, and people are still failing to use or inconsistently using sun-protective measures (Kasparian et al., 2009). Although the solution to reducing skin cancer rates appears straightforward (i.e. reducing UVR exposure), changing behaviour has proved challenging.

Tanning behaviour extends beyond sun exposure via outdoor tanning, with solarium use and fake tanning enabling individuals to achieve a tanned appearance through means other than sun exposure. Solaria utilise concentrated forms of both UVA and UVB rays, both of which have been associated with skin cancer, and therefore, solarium use increases skin cancer risk (Miyamura et al., 2011; Weinstock & Fisher, 2010). Fake tanning, on the contrary, is a process that enables individuals to dye the outer layer of the skin with chemicals in order to achieve a temporary tanned appearance without exposure to UVR; to date, this has not been associated with increased skin cancer risk (Pagoto et al., 2009). There is inconsistency in the literature, with overlaps and interchangeable use of terminology regarding different tanning behaviours. Behaviour referred to in this article as *outdoor tanning* means exposure to UVR directly from the sun for the purpose of achieving a tan but has been called tanning, outdoor tanning, sunbaking, and sun-bathing in the past literature (e.g., Boldeman et al., 2001; Sayre & Dowdy, 2003). Solarium use has been called nonsolar tanning, indoor tanning, indoor UV tanning, artificial tanning, and sun-bed use

(Boldeman et al., 2001; Lazovich et al., 2008; Stapleton et al., 2008). Behaviour referred to here as *fake tanning* has been called sunless tanning, artificial tanning, chemical tanning, and self tanning (Beckmann et al., 2001; Brooks et al., 2006; Lazovich et al., 2008; Pagoto et al., 2009).

Recommendations regarding adequate sun protection have changed over time, often as a result of changing epidemiology or the development of technologies. Sun-protective behaviours have been defined as including avoidance of direct sunlight exposure, use of sun-protective clothing, hats, sunglasses and, as an adjunct, use of broad-spectrum sunscreens (Kasparian et al., 2009). Importantly, sunscreen is included only in addition to other sun-protective behaviours, as research suggests that sunscreen use alone does not provide adequate UVR protection (Glanz et al., 2007). Thus, relying on sunscreen utilisation as a key indicator of sun-protective behaviour may jeopardise the practical significance of research designed to address skin cancer incidence. Despite this, a number of studies have measured sunscreen utilisation as the main indicator of sun-protective behaviour (A. Armstrong et al., 2011; Coups, 2011; Pichon et al., 2010). There has been such inconsistency in the measurement of sun exposure that the National Cancer Institute of America and the Emory Prevention Research Center convened a workshop in 2005 to address this issue (Glanz et al., 2008). The key features of sun exposure identified were the number of hours spent outside between 10 a.m. and 4 p.m. and existence of sunburn, described as “red OR painful sunburn that lasted a day or more” (Glanz et al., 2008, p. 220).

Sunburn in childhood can double an individual’s subsequent risk of developing melanoma (e.g., Elwood & Jopson, 1997; Whiteman et al., 2001). Sun-protective behaviours (i.e. use of protective clothing, sunscreen) are reported to decline in adolescence, and young adults have been found to spend the most time in the sun and

are most determined to develop a tan (Clarke, Williams, & Arthey, 1997; Marks & Hill, 1988; Olson et al., 2007). It is important to explore the relationship between skin cancer knowledge and sun-protective behaviours across all developmental phases, particularly during times where sun exposure is relevant to subsequent melanoma risk, and when sun-protective behaviours are reported to decline.

Increasing public knowledge is one of the key goals of public health campaigns. These campaigns are often based on the Transtheoretical Model, a stage theory that separates individuals into five different stages of readiness for behaviour change (Prochaska & Velicer, 1997). Similar to other health-related behaviours, there is ongoing debate regarding the role of health knowledge in relation to behaviour. It has been widely reported, for example, in the smoking literature, that health education alone is insufficient to induce behaviour change (e.g., Oncken, McKee, Krishnan-Sarin, O'Malley, & Mazure, 2005; Sandford, 2008). Notably, the authors of this article were unable to find any similar reviews of health knowledge in relation to either cigarette smoking or alcohol use. Although skin cancer knowledge is not the only determinant of sun-related behaviours, the failure to incorporate measures of skin cancer knowledge results in a significant barrier for those wanting to predict and minimise skin cancer incidence; thus, it is essential that this relationship be examined more thoroughly.

Previous reviews in the skin cancer literature have not focused on skin cancer knowledge; however, some of the reviews have mentioned the construct. A systematic review relating to solarium users reported that the typical user has low knowledge regarding the health risks of UVR (Schneider & Krämer, 2010). Kasparian and colleagues' (2009) review of skin cancer-related prevention and screening behaviours mentioned skin cancer knowledge in the context of correlates of sun-protective behaviours; however, this was not a focus of the review, and as such there was neither

exploration of the strength and size of any relationships nor methodological rigour (e.g., validity and/or reliability of measurement) in relation to skin cancer knowledge measurement. There have been a number of reviews that have made the claim skin cancer knowledge is not sufficient to produce effective behavioural changes; however, these reviews were nonsystematic and did not assess the methodological quality of included studies (Hart & DeMarco, 2008; Keeney, McKenna, Fleming, & McIlfatrick, 2009; D. Reynolds, 2007). Conversely, a comprehensive systematic review of interventions aiming to reduce UVR exposure suggested that interventions that included skin cancer knowledge were effective in primary school children, and that there was insufficient evidence to come to a sound conclusion in relation to interventions in high school, college and occupational settings (Saraiya et al., 2004). Thus, existing reviews in the area have failed to focus on collecting and summarising all available data exploring the relationship between skin cancer knowledge and sun-protective, exposure and tanning behaviours. Further, those reviews that have involved skin cancer knowledge in a limited capacity have lacked examination of the methodological rigour of skin cancer knowledge measures. This review adds to the literature by focusing specifically on skin cancer knowledge as a sun-related determinant of behaviour and also by assessing the psychometric properties of measures utilised in the included studies in order to review their claims.

Key questions addressed in this review

1. What is the nature of the relationship between sun-protective behaviour and skin cancer knowledge in the general population across all ages?

2. What is the nature of the relationship between tanning behaviour (outdoor tanning, solarium use and fake tanning) and skin cancer knowledge in the general population across all ages?

3. What is the nature of the relationship between sun exposure behaviour and skin cancer knowledge in the general population across all ages?

Method

Literature Search Strategy/ Identification of Studies

This systematic review was conducted in accordance with the National Health and Medical Research Council and Cochrane guidelines for systematic reviews (Higgins & Green, 1999; National Health and Medical Research Council, 1999). The diagram that represents the flow of included studies conforms to the Preferred Reporting Items for Systematic reviews and Meta-analyses (PRISMA) statement, as recommended by the Cochrane guidelines (see Higgins & Green, 1999; Moher, Liberati, Tetzlaff, & Altman, 2010). The key concepts, sun-protective behaviour, sun exposure and tanning behaviours, were defined prior to commencement of the review (see Introduction). For the purposes of this review, items that measure skin cancer knowledge were defined as *items that assess health outcomes related to skin cancer.* Items relating to attitudes or beliefs about attractiveness or appearance were not considered to be skin cancer knowledge items for the purposes of this review. We initially searched for and evaluated eight existing systematic reviews (see Introduction section for a review of those studies), although potentially relevant studies identified in these systematic reviews were all found in our systematic database searches. Five electronic databases considered to be most relevant were searched: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase, PsycINFO, PubMed and SciVerse Scopus. In consultation with a psychology research librarian, a comprehensive list of search terms was created for each database, taking into consideration their individual search protocols and thesaurus or key terms. The terms used varied among databases; however, the following keywords provide a summary: *Skin cancer,*

melanoma, skin neoplasm, basal cell carcinoma, squamous cell carcinoma, health knowledge, knowledge, health behaviour, sun exposure, sun protection, sunbathing, sun tan, artificial tan, fake tan, sunless tan, outdoor tan and solarium. The literature search was current as of 11 October 2011.

Inclusion or Exclusion Criteria

Studies dealing with the general population were eligible for inclusion. Further, studies were only included if they reported data on skin cancer-related knowledge as well as data on skin cancer-related intentions or behaviours. Studies focusing on melanoma or skin cancer more generally were included. In order to ensure relevance of the measures used, studies were only included if there was information provided regarding the number of items in a measure and at least one example item. If studies did not have such information, the authors were contacted and asked to provide the required information. Eight studies were excluded due to unavailability of critical information, either in the publication itself or directly from the authors. Finally, studies were only considered if they were reported in published articles and included original data not reported elsewhere.

Data Selection and Extraction

The data selection process is illustrated in Figure 1. Results were screened for duplicates and irrelevant references such as commentaries, conference abstracts, non journal articles or editorials. Titles and abstracts of the remaining studies were reviewed against a priori-determined inclusion criteria, and full-text versions of studies meeting these criteria (n = 536) were reviewed. In order to minimise data-extraction bias, an independent researcher not related to the project reviewed a randomly selected 10% of these studies (n = 54) with 100% inter-rater agreement. The reference lists of all the included studies were then examined for potentially relevant articles not captured by the

initial literature search.

Results

After deleting duplicates, excluding articles that did not meet inclusion criteria, and manually searching reference lists of the included studies, 34 articles were identified for inclusion in this review. The majority of included articles provided Level IV evidence in accordance with the evidence rating system developed by the National Health and Medical Research Council (2000) of Australia; Level IV evidence is "obtained from descriptive studies of ... behaviours, knowledge, or attitudes ..." (p. 4). Twenty of the included studies reported ethnicity information, and most of these (18) had a majority of participants of Caucasian ethnicity. The studies with a non-Caucasian majority did not differ notably from the remainder of the studies (Gillani et al., 2001; Glanz, Lew, Song, & Cook, 1999; Putnam, Brannon, & Yanagisako, 1982). Of the eight studies reporting a conceptual framework, both the Health Belief Model and the Social Cognitive Theory were referenced on three occasions (see M. K. Buller et al., 2008; Castle, Skinner, & Hampson, 1999; Glanz et al., 1999; K. D. Reynolds, Buller, Yaroch, Maloy, & Cutter, 2006; Stone, Parker, Quarterman, & Lee, 1999). The Theory of Planned Behaviour and Social Learning Theory were both used twice, and four other theories were mentioned in single studies (see Castle et al., 1999; de Vries et al., 2005; Guile & Nicholson, 2004; K. D. Reynolds et al., 2006; Stone et al., 1999; Turner & Mermelstein, 2005).

Data in this article are grouped by behavioural outcome, within which data are presented in order of strength of association. Due to the heterogeneity of study populations and disparity in construct measurements, meta-analyses were not performed. Where possible, Cohen's *d* effect sizes were calculated (Cohen, 1988; Gilpin, 1993). Where strength of association was not available, data are presented in

order of quality, with those reporting reliability or validity information first, and then those using multi-item measures are presented ahead of single-item studies.

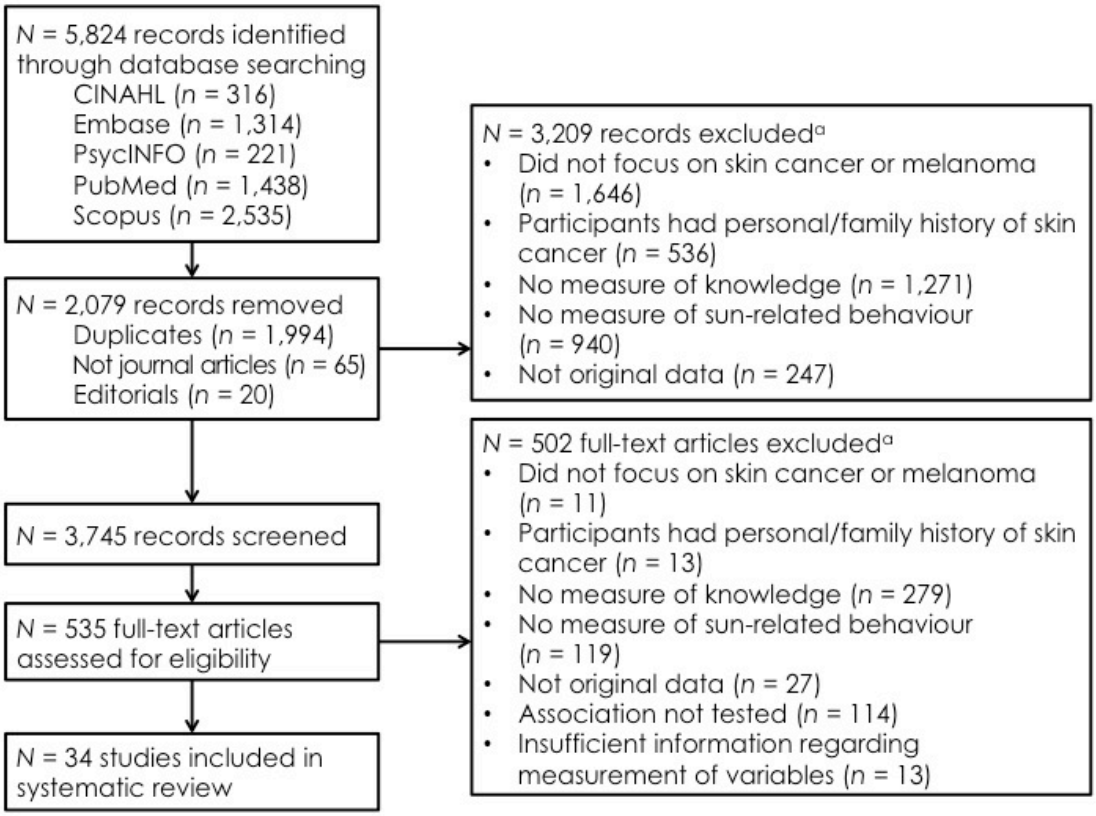


Figure 1. Flow of included studies.

[a]Figures of exclusions do not equal the total studies excluded as some were excluded for more than one reason.

Protective behaviour

A total of 19 studies measured the association between skin cancer knowledge and protective behaviours, with 33 results reported (see Table 1). Of these, 22 reported skin cancer knowledge to be positively associated with sun-protective behaviours, with the remaining 11 results failing to attain statistical significance. Effect sizes could be reported for 19 of the 33 results. Of these, 18 reported a positive association between

skin cancer knowledge and sun-protective behaviour.

Positive associations. Fifteen of the positive results utilised multi-item scales to assess sun-protective behaviour and/or skin cancer knowledge. Of these, two studies involved children of 13 years and younger, one study involved young adults and eight involved adults. Effect sizes could be reported for nine of these 15 results, ranging from d = .18 to 1.06. Five studies found a positive association between skin cancer knowledge and/or sun-protective behaviour assessed through single-item measures. Of these, effect sizes could be calculated for nine results, ranging from d = .10 to .75. Five of these results reported the association between skin cancer knowledge and sunscreen use, and single results for protective clothing use and shade use.

Nonsignificant associations. Seven studies found nonsignificant results assessed through single-item measures. Three of the nonsignificant results assessed sun-protective behaviour and skin cancer knowledge with multi-item scales, of which one moderate effect could be calculated (d = .46). One study reported the association between skin cancer knowledge and protective clothing use in a population of unreported age, one study reported on hat and shirt use among an adult population and one study reported four unspecified protective behaviours in a sample of children.

Overall, studies indicated that better knowledge was associated with higher compliance with sun-protective behaviours. This included single-item measures of specific sun-protective behaviour(s) or total scores summarising performance on a number of behaviours.

Table 1

Summary of studies measuring the association between skin cancer knowledge and sun-protective behaviours

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
1; Greece	*Design:* Cross-sectional; convenience *Setting:* Children's hospital [outpatient] *Method:* Questionnaire *Data Collection:* 2002	295 (-) 31.3 [-]	0	5-items Open-ended "Does 11am-3pm in summer have the greatest hazard of sunlight exposure?"	8-items Open-ended "What time do you usually go to the beach?"	Knowledge: $\alpha = 0.65$ Protection: $\alpha = 0.73$	+ve	$d \sim 1.06$[b]
2; UK	*Design:* Cross-sectional; convenience *Setting:* Two universities *Method:* Questionnaire *Data Collection:* -	97 (-) 17.5 [16-19]	0	19-items Y/N, MC, Open-ended "The risk of skin cancer is greatest if you burn"	5-items - "Avoided the midday sun"	-	+ve	$d = 1.01$
3; USA	*Design:* Cross-sectional; convenience *Setting:* Farmers *Method:* Telephone survey *Data Collection:* -	448 (-) 50 [-]	100	7-items MC "How long before going out in the sun should you apply sunscreen for it to be most effective?"	Sunscreen use: 3 Long-sleeved shirts: 2 Sun-protective hats: 2 Likert "How often do you wear a sunscreen when working?"	Sunscreen $\alpha = 0.76$ Shirts $\alpha = 0.82$ Hats $\alpha = 0.77$	Sunscreen use: +ve Protective shirt: +ve Protective hat: +ve	Sunscreen use: $d = 0.75$ Protective shirt: $d = 0.52$ Protective hat: $d = 0.41$
4; Aus	*Design:* Cross-sectional; convenience sample *Setting:* 26 GP offices *Method:* Questionnaire *Data Collection:* 1989; Dec (Summer)	242 (82.7) - [16+]	31.4	12-items Closed-ended Skin cancer awareness, prevention, warning signs, melanoma	4-items Open-ended Sunscreen use, clothing, shade and timed sun exposure	Knowledge measure: "face validity"	+ve	$d = 0.58$

Table continues

Table 1 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
5; Greece	*Design:* Cross-sectional; convenience sample *Setting:* Children's hospital [outpatient] *Method:* Questionnaire *Data Collection:* 1993; Sept-Nov(Autumn)	315 (-) 32.5 [-]	0	5-items Open-ended "What does the sun-protective factor of a sunscreen indicate?"	4-items Open-ended "What is your schedule of sunscreen use while on the beach?"[c]	-	+ve	$d \sim 0.56$[b]
6; USA	*Design:* Cross-sectional; convenience sample *Setting:* 16 day-care centres *Method:* Questionnaire *Data Collection:* -	391 (58.8) 34.4 [20-58]	9.21	15-items T/F, MC Meaning of SPF	7-items Likert Limit midday exposure	Knowledge: KR-20 = .69 Protection: α = .81	+ve	$d = 0.49$
7; USA	*Design:* Cross-sectional; convenience sample *Setting:* Jury pool *Method:* Questionnaire *Data Collection:* 1993; April (Spring)	205 (-) 35.6 [19-56]	47.0	14-items T/F "People can get a sunburn on cloudy days"	4-items Likert "Wore protective clothing such as long-sleeved shirts and a hats[sic]"	Knowledge: KR-20 = 0.66 Self-protection scale: α = 0.74	+ve	$d = 0.47$
8; USA	*Design:* Cross-sectional; convenience sample *Setting:* Two churches *Method:* Questionnaire *Data Collection:* 1999	43 (-) - [20-40]	0	17-items T/F "Developing a new mole may be a sign of skin cancer"	6-items Likert e.g., Sunscreen use	-	ns	$d \sim 0.46$[b]

Table continues

Table 1 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
9; USA	*Design:* Cross-sectional; convenience sample *Setting:* 30 schools -Parents of 8th graders *Method:* Questionnaire *Data Collection:* 1996; mid-June (Summer)	756 (64) 38 [-]	<15	7-items Closed-ended "People with light hair and skin are at greatest risk"	5-items Likert "Wear shirt with sleeves"	Knowledge: α = 0.47 Protective behaviour: α = 0.70	+ve	*d* = 0.41
10; USA	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* 2007; Oct (Autumn)	270 (91) 23.5 [20-40]	56.7	9-items T/F "You do not need to wear sunscreen on cloudy days"	11-items - 3 scales; sunscreen use, sun avoidance, other measures (sunglasses, hats, avoid solaria) Likert "Wear hats"	"validated"	Sunscreen use: +ve Sun avoidance: +ve Other: +ve	Sunscreen use *d* ~ .41[b] Sun avoidance *d* ~ 0.10[b] Other: *d* ~ 0.33[b]
11; Netherlands	*Design:* Cross-sectional; convenience *Setting:* Home *Method:* Phone Survey *Data Collection:* 2001; April (Spring)	500 (76) 17.5 [15-20]	48.6	3-items T/F "No sun protection is needed if you are already tanned"	3-items Likert How often "Stayed in the shade between 1200 and 1500h"	-	Sunscreen use: +ve Protective clothing use: +ve Shade use: + ve	Sunscreen use: *d* = 0.32 Clothing use: *d* = 0.15 Shade use: *d* = 0.18
12; USA	*Design:* Cross-sectional; convenience sample *Setting:* 12 schools *Method:* Questionnaire *Data Collection:* Pretest: 2002; March-May/ Posttest: 2002; May-June (Spring-Summer)	871 (66) - [5-13]	51.4	21-39-items Y/N "Can the sun hurt your eyes?" *Note: Number of items varied between groups*	5-6-items Likert "How often do you wear a hat when you're outside in the summer?"[d]	Knowledge KR-20= 0.42-0.55 Protection: α = 0.31-0.43	+ve (whole sample)	*d* = 0.18

Table continues

Table 1 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
13; USA	*Design:* Cross-sectional; convenience *Setting:* 30 schools *Method:* Questionnaire *Data Collection:* -	1788 (87.73) 13 [11-15]	42.8	10-items T/F "Tanning beds are a safe way to get a tan"	6-items Likert "I stayed in the shade"	Knowledge KR-20 = .71, test-retest reliability κ = .163-.594	+ve	*d* = 0.12
14; USA[e]	*Design:* Cross-sectional; convenience sample *Setting:* Home *Method:* Survey *Data Collection:* 1981; February (Winter)	1616 (-) - [-]	-	5-items Closed-ended "Melanoma most dangerous"	2-items Closed-ended Wear protective clothing	-	Sunscreen use: +ve Protective clothing use: ns	
15; Aus	*Design:* Cross-sectional; convenience sample *Setting:* Three schools *Method:* Questionnaire *Data Collection:* 1990	710 (-) - [13-15]	50.5	11-items T/F "Skin cancer only effects the elderly"	Diary Assessed hat, shirt, sunscreen use for 2-hours between 11am-3pm during weekends	-	Sunscreen use: +ve Hat use: ns	
16; UK	*Design:* Cross-sectional; convenience sample *Setting:* Seven schools *Method:* Questionnaire *Data Collection:* 1990; May – July (Spring)	262 (-) - [12+]	48.0	33-items T/F "A sun-tan protects you against skin cancer"	5-items Y/N "When sunny...did you cover up?"	-	Sunscreen use: +ve Other factors: 4x ns	

Table continues

Table 1 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
17; USA	*Design:* Cross-sectional; convenience sample *Setting:* Home *Method:* Phone Survey *Data Collection:* 1994; April (Spring)	864 (27) - [18+]	43.0	4-items 3T/F + 1MC "Sunscreen should be applied 30minutes before going outside"	6-items Likert Percentage of time used sunscreen on face	-	Sunscreen use (various results): +ve Hat use: ns Shirt worn: ns	-
18; USA	*Design:* Cross-sectional; nationally representative *Setting:* Home *Method:* Phone Survey *Data Collection:* 1999; September-October	651 (57) 40 [-]	21.0	4-items MC "Excessive sun exposure can lead to skin cancer"	5-items Likert "Wearing a shirt with sleeves"	-	ns	-
19; Pakistan	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* -	71 (91) 20.3 [-]	66.0	11-items Closed-ended "Skin cancer commonest of cancers"	5-items Closed-ended "I wear a cap in the sun"	Test-retested questionnaire with 10% of participants	ns	-

Note. Study 1 = Kakourou et al. (2006); 2 = Castle et al. (1999); 3 = Parrott et al. (2003); 4 = Martin (1995); 5 = Kakourou et al. (1995); 6 = Turner et al. (2005); 7 = Buller et al. (1995); 8 = Stone et al. (1999); 9 = Glanz et al. (1999); 10 = Patel et al. (2010); 11 = De Vries et al. (2005); 12 = Buller et al. (2008); 13 = Reynolds et al. (2006); 14 = Putnam et al. (1982); 15 = Fritschi et al. (1992); 16 = Hughes et al. (1993); 17 = Newman et al. (1996); 18 = O'Riordan et al. (2003); 19 = Gillani et al. (2001); RR = Response Rate; α = Cronbach's alpha; +ve = positive association; –ve = negative association; AUS = Australia; KR-20 = Kuder-Richardson 20; ns = nonsignificant association; MC = multiple choice; T/F = true/false; Y/N = yes/no.

[a]If age range was not reported, minimum age was given in brackets followed by a + symbol. [b]Approximate effect size reported as per Gilpin conversion chart (1993). [c]Sun protection results as reported in Kakourou et al. (2006). [d]Knowledge was reported as a summed score of correct pre-test and post-test knowledge items. [e]Results also reported in King et al. (1983).

Tanning Behaviour

Ten studies measured the association between skin cancer knowledge and tanning behaviour, with 11 results reported (see Table 2). Of these, three results reported skin cancer knowledge to be positively associated with tanning behaviours, one result reported a negative association, six results reported no statistically significant association, and one study reported varying results. Effect sizes could be reported for 5 of the 11 results. Of these, one related to a positively associated result and four to nonsignificant associations. All of the included studies reported UVR tanning behaviour: Seven reported results relating to outdoor tanning, four reported results related to solarium use, with one reporting both outdoor and solarium use. None of the included studies reported fake tanning behaviour.

Positive associations. Only one study assessed tanning behaviour using a multi-item scale, also measuring skin cancer knowledge with a multi-item scale. Unfortunately, insufficient information was provided to enable calculation of an effect size for this study although the result indicated that having higher levels of skin cancer knowledge was associated with higher levels of tanning behaviour in a sample of children. The remaining three studies used single-item measures and reported a positive association between skin cancer knowledge and solarium use in adult samples, of which one small effect was able to be calculated (d = .20).

Negative associations. Both studies that reported a negative association assessed tanning in an adult sample using single-item measures of tanning behaviour: One assessed solarium use and the other outdoor tanning.

Table 2

Summary of studies measuring the association between skin cancer knowledge and tanning behaviours

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
1; USA	*Design:* Cross-sectional; convenience *Setting:* Five beaches *Method:* Survey *Data Collection:* -	120 (74) 32.5 [18-64]	45.0	10-items MC "A symptom of skin cancer; a sore that does not heal, a bleeding sore, a painful sore."	1-item Likert "Hours of sun bathing per week"	-	ns	*d* = 0.24
2; USA	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire (online) *Data Collection:* 2007; September-December (Autumn)	596 (74.5) - [17+]	36.9	12-items T/F "Only sunburn causes skin damage, a tan actually protects the skin from damage"	1-item Closed-ended "Have you ever utilized a tanning salon?" 2-items Closed-ended Past summer how often did you sunbathe?	-	Solarium use: +ve Outdoor tanning: ns	Solarium use: *d* = 0.20 Outdoor tanning: *d* = 0.14
3; USA	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* 1990; September-December (Autumn)	296 (87) - [17+]	39.2	12-items T/F "Moisturizers can repair sun damage"	1-item Likert Frequency of sunbathing when working?"	"content validity" – whole study	ns	*d* = 0.19
4; USA	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* -	266 (-) - [17 – 23]	50.0	15-items - "What is the most fatal form of skin cancer?"	4-items Likert "How often (they) used sunlamps or tanning booths to get or maintain a tan"	α >.70 for all measures	ns	*d* = 0.18

Table continues

Table 2 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
5; Sweden	*Design:* Cross-sectional; convenience *Setting:* Home *Method:* Questionnaire (mail-out) *Data Collection:* 50% April, 50% September (Spring/Autumn)	2615 (66) 15 [13, 15, 17]	-	16-items Closed-ended Is fair skin a risk factor for melanoma?	11-items Likert "How often do you suntan during summer?"	-	+ve	-
6; Denmark	*Design:* Cross-sectional; convenience *Setting:* Home *Method:* Survey (Online and Phone) *Data Collection:* 2007; March – 2 weeks (Spring)	3437 (24-30%) - [15-59]	43.1	1-item Y/N "Sunbeds cause cancer"	1-item Likert "How often did you use sunbed within the last 12 months?"	-	ns	-
7; USA	*Design:* Cross-sectional; convenience *Setting:* 3rd graders at two schools *Method:* Questionnaire *Data Collection:* 1991	82 (-) 8 [-]	52.4	16-items T/F, MC "Too much sun can cause freckles"	1-item Y/N "Have you ever tried to get a suntan?"	-	ns	-
8; USA	*Design:* Cross-sectional; convenience *Setting:* Three community settings *Method:* Survey *Data Collection:* -	476 (-) 33.6 [16-90]	63.0	1-item Y/N Which of a list causes skin cancer	1-item Likert Frequency of tanning bed use	-	+ve	-

Table continues

Table 2 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
9; USA	*Design:* Cross-sectional; nationally representative *Setting:* Home *Method:* Survey (Phone) *Data Collection:* 2005	821 (62.5) - [18-64]	-	1-item Open-ended Ways to reduce skin cancer risk	1-item Likert use Amount of times used indoor tanning devices last 12 months	-	Various results: +ve, ns, -ve	-
10; USA	*Design:* Cross-sectional; convenience *Setting:* Home *Method:* Survey (Phone) *Data Collection: 1994; April (Spring)*	864 (27) - [18+]	43.0	4-items 3T/F + 1MC "Sunscreen should be applied 30 minutes before going outside"	1-item Likert Percent of time spent in sun… "for purpose of getting a tan?"	-	-ve	-

Note. Study 1 = Keesling et al. (1987); 2 = Felts et al. (2010); 3 = Vail-Smith et al. (1993); 4 = Leary et al. (1993); 5 = Sjöberg et al. (2004); 6 = Koster et al. (2009); 7 = Thornton et al. (1996); 8 = Mawn et al. (1993); 9 = Choi et al. (2010); 10 = Newman et al. (1996); RR = Response Rate; α = Cronbach's alpha; +ve = positive association; –ve = negative association; ns = nonsignificant association; MC = multiple choice; T/F = true/false; Y/N = yes/no.

[a]If age range was not reported, minimum age was given in brackets followed by a + symbol.

Nonsignificant associations. One study assessed tanning and skin cancer knowledge using multi-item scales in a young-adult population, with a small effect of (*d* = .18). The six remaining studies that reported a nonsignificant association assessed skin cancer knowledge and/or tanning behaviour through a single-item measure. Of these, three small effects could be calculated (*d* = .14 to .24). Three studies reported the association between skin cancer knowledge and outdoor tanning with an adult sample.

Overall, there was no clear association between better knowledge and less tanning. This contrasts with the results involving sun-protective behaviour, where the direction of the association was largely positive.

Sun exposure

Six studies measured the association between skin cancer knowledge and sun exposure (see Table 3). Of these, one study found skin cancer knowledge to be positively associated with sun exposure, one study found the association to be negative and the remaining four studies reported no statistically significant association. Effect sizes could be reported for two of the six studies. Of these, one related to a nonsignificant association and the other to a negative association.

Positive association. The study that found a positive association assessed sun exposure in a sample of children aged 10–16 years, using a single-item measure that recorded the number of burns experienced during the previous summer.

Negative association. The single study that found a moderate negative association also assessed sun exposure using a single-item measure that recorded hours of sun exposure per week in a sample of adults. A moderate effect was calculated (*d* = .52).

Nonsignificant associations. One study assessed sun exposure using a multi-item scale (two items), also measuring skin cancer knowledge with a multi-item scale.

There were four nonsignificant results assessed through one-item measures of sun exposure; two assessing hours of exposure in adults and two assessing number of sunburns experienced in children and adults. In the study involving children reporting sunburn experiences over the previous summer, a small effect was calculated (d = .12).

Overall, there was no clear association between better knowledge and less sun exposure. This is similar to the results involving tanning behaviour and contrasts with the results involving sun-protective behaviour, where the direction of the association was largely positive.

Miscellaneous Behaviour

Four studies combined protective, exposure and/or tanning behaviours into one behavioural outcome, which was subsequently used to test the association with skin cancer knowledge (see Table 4). None of these studies found a significant correlation between behaviour and skin cancer knowledge.

Table 3

Summary of studies measuring the association between skin cancer knowledge and sun exposure behaviours

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
1; USA	*Design:* Cross-sectional; convenience *Setting:* Five beaches *Method:* Survey *Data Collection:* -	120 (74) 32.5 [18-64]	45.0	10-items MC (See Table 2)	1-item Likert "Hours of sun exposure per week"	-	-ve	*d* = 0.52
2; UK	*Design:* Cross-sectional; convenience *Setting:* Seven schools *Method:* Questionnaire *Data Collection:* 1990; May – July	262 (-) - [12+]	48.0	33-items T/F "A sun-tan protects you against skin cancer"	1-item Closed-ended "Did you get sunburnt during the summer holidays?"	-	ns[b]	*d* = 0.12
3; USA	*Design:* Cross-sectional; convenience *Setting:* Six schools *Method:* Questionnaire *Data Collection:* -	2275 (-) 12.1 [10-16]	54.6	20-items MC, T/F "Tanning salons and sun lamps are safe ways to get a tan"	1-item - "Number of sunburns during the previous summer"	Face & Content validity	+ve	-
4; USA	*Design:* Cross-sectional; convenience *Setting:* Community *Method:* Survey (Phone) *Data Collection:* 1988	214 (85) - [-]	34.5	6-items T/F, Open-ended "Clouds protect from burn"	1-item Likert "Hours outdoors on weekends without sunscreen"	-	ns	-

Table continues

Table 3 continued

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
5; USA	*Design:* Cross-sectional; convenience *Setting:* Home *Method:* Survey (Phone) *Data Collection:* 1999; September-October (Autumn)	651 (57) 40 [-]	21.0	4-items MC "Excessive sun exposure can lead to skin cancer"	1-item Likert "Number of sunburns"	-	ns	-
6; Pakistan	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* -	71 (91) 20.3 [-]	66.0	11-items Closed-ended "Skin cancer commonest of cancers"	2-items Closed-ended "I had sunburn this summer"	Test-retested 10% of participants	ns	-

Note. Study 1 = Keesling et al. (1987); 2 = Hughes et al. (1993); 3 = Alberg et al. (2002); 4 = Berwick et al. (1992); 5 = O'Riordan et al. (2003); 6 = Gillani et al. (2001); RR = Response Rate; +ve = positive association; –ve = negative association; ns = nonsignificant association; MC = multiple choice; T/F = true/false.
[a]If age range was not reported, minimum age was given in brackets followed by a + symbol. [b]Knowledge questionnaire distributed pre-intervention, exposure questionnaire distributed post-intervention.

Table 4

Summary of studies measuring the association between skin cancer knowledge and composite sun-related behaviours

Study; Country	Design Methods	Participants		Knowledge Measure	Outcome Measure	Validity/ Reliability	Results	
		N (Response Rate %) *M* age [Range[a]]	% male	*Items/ format/ example*	*Items/ format/ example*		Relationship [+ve, ns, -ve]	Effect Size
1; USA	*Design:* Cross-sectional; convenience *Setting:* University *Method:* Questionnaire *Data Collection:* -	492 (-) - [18-24]	47.2	24-items MC "The most common form of cancer is…"	(Protection and Tanning items) 20-items Likert, MC "Do you use tanning beds?"	-	ns	*d* = 0.01
2; NZ	*Design:* Cross-sectional; convenience *Setting:* Six schools *Method:* Questionnaire *Data Collection:* 2004	488 (73.6) Mode = 12 [-]	48.0	11-items Closed-ended Safe to get sunburnt once or twice a year	(Protection, Tanning and Exposure items) 9-items Likert "Sunburnt last summer"	-	ns[b]	-
3; Sweden	*Design:* Cross-sectional; convenience *Setting:* Two universities *Method:* Questionnaire *Data Collection:* 1995; March - 5 days (Spring)	296 (97) - [19-48]	53.0	25-items Y/N/DK Is fatty food a risk factor for melanoma?	(Tanning and Exposure items) 7-items Likert "How often do you use a sunbed?"	Behaviour items "previously validated"	ns	-
4; UK	*Design:* Cross-sectional; convenience *Setting:* Hospital patients and staff *Method:* Questionnaire *Data Collection:* -	183 (55) - [18+]	26.2	18-items Y/N/DK A mole changing shape can be a sign of skin cancer	(Protection Score [5-items/ Likert/ "Avoiding strong sunlight"] minus Exposure Score [9-items/ Likert/ "Do you consider yourself a sun seeker?"])	Face & Content validity	ns	-

Note. Study 1 = Spradlin et al. (2010); 2 = Wright et al. (2008); 3 = Jerkegren et al. (1999); 4 = Guile et al. (2004); RR = Response Rate; ns = nonsignificant association; MC = multiple choice; Y/N/DK = yes/no/don't know.

[a]If age range was not reported, minimum age was given in brackets followed by a + symbol. [b]Association between knowledge and protection significant when mediated by tanning attitudes (importance of having a tan, attractiveness of a good tan, and desire for a tan).

Discussion

This review includes 34 studies assessing the relationship between skin cancer knowledge and sun-related behaviours. Research has been published steadily over the past two decades, with 17 of the included studies published between 2001 and 2010 and 16 between 1991 and 2000 (two studies were published in the 1980s). In general, most studies were conducted in North America, relied on single-item measures of skin cancer knowledge and/or sun-related behaviours and did not report on the validity or reliability of their measures. Measuring the association between skin cancer knowledge and behaviour was not the main focus of 41% of the articles (14 studies). Further, 113 studies were excluded from this review because, although they measured both skin cancer knowledge and sun-related behaviours, they did not test the relationship(s). It is possible, although unknowable, that a number of these studies did not report results due to nonsignificance – a well-documented publication bias (e.g., Easterbrook, Berlin, Gopalan, & Matthews, 1991). While the three behavioural outcomes (sun protection, exposure and tanning) were investigated across a range of age and gender groups, measurement across studies varied – limiting the scope of analysis in this review.

This study aimed to determine the nature of the relationship between sun-protective behaviour and skin cancer knowledge in the general population across all ages. Due to measurement variability and methodological problems with some included studies, we were unable to conclusively establish our aim. The majority of studies reported a positive association, with the remainder failing to attain statistical significance. The majority of studies that reported a positive association used multi-item measures of skin cancer knowledge and/or sun-protective behaviour, whereas this was not the case for studies reporting nonsignificant results.

Further, all the seven studies that reported internal consistency of their skin cancer knowledge and/or sun-protective behaviour measures found a positive relationship between the two constructs. Interestingly, although sun-protective behaviours reportedly decrease in adolescence (Olson et al., 2007), the present review found that they remained positively associated with skin cancer knowledge. This suggests that other factors may be responsible for the reported decrease in protective behaviour. A number of studies linked parents' protective behaviour to their children's, and it has been reported that parental influence wanes in adolescence as peer and media influences become more critical (Cafri et al., 2008).

This study also aimed to determine the nature of the relationship between all forms of tanning behaviour and skin cancer knowledge in the general population across all ages. Due to measurement variability and the limited sample of studies to draw from, we were unable to fully achieve this aim. Notably, none of the included studies reported fake tanning behaviour; although there is limited research regarding fake tanning behaviour, it is important that this emerging area of the literature explores this relationship. Three of the 10 studies assessing this relationship used single-item skin cancer knowledge measures, and eight of the 10 used single-item tanning behaviour measures. The only two studies that mentioned validity and reliability were vague, stating that all measures had content validity (Vail-Smith & Felts, 1993), and that Cronbach's α exceeded .70 for all measures (Leary & Jones, 1993). Measurement of outdoor tanning varied from "Have you ever tried to get a suntan" to an 11-item scale (see Table 2). Two studies involved children: One with multi-item skin cancer knowledge and tanning behaviour measures reporting a positive relationship in adolescents (Sjöberg et al., 2004) and the other using a single-item measure of ever trying to get a suntan, reporting a nonsignificant relationship (Thornton & Piacquadio,

1996). Notably, of the seven results reporting the relationship between solarium use and skin cancer knowledge, three studies reported a positive relationship, two of which assessed both skin cancer knowledge and tanning with single items (Choi et al., 2010; Mawn & Fleischer Jr, 1993). Furthermore, these studies assessed different areas of skin cancer knowledge (see Table 1). Despite methodological limitations, the reported nonsignificant results suggest that skin cancer knowledge may play a minimal role in the decision to engage in tanning behaviour.

Only six studies were identified that assessed the relationship between sun exposure behaviour and skin cancer knowledge, the most recent of which was published in 2003. Despite sun exposure being one of the most commonly measured factors in the skin cancer literature, none of the included studies reported reliability information for either the sun exposure measure or the skin cancer knowledge measure. Furthermore, only one study reported validity information, simply stating the measures had face and content validity (Alberg et al., 2002). All but one study used single item measures of sun exposure, with the exception using a two-item measure (Gillani et al., 2001). One study assessed skin cancer knowledge pre-intervention and exposure post-intervention consequently response bias may have influenced the (nonsignificant) result (Thornton & Piacquadio, 1996). It is well documented that sun exposure in the first 18 years of life increases subsequent risk of developing skin cancer (e.g., Elwood & Jopson, 1997; Whiteman et al., 2001), and large amounts of time and money are invested in skin cancer prevention campaigns targeting young children. It is thus concerning that only two studies in this review measured the relationship between children's skin cancer knowledge and the most relevant risk behaviour for youth regarding skin cancer. This limits our understanding of the effects of such campaigns on children's comprehension of skin cancer prevention messages and the subsequent influence, or lack thereof, on

sun exposure.

Given the importance of skin cancer knowledge in prevention programmes and the size of the skin cancer literature, there were surprisingly few studies that qualified for inclusion in this review. The following paragraph highlights some examples drawn from the included literature regarding skin cancer knowledge and sun-related behaviours that could not be reviewed systematically due to paucity of data. In general, regardless of the relationship with sun-related behaviour, studies reported a high level of skin cancer awareness among participants (e.g., D. B. Buller, Callister, & Reichert, 1995; Gillani et al., 2001; Glanz et al., 1999; Guile & Nicholson, 2004; Hughes, Altman, & Newton, 1993); however, there were a number of reported examples of skin cancer knowledge deficits. For instance, studies reported low skin cancer knowledge regarding the effects of the sun on physical appearance over time (e.g., Kakourou et al., 1995; Kakourou et al., 2006), the future impact of severe sunburns (see Felts et al., 2010) and identification of melanoma as a form of skin cancer (see Fritschi, Green, & Solomon, 1992). Notably, authors reflected that some participants were not convinced of their children's susceptibility to skin cancer (D. B. Buller et al., 1995), of the utility of protective methods (de Vries et al., 2005) or (as recently as 2010) felt that "sun-safe" behaviours were not necessary (Spradlin et al., 2010). In general, females had higher levels of skin cancer knowledge but engaged in more risky sun-related behaviours than their male counterparts (see Felts et al., 2010; Jerkegren, Sandrieser, Brandberg, & Rosdahl, 1999; Køster, Thorgaard, Clemmensen, & Philip, 2009; Mawn & Fleischer Jr, 1993; Sjöberg et al., 2004). One study reported solarium users had higher skin cancer knowledge than nonusers, and that over 50% of solarium users believed solaria to be more dangerous than the sun (Choi et al., 2010). This appears to be inconsistent with a previous review of solarium use, which reported that the typical solarium user has low

knowledge of the risks of UVR (Schneider & Krämer, 2010). Despite general awareness and moderate overall skin cancer knowledge, studies paradoxically reported that participants believe a tan is healthy (e.g., Keesling & Friedman, 1987; Newman, Agro, Woodruff, & Mayer, 1996; Stone et al., 1999). This could be indicative of the quality of the utilised skin cancer knowledge measures or due to a lack of detailed health information regarding tanning being disseminated in the community. While most studies found a positive association, the actual extent of participation in sun-protective behaviour was often reported to be suboptimal (e.g., Alberg et al., 2002; de Vries et al., 2005; Mawn & Fleischer Jr, 1993). Despite relatively high rates of sunscreen use, it was reported that sunburn incidence remained high (see Kakourou et al., 1995; O'Riordan et al., 2003). This may be attributed to the finding that many participants do not use sunscreen as recommended, either by not using enough or by not reapplying as necessary (e.g., Kakourou et al., 2006; Spradlin et al., 2010). The results of this review indicate support of previous assertions that prevention messages often focus on sunscreen use, perhaps neglecting other methods (de Vries et al., 2005; Glanz et al., 1999). As sunscreen alone has been shown to provide inadequate UVR protection, it is critical that prevention messages stress the importance of protective clothing and shade.

Limitations

A reasonably small number of studies, sourced from a wide range of databases, were identified for inclusion in this review. Quantitative information was reported, focusing on the direction as well as the strength of the association, with effect sizes calculated where possible. A meta-analysis was unable to be undertaken due to a lack of quantitative information reported in included studies. While every attempt was made to detect as many potential studies as possible through the use of a large number of search terms and a systematic search strategy, studies may have potentially been overlooked

due to unclear key words, titles or abstracts. Some degree of publication bias may be present and the inclusion of grey literature may have changed the results. Cochrane review guidelines were followed within practical resource limitations. Although Cochrane review guidelines recommend including studies regardless of the language in which they are written (Higgins & Green), we limited our study to publications in English due to resource restraints. Thus, we cannot exclude the possibility of a language bias.

A significant weakness identified in the skin cancer knowledge literature is the variability in methodological quality of the reported studies. There was wide diversity in the factors assessed, particularly among the single-item measures. For example, eight different protective behaviours were assessed among studies using single-item measures. While this can be useful to assess differences in specific behaviours, the reliability of such measurement is limited. There was only one instance of the same skin cancer knowledge measure being used on more than one occasion, a follow-up study conducted by the same authors (Felts et al., 2010; Vail-Smith & Felts, 1993). Furthermore, areas of skin cancer knowledge assessed varied, with foci including sun protection, risk factors and prevalence of skin cancer. In some cases, the "correct" skin cancer knowledge answers varied among articles. For example, a number of studies asked a variation of the question "What time of day is the sun the strongest?" and the correct answer varied between 10 a.m. and 2 p.m., 10 a.m. and 3 p.m., 11 a.m. and 3 p.m. and 10 a.m. and 4 p.m. This is unsurprising when leading cancer-prevention websites also report different information in this regard (e.g., Cancer Council Australia, 2011a; Cancer Research UK, 2011b; World Health Organization, 2011). Although sun strength may vary depending on the location and season, it is important to reach consensus on key prevention guidelines to minimise confusion and uncertainty for both

researchers and health professionals.

Implications for Future Research

The following recommendations are presented to expand the evidence base:

Continued inclusion of skin cancer knowledge measurement in studies of predictors of sun-related behaviours. In addition to improving understanding of this complex relationship, continued measurement of the association between skin cancer knowledge and sun-related behaviour will enable the assessment of any changes in the strength of the association(s) in the face of evolving sun protection and tanning methods.

Use of standardised, multi-item measures of both skin cancer knowledge and sun-related behaviours. Considerable efforts have been made to produce valid measures of sun-related behaviours (e.g., Glanz et al., 2008; Lazovich et al., 2008), and such measures should be employed to aid comparability of results. Multi-item measures can provide an estimation of the internal consistency, which carries significant psychometric importance (Loo, 2002). Furthermore, as sun-related behaviours are not homogenous (e.g., sunscreen use and hat use), measuring a single behaviour does not allow comparability across behaviours. Based on the findings of this review, a number of items are suggested for inclusion in future measures of skin cancer knowledge (see Table 5). These items are based on current best practice research and reflect the recommended move from awareness-type questions to procedural skin cancer knowledge, which may give more useful insight in terms of related behaviour (Schneider & Krämer, 2010).

Table 5

Skin cancer and sun health knowledge: Recommended measurement items

Item
1. I should stay out of the sun if my shadow is shorter than my body □ **True** □ False
2. Sunbathing for only a couple of weeks a year (e.g., when on holiday) increases you likelihood of getting skin cancer □ **True** □ False
3. Solariums/sun beds are a safe way to get a tan □ True □ **False**
4. When using sunscreen, you can tan without any negative effects □ True □ **False**
5. Having a tan protects my skin from the sun □ True □ **False**
6. A fake/spray on tan provides me with no protection from the sun □ **True** □ False
7. Keeping your skin tanned at a solarium during the winter protects it from sun damage during the summer □ True □ **False**
8. Gradual tanning eliminates most of the negative effects of lengthy exposure to the sun □ True □ **False**
9. A tan is a sign that the skin is damaged □ **True** □ False
10. UVR (ultraviolet rays) from tanning beds is safer than UVR from the sun □ True □ **False**
11. Tanning is an unsafe way to get the vitamin D your body needs □ **True** □ False
12. A tan is a sign of good health □ True □ **False**

Table continues

Table 5 continued

Item
13. If you are not usually exposed to the sun, being severely sunburned two or three times during your life will probably not increase your chances of skin disease. □ True □ **False**
14. The only way a person can get skin cancer is from too much exposure to the sun □ True □ **False**
15. People with dark skin cannot get skin cancer □ True □ **False**
16. When should sunscreen be applied for best protection? □ Just before you go in the sun □ **15-30 minutes before going in the sun** □ Within 15-30 minutes after going in the sun
17. How often should SPF 30 sunscreen be reapplied? □ Every 30 minutes □ **Every two-three hours, and more often if swimming or sweating** □ Neither of these options
18. When is the sun the strongest? □ 9:00 a.m. – 12:00 p.m. □ **10:00 a.m. – 4:00 p.m.**[a] □ 2:00 p.m. – 5:00 p.m.
19. Damage caused by the skin can be repaired by: □ After-sun lotions (e.g., Aloe Vera lotion) □ Moisturisers □ Both of these options □ **Neither of these options**
20. What type of clothing usually blocks more UV radiation (from the sun)? □ Lighter coloured clothing □ **Darker coloured clothing** □ Both of these options □ Neither of these options
21. What does SPF 30 mean? □ **A sunscreen with a SPF of 30 means a person can stay in the sun 30 times longer without burning than he or she could if not wearing sunscreen** □ A sunscreen with a SPF of 30 provides twice as much protection as a sunscreen with a SPF of 15 □ Both of these options □ Neither of these options

Table continues

Table 5 continued

Item
22. Can you get a sunburn…
□ At the snow?
□ In an outdoor pool or the ocean?
□ **Both of these places**
□ Neither of these places
23. Which of the following increases your risk of skin cancer?
□ Having had three severe sunburns in your past
□ Having a family history of skin cancer
□ **Both of these options**
□ Neither of these options
24. What is the most common form of skin cancer?
□ Melanoma
□ **Basal cell carcinoma**
□ Squamous cell carcinoma
□ None of these options
25. Which of the following could be a sign of skin cancer?
□ A sudden or gradual change in a mole's appearance
□ A sore that doesn't heal
□ **Both of these options**
□ Neither of these options

Note. SPF = sun protection factor. Correct answers are printed in boldface type. This is not a validated scale. A number of these items have been used by a multiple studies, either with similar or with exact wording. The authors recommend including an "I don't know" option on all of the above questions.
[a]As reported in text, different studies and cancer organisations cite different correct responses to this question. We have chosen the broadest time frame in order to allow for seasonal and atmospheric variation.

Focus on factors influencing adolescent sun-related behaviours, particularly a decline in protective behaviour. It is well documented that UVR exposure in the first 18 years of life significantly influences subsequent skin cancer risk. This review found that commonly in adolescence sun-protective behaviours reach their lowest level, yet skin cancer knowledge was found to be positively associated with sun protection in four studies. Other factors that may be influential in this relationship include the transition from parental control of behaviour to behaviour driven by appearance motivation, peer and media influences. Although work has been done in this area, studies including skin cancer knowledge as a factor are scarce. It is important for future work to determine to what extent skin cancer knowledge plays a role in

behaviour in this cohort and whether skin cancer knowledge is mediated by other influences, such as peer and/or media influences.

Conclusion

Although skin cancer knowledge can be seen as the first step to progress in prevention campaigns, many studies have failed to adequately measure skin cancer knowledge or include a measure of skin cancer knowledge at all. A small number of studies have reported that skin cancer knowledge does not influence behaviour (e.g., Cokkinides et al., 2010; Dissel et al., 2009; Heckman et al., 2008), however the results of this review do not corroborate such a claim. Although results, in general, were varied, a number of studies found that higher levels of skin cancer knowledge were related to better compliance with sun-protective behaviours. Results from this review suggest that there are still a number of deficits in the general population's skin cancer knowledge levels; however, these findings must be considered in light of the substantial methodological issues of the majority of included studies. Until the quality of skin cancer knowledge measurement improves, it will remain difficult to draw sensible conclusions about the true level of knowledge in this area and the relationship between knowledge levels and other factors. As such, the authors have made suggestions for future measurement of this construct (see Table 5). Although skin cancer knowledge is not the only determinant of sun-related behaviours, it is nonetheless essential that this association be investigated more thoroughly. By doing so, we can attempt to truly understand the nature of this fundamental and complex relationship, in order to develop a sound platform on which to base future research and prevention work.

2.3. Final Remarks

There were a limited number of studies available for inclusion in this review (*N* = 34). Due to the variety of sun-related behaviours and presumably motivations to choose to engage in different kinds of those behaviours, a key aim of this review was to consider the link between skin cancer knowledge and all forms of sun-related behaviours. Of the included studies, only six measured incidental sun exposure as the outcome variable and no studies measured the relationship between skin cancer knowledge and fake tanning behaviour. Furthermore, none of the studies included in this review used the same measure of skin cancer knowledge. Hence, conclusions based on the available data were limited. The results of this review provided evidence of a relationship between skin cancer knowledge and sun-related behaviours, indicating that continued measurement of skin cancer knowledge is worthwhile. However, the review revealed a number of methodological issues associated with past measures of skin cancer knowledge including the lack of validity and reliability information and the heterogeneity of items. This heterogeneity in methodology limits the conclusions that can be drawn from previous research about the specific nature and size of the association between skin cancer knowledge and sun-related behaviours.

2.4. Appendix A

Search Strategy[1]

(Skin neoplasms[mh] OR Skin neoplasm*[tiab] OR Skin Cancer*[tiab] OR Melanoma[mh:NoExp] OR Melanoma[tiab] OR Melanomas[tiab] OR melanoma/nonmelanoma[tiab] OR Non-Melanoma*[tiab] OR Nonmelanoma*[tiab] OR Carcinoma, Squamous Cell[mh:NoExp] OR Squamous Cell Carcinoma*[tiab] OR Carcinoma, Basal Cell[mh:NoExp] OR Basal Cell Carcinoma*[tiab] OR Skin-tumour*[tiab] OR Skin-tumor*[tiab])

AND

(Knowledge[mh] OR Knowledge[tiab] OR Health knowledge[tiab] OR Knowledge Bases[mh] OR Knowledge Base[tiab] OR Attitude[mh:NoExp] OR Attitude to Health[mh] OR Attitude*[tiab] OR Belief*[tiab] OR Health Education[mh:NoExp] OR Health-Education[tiab] OR Patient Education as Topic[mh] OR Consumer Health Information[mh] OR Attitude of Health Personnel[mh] OR Awareness[mh] OR Awareness[tiab])

AND

(Health Behavior[mh] OR Health Behavior*[tiab] OR Health Behaviour*[tiab] OR Sun-behaviour*[tiab] OR Sun-behavior*[tiab] OR Sunstroke[mh] OR Sunstroke*[tiab] OR Sun-stroke*[tiab] OR Environmental exposure[mh:NoExp] OR Sunburn[mh] OR Sunburn*[tiab] OR Sun-burn*[tiab] OR Heliotherapy[mh] OR Ultraviolet Rays[mh] OR Ultraviolet Ray*[tiab] OR Ultra-violet Ray*[tiab] OR UV Light[tiab] OR Ultraviolet Rad*[tiab] OR Ultra-violet Rad*[tiab] OR Ultraviolet Light[tiab] OR Ultra-violet Light[tiab] OR Sunlight/ae[mh] OR Self Care[mh:NoExp] OR Self-Care[tiab]

[1] Search terms presented here are formatted in as per Medical Subject Headings (MeSH) for PubMed search. Terms were modified in accordance with each electronic databases search requirements.

OR Self-Management[tiab] OR Skin Care[mh] OR Protective Clothing[mh:NoExp] … … OR Protective-Clothing[tiab] OR Sun-Protec*[tiab] OR UVR-protec*[tiab] OR UV-protec*[tiab] OR Ultra-violet protec*[tiab] OR Ultraviolet-protec*[tiab] OR Sun-block*[tiab] OR sunblock*[tiab] OR Sunscreening Agents[mh] OR Sunscreen*[tiab] OR Sun-screen*[tiab] OR Preventative*[tiab] OR Preventive[tiab] OR Suntan[mh] OR Suntan*[tiab] OR Sun-tan*[tiab] OR Sunbathing[mh] OR Sunbath*[tiab] OR Sun-bath*[tiab] OR Outdoor tanning[tiab] OR Sunba*[tiab] OR Sun-ba*[tiab] OR sunbed*[tiab] OR Sun-bed*[tiab] OR Sun-benches[tiab] OR Solarium*[tiab] OR Tanning-bed*[tiab] OR Tanning-booth*[tiab] OR Tanning-lamp*[tiab] OR Artificial-UV*[tiab] OR Indoor-tanning[tiab] OR Indoor-tanners[tiab] OR Artificial-tan*[tiab] OR Sunless-tan*[tiab] OR Self-tan*[tiab] OR Intention[mh] OR Intent[tiab] OR Intend*[tiab] OR Intention*[tiab])

2.5. Appendix B

Log of the Electronic Database Searches

Date	Database	Search Terms	Articles Identified	Articles Exported to Endnote
11 OCT 2012	CINAHL	1. Skin Cancer	7,947	
		2. Knowledge	226,937	
		3. Outcome	142,956	
		1 + 2 + 3	316	**316**
		Limited to: English		
11 OCT 2012	Embase	1. Skin Cancer	171,824	
		2. Knowledge	1,048,226	
		3. Outcome	228,703	
		1 + 2 + 3	1,314	**1,314**
		Limited to: English		
		Excluded keywords: animals, nonhuman		
11 OCT 2012	PsycINFO	1. Skin Cancer	1,150	
		2. Knowledge	552,513	
		3. Outcome	696,002	
		1 + 2 + 3	221	**221**
		Limited to: English, Human		
11 OCT 2012	PubMed	1. Skin Cancer	235,431	
		2. Knowledge	789,533	
		3. Outcome	390,363	
		1 + 2 + 3	1,438	**1,438**
		Limited to: English, Human		
11 OCT 2012	Scopus	1. Skin Cancer	343,632	
		2. Knowledge	1,780,026	
		3. Outcome	1,024,413	
		1 + 2 + 3	2,535	**2,535**
		Limited to: English		
		Excluded keywords: animals, nonhuman		
			TOTAL	**5,824**

Note. Outcome = Tanning behaviour, sun protection, and sun exposure terms

2.6. Appendix C

Study Inclusion Criteria Checklist

INCLUDE ☐ EXCLUDE ☐

Reason:_____

YEAR OF STUDY: _____

NAME OF STUDY: _____
_____
_____

AUTHORS: _____
_____
_____

JOURNAL: _____
_____

SOURCED FROM:

- ☐ Embase
- ☐ CINAHL
- ☐ PsycINFO
- ☐ PubMed
- ☐ Scopus

INCLUSION/EXCLUSION CRITERIA

	YES (include)	**NO** (exclude)
Skin cancer related knowledge reported?	☐	☐
Skin cancer related behaviour/intention reported? e.g., sun exposure or protective behaviours, tanning methods	☐	☐
Focus on melanoma or skin cancer more generally?	☐	☐
Participants from general population?	☐	☐
In English?	☐	☐
$N > 1$	☐	☐
Original/Primary data?	☐	☐

CHAPTER 3. PAPER TWO

3.1. Preamble

It is essential we measure skin cancer knowledge comprehensively in order to reliably determine levels of knowledge in the population and accurately evaluate the relationship between skin cancer knowledge and sun-related behaviours. The results reported in Chapter 2 highlighted the need for a standardised, multi-item measure of skin cancer knowledge, and this second study describes the development of such a scale.

The Skin Cancer and Sun Knowledge (SCSK) scale: Validity, reliability, and relationship to sun-related behaviors among young western adults

- PAPER ACCEPTED FOR PUBLICATION[1] -

Ashley Day, University of Adelaide

Carlene Wilson, Flinders University and Cancer Council South Australia

Rachel Roberts, University of Adelaide

Amanda Hutchinson, Flinders University and Cancer Council South Australia

3.2. Statement of Authorship

Day, A. K., Wilson, C., Roberts, R. M., & Hutchinson, A. D. (2014). The Skin Cancer and Sun Knowledge (SCSK) scale: Validity, reliability, and relationship to sun-related behaviors among young Western adults. *Health Education and Behavior, 41*, 440-448. doi: 10.1177/1090198114529129

Ashley Day (*Candidate)*

I was responsible for primary authorship of this paper, and collaborated with co-authors on its conceptualisation and design. I conducted the statistical analyses, and took the lead role in interpreting the results and writing and revising the manuscript, again with input and advice from co-authors. I served as corresponding author and was responsible for manuscript submission, revisions, and responses to journal reviews.

Signed: _____ Date: _____

[1] Please see Appendix B at the end of this thesis for a copy of the published manuscript

Prof Carlene Wilson, Dr Rachel Roberts, and Dr Amanda Hutchinson (*Co-authors)*

We were the supervisors of the research programme that led to this publication and there was ongoing collaboration between Ashley Day and us in refining the direction of the research. The realisation of the idea, collection of data, and analysis of data were the work of Ashley Day. Ashley Day was responsible for writing this paper; our role was to comment on drafts, make suggestions on the methodology and presentation of material in the paper, and to provide editorial input. We also provided advice on responding to comments by the journal reviewers and editor. We hereby give our permission for this paper to be incorporated in Ashley Day's submission for the degree of Doctor of Philosophy from the University of Adelaide.

Signed: Carlene Wilson _____ Date: _____

Signed: Rachel Roberts _____ Date: _____

Signed: Amanda Hutchinson _____ Date: _____

Abstract

Increasing public knowledge remains one of the key aims of skin cancer awareness campaigns, yet diagnosis rates continue to rise. It is essential we measure skin cancer knowledge adequately so as to determine the nature of its relationship to sun-related behaviours. This study investigated the psychometric properties of a new measure of skin cancer knowledge, the Skin Cancer and Sun Knowledge (SCSK) scale. A total of 514 Western young adults (females n = 320, males n = 194) aged 18 to 26 years completed measures of skin type, skin cancer knowledge, tanning behaviour, sun exposure, and sun protection. Two-week test–retest of the SCSK was conducted with 52 participants. Internal reliability of the SCSK scale was acceptable (KR-20 = .69), test–retest reliability was high (r = .83, n = 52), and acceptable levels of face, content, and incremental validity were demonstrated. Skin cancer knowledge (as measured by SCSK) correlated with sun protection, sun exposure, and tanning behaviours in the female sample, but not in the males. Skin cancer knowledge appears to be more relevant to the behaviour of young women than that of young males. We recommend that future research establish the validity of the SCSK across a range of participant groups.

Skin cancer remains a significant public health concern in Australia. Despite more than 30 years of public health messages surrounding skin cancer, the diagnosis rate continues to rise (Kasparian et al., 2009). As basal and squamous cell carcinomas are not notifiable diseases in the majority of Australian states and territories it is difficult to obtain an accurate rate of skin cancer incidence; however, it is estimated that there are over 330,000 diagnoses of melanoma and nonmelanoma skin cancers annually (Australian Institute of Health and Welfare, 2011a; Cancer Council Australia, 2013). Appropriate sun protection should prevent most cases of skin cancer, yet it is widely reported that people are failing to use, or inconsistently using, sun-protective methods (e.g., Kasparian et al., 2009). The incidence of melanoma also varies by sex and by age; among Australians aged 20 to 24 years, incidence of melanoma was nearly 30% higher in females than in males in 2008 although by age 50 to 59 years incidence of melanoma was almost 16% higher in males, suggesting sex and age differences in risk profile (e.g., Australian Institute of Health and Welfare, 2011a).

The specific role of health knowledge in affecting behaviour change has been debated across a number of health issues (e.g., smoking and binge drinking; Oncken et al., 2005; Sandford, 2008). Perspectives vary among researchers regarding the utility of increasing skin cancer knowledge as a means to improving sun-related behaviours. Consequently, many studies that explore determinants of sun-related behaviours do not address skin cancer knowledge. Nonetheless, increasing public knowledge remains one of the key steps in the majority of public health campaigns, and it is essential that we understand the utility of information provision as a correlate of health promoting behaviour.

A recent systematic review conducted by the authors of this study found that the relationship between skin cancer knowledge and sun-related behaviours is unclear, and

more research is needed (Day, Wilson, Hutchinson, & Roberts, 2013). There appears to be a positive association between sun protection and skin cancer knowledge, and although there are limited data on the link between knowledge and sun tanning, there is some suggestion that the relationship acts in a counterintuitive direction, with skin cancer knowledge positively related to unhealthy tanning behaviours (Choi et al., 2010; Sjöberg et al., 2004). The reasons for this are unclear. The recent review also revealed that the vast majority of measures of skin cancer knowledge do not have adequate validity or reliability. It is evident that there is need for research to (a) include skin cancer knowledge as a potential determinant of sun-related behaviours and (b) to measure skin cancer knowledge adequately and consistently.

Although skin cancer knowledge is unlikely to account for all the variance in the three sun-related behaviours linked to skin cancer (sun protection, "incidental" sun exposure, and the "deliberative sun exposure" of outdoor tanning), the construct has not been measured adequately in the past. Health research indicates that knowledge predicts intention to behave and is a necessary precursor to the contemplation of behaviour change (Prochaska & Velicer, 1997). We would expect that skin cancer knowledge, should it be measured adequately, would be related to sun-related behaviours. Thus, it is essential that care be taken to measure this relevant construct adequately so as to determine the nature of its relationship to sun-related behaviours.

Study Aims

This study aims to examine the psychometric properties of the Skin Cancer and Sun Knowledge (SCSK) scale—a new, comprehensive measure of skin cancer and sun health knowledge—in young adults of Western background. Due to significant gender differences often found in sun-related behaviour research, we will report the results by gender. It is hypothesized that the SCSK will be a valid and reliable measure of skin

cancer knowledge. Furthermore, it is hypothesized that skin cancer knowledge (as measured by the SCSK) will be associated with frequency of sun-protective behaviour, sun exposure, and outdoor tanning. Last, it is hypothesized that the SCSK will exhibit incremental validity over two existing measures of skin cancer knowledge, that is, the SCSK will explain more variance in frequency of sun-protective behaviour, sun exposure, and outdoor tanning than both the single-item measure of skin cancer knowledge "Does the sun cause skin cancer?" as well as a recently used knowledge measure (Patel et al., 2010).

Method

Participants

Participants were 514 undergraduate students aged between 18 and 26 (M = 20.60, SD = 2.06), recruited from The University of Adelaide. Using a student sample was appropriate as young adults are considered a high-risk group regarding sun-related behaviour practices (Abroms et al., 2003; Cafri et al., 2009; Cottrell et al., 2005). Furthermore, a large proportion of literature in the area uses student populations, making comparisons meaningful (see Day, Wilson, et al., 2013).

Measures

Demographics. Participants were asked to indicate their age, gender, ethnicity, and skin type (as per the Fitzpatrick Classification Scale; Fitzpatrick, 1988). Participants were also asked about their history of skin cancer diagnosis (personal or familial).

Skin cancer knowledge.

Skin Cancer and Sun Knowledge (SCSK) scale. This scale consists of 25 items that assess skin cancer and sun health knowledge. This measure was developed by the authors following a systematic review of the skin cancer knowledge literature and is

based on existing scale items and current best practice research (for further details, see Day, Wilson, et al., 2013). A large proportion of commonly utilized theories of health psychology implicitly recognize the role of knowledge of the disease in perceiving susceptibility and severity, as well as actions that can be taken to reduce risk (e.g., the Health Belief Model, Becker, 1974; the Theory of Reasoned Action, Fishbein, 1975; the Transtheoretical Model, Prochaska & Velicer, 1997; and the Protection Motivation Theory, Rogers, 1975). Based on this theoretical background, the SCSK was developed to encompass five broad domains of knowledge: Sun protection (Items 1, 4-7, 16-22), tanning (Items 2-12), skin cancer risk factors (Items 13-15, 23), prevalence of skin cancer (Items 15, 24), and signs of skin cancer (Item 25). A 25-item, pilot form of the measure was sent to four health professionals with experience in skin cancer research for review and feedback. As a result of this expert review, two items were reworded for clarity. The revised form of the measure was then piloted with 11 postgraduate psychology students, and based on feedback from this stage, a further two items were reworded into the form included in this article. The SCSK scale includes 15 true-false items and 10 multiple-choice items, with a possible score range of 0 to 25; a higher score indicating higher knowledge (see Table 1).

Table 1

Skin cancer and sun health knowledge: Recommended measurement items

Item
1. I should stay out of the sun if my shadow is shorter than my body □ **True** □ False
2. Sunbathing for only a couple of weeks a year (e.g., when on holiday) increases you likelihood of getting skin cancer □ **True** □ False
3. Solariums/sun beds are a safe way to get a tan □ True □ **False**
4. When using sunscreen, you can tan without any negative effects □ True □ **False**
5. Having a tan protects my skin from the sun □ True □ **False**
6. A fake/spray on tan provides me with no protection from the sun □ **True** □ False
7. Keeping your skin tanned at a solarium during the winter protects it from sun damage during the summer □ True □ **False**
8. Gradual tanning eliminates most of the negative effects of lengthy exposure to the sun □ True □ **False**
9. A tan is a sign that the skin is damaged □ **True** □ False
10. UVR (ultraviolet rays) from tanning beds is safer than UVR from the sun □ True □ **False**
11. Tanning is an unsafe way to get the vitamin D your body needs □ **True** □ False
12. A tan is a sign of good health □ True □ **False**

Table continues

Table 1 continued

Item
13. If you are not usually exposed to the sun, being severely sunburned two or three times during your life will probably not increase your chances of skin disease. □ True □ **False**
14. The only way a person can get skin cancer is from too much exposure to the sun □ True □ **False**
15. People with dark skin cannot get skin cancer □ True □ **False**
16. When should sunscreen be applied for best protection? □ Just before you go in the sun □ **15-30 minutes before going in the sun** □ Within 15-30 minutes after going in the sun
17. How often should SPF 30 sunscreen be reapplied? □ Every 30 minutes □ **Every two-three hours, and more often if swimming or sweating** □ Neither of these options
18. When is the sun the strongest? □ 9:00 a.m. – 12:00 p.m. □ **10:00 a.m. – 4:00 p.m.**[a] □ 2:00 p.m. – 5:00 p.m.
19. Damage caused by the skin can be repaired by: □ After-sun lotions (e.g., Aloe Vera lotion) □ Moisturisers □ Both of these options □ **Neither of these options**
20. What type of clothing usually blocks more UV radiation (from the sun)? □ Lighter coloured clothing □ **Darker coloured clothing** □ Both of these options □ Neither of these options
21. What does SPF 30 mean? □ **A sunscreen with a SPF of 30 means a person can stay in the sun 30 times longer without burning than he or she could if not wearing sunscreen** □ A sunscreen with a SPF of 30 provides twice as much protection as a sunscreen with a SPF of 15 □ Both of these options □ Neither of these options
22. Can you get a sunburn… □ At the snow? □ In an outdoor pool or the ocean? □ **Both of these places** □ Neither of these places

Table continues

Table 1 continued

Item
23. Which of the following increases your risk of skin cancer? □ Having had three severe sunburns in your past □ Having a family history of skin cancer □ **Both of these options** □ Neither of these options
24. What is the most common form of skin cancer? □ Melanoma □ **Basal cell carcinoma** □ Squamous cell carcinoma □ None of these options
25. Which of the following could be a sign of skin cancer? □ A sudden or gradual change in a mole's appearance □ A sore that doesn't heal □ **Both of these options** □ Neither of these options

Note. SPF = sun protection factor. Correct answers are printed in boldface type. An "I don't know" option was included for all questions. When this study was conducted, Q22 a) stated "At the snow". This item has been reworded as a result of subsequent feedback.
[a]Different studies and cancer organisations cite different correct responses to this question (Q18). We have chosen the broadest time frame in order to allow for seasonal and atmospheric variation.

Knowledge of Sun Protection Methods (KSPM). The KSPM is a nine-item, true or false measure assessing young adults' knowledge of sun-protective methods (e.g., "If you apply sunscreen, you only need to apply it once a day") (Patel et al., 2010). Higher scores indicate a higher level of knowledge, and total score ranges from 0 to 9. This measure was included to test the incremental validity of the SCSK scale.

Single-item measure. A single, true-false item "Does sun exposure cause skin cancer?" was also included to establish incremental validity of the SCSK. This item has been utilized a number of times in the literature as the sole measure of skin cancer knowledge.

Tanning behaviour. Participants were presented with the following definition of outdoor tanning: "Exposing your body to direct sunlight outside for the purpose of tanning your skin." Participants were then asked to rate on a scale from 0 to 4 the frequency with which they engaged in outdoor tanning behaviour over the past few

years (*never, once or twice, 3-5 times a year* [i.e. *once every month or two on average*], *7-12 times a year* [i.e. *almost every month on average*], *more than once a month*). As 57.7% of males (*n* = 112) reported never having deliberately outdoor tanned in this period, we recoded their responses into dichotomous yes/no format.

Sun exposure. This is a 2-item measure assessing participants' sun exposure (Sun Habits; Glanz et al., 2008) during summer. Participants indicated their average frequency of hours spent outside per day between the hours of 10 a.m. and 4 p.m. on weekdays and weekends during the summer on a 7-point Likert-type scale. These two scores are combined and weighted (by 5 for weekdays and by 2 for weekends, then divided by 7) to enable an average daily sun exposure score ranging from one to seven with higher scores reflecting greater levels of sun exposure.

Sun Protection Behaviour Scale (SPBS). This is a nine-item measure assessing the use of sun-protective behaviours (Weinstock, Rossi, Redding, & Maddock, 2002; Weinstock, Rossi, Redding, Maddock, & Cottrill, 2000) when in the sun for more than 15 minutes (e.g., frequency of wearing hats, time spent in the shade). Participants indicated the frequency with which they practiced sun protection on a 5-point Likert-type scale (*never, rarely, sometimes, often, and always*) with higher scores reflecting more frequent use of sun-protective behaviours (range was nine to 45). Cronbach's alpha for the SPBS has been reported at .83 in a US study of beachgoers aged 12 to 65 (*N* = 2,324; Weinstock et al., 2000).

Procedure

On receiving institutional ethics approval, the study was advertised online on the university's Research Central website to first-year Psychology students and on the university's intranet home page to all undergraduate students (approximately 37,000 students have access to this page). Due to confidentiality constraints, we were unable to

determine an accurate number of eligible first-year psychology students or undergraduate intranet users to calculate response rates. Sixty-four first-year psychology participants agreed to complete a partial retest of the survey (the SCSK scale) at a later date (when electing to participate, participants were unaware which section would be retested), and of these, 52 participated in retesting 2 weeks after the initial survey (retest response rate of 81%). Psychology participants received course credit in exchange for their participation; all other undergraduate student participants went into the draw for one of four $50 shopping vouchers.

Table 2

Descriptive statistics for the study measures among participants (N = 514)

Variable	Items	Females (*n* = 320)			Males (*n* = 194)		
		Mean (SD)	Range	α	Mean (SD)	Range	α
SPB	9	29.84 (5.56)	16 – 43	.76	27.68 (5.71)	13 – 40	.78
Sun Exposure	2	2.99 (1.33)	1 – 7	.76	2.82 (1.33)	1 – 7	.82
Outdoor Tanning	1	1.31 (1.24)	0 – 4	- [b]	-	-	-
KSPM	9	8.68 (0.65)	6 – 9	.31[a]	8.60 (0.70)	5 – 9	.30[a]
SCSK	25	18.35 (3.12)	8 – 25	.70[a]	18.06 (3.14)	8 – 24	.67[a]

Note. α = Cronbach's alpha for the present study; SPB = Sun-Protective Behaviour; KSPM = Knowledge of Sun Protection Methods; SCSK = Skin Cancer and Sun Knowledge.
[a]In the case of both the KSPM and SCSK scales, Kuder Richardson-20 is reported rather than Cronbach's α because the items are scored dichotomously. [b]α could not be calculated for the Outdoor Tanning variable as it is a single item measure

Statistical Analysis

IBM SPSS Statistics 20.0 was used for all analyses. Regression analyses included skin type as a predictor of sun-related behaviours.

SCSK analysis. The SCSK measure was subjected to exploratory factor analysis, using a principal axis extraction method (Fabrigar, Wegner, MacCallum, &

Strahan, 1999). Based on the scree plot and Kaiser rule (eigenvalues >1) a single factor solution was retained, and no items were dropped. To evaluate the internal reliability of the SCSK scale, Kuder-Richardson-20 statistics were calculated. Test–retest reliability was assessed at 2 weeks in the subsample described above using Pearson's product moment correlation.

Predictive analysis. Preliminary analyses were conducted to ensure no violation of the assumptions of normality, linearity, homoscedasticity, and multicollinearity. One variable (KSPM) was transformed due to kurtosis; however, the subsequent data analysis revealed no significant difference in the results due to transformation, so the original variable was used in the analyses presented. Personal history of skin cancer was not included in the analyses as only $n = 2$ participants reported an experience. Sequential multiple regression analyses were performed to determine (a) whether the KSPM measure predicted each of the three sun-related behaviours (controlling for relevant variables in the first step) and (b) whether the SCSK scale explains incremental variance in sun-related behaviour as compared to the KSPM measure alone. All procedures followed guidelines specified by Tabachnick and Fidell (2007).

Results

Demographic Information

Participants reported their ethnic background as follows: $n = 332$ (64.6%) Australian, $n = 174$ (33.8%) European, and $n = 8$ (1.6%) American. Two participants (0.6%) reported a personal history of skin cancer, with $n = 182$ (35.4%) reporting a family history. Participants reported their Fitzpatrick Skin Type as follows: $n = 127$ (24.7%) Skin Type I (fairest), $n = 126$ (24.5%) Skin Type II, $n = 127$ (24.7%) Skin Type III, $n = 105$ (20.4%) Skin Type IV, $n = 27$ (5.3%) Skin Type V, and $n = 2$ (0.4%) Skin Type VI (darkest).

Psychometric Analysis of the SCSK Scale

Internal reliability for the SCSK scale was acceptable (KR-20 = .69), and 2-week test–retest reliability was high, $r = .83$, $n = 52$ ($p < .001$). Both face and factorial validity were evidenced (see Method for details). Incremental validity was intended to be tested against the single true–false item "Does sun exposure cause skin cancer?" across the three sun-related behaviours; however, the single knowledge item was not correlated with any of the three sun-related outcomes, making formal regression testing unnecessary. The SCSK demonstrated incremental validity over the KSPM measure in predicting outdoor tanning, sun exposure, and sun protection (see section *Knowledge as a Predictor of Sun-Related Behaviours* below).

Predictive Analysis

Bivariate correlations among all variables of interest are presented in Table 3.

Females. SCSK scores, $F(4, 315) = 3.31$, $p = .01$, sun-protective behaviour, $F(4, 315) = 5.34$, $p < .001$, average sun exposure, $F(4, 315) = 6.73$, $p < .001$, and outdoor tanning, $F(4, 315) = 21.32$, $p < .001$, differed significantly as a function of reported skin type. Knowledge measured with the KPSM and age did not differ significantly between skin type groups.

On average, participants who reported a family history of skin cancer had significantly higher SCSK knowledge ($M = 18.81$, $SD = 2.77$) than those with no reported family history ($M = 18.07$, $SD = 3.29$), $t(287) = 2.16$, $p = .03$, Cohen's $d = .26$. Those participants who reported a family history of skin cancer reported significantly lower levels of outdoor "deliberative" tanning ($M = 1.06$, $SD = 1.07$) than those with no reported family history ($M = 1.46$, $SD = 1.31$), $t(292) = -2.98$, $p = .003$, Cohen's $d = .34$.

Males. Reported age, familial history of skin cancer, and knowledge measured with the KSPM and SCSK did not differ significantly as a function of reported outdoor tanning. As neither of the knowledge measures were associated with sun exposure, sun protection, or outdoor tanning, multiple regression analyses were not performed with this group.

Table 3

Intercorrelations between demographic, independent, and dependent variables for females (n = 320) and males (n = 194).

Variable	1	2	3	4	5	6
Predictor variables						
1. Age	–	.01	.06	.12	-.15*	–
2. KSPM	.01	–	.20**	.02	.07	–
3. SCSK	.18**	.30**	–	.03	-.01	–
Outcome variables						
4. SBP	.15**	.12*	.27**	–	-.04	–
5. Sun Exposure	-.19*	-.12	-.25**	-.21**	–	–
6. Outdoor Tanning	-.11	-.15**	-.21**	-.36**	.35**	–

Note. Intercorrelations for male participants (n = 194) are presented above the diagonal, and below the diagonal for female participants (n = 320). KSPM = Knowledge of Sun Protection Methods; SCSK = Skin Cancer and Sun Knowledge; SPB = Sun-Protective Behaviour.
* $p < .05$, ** $p < .01$.

Knowledge as a Predictor of Sun-Related Behaviours (Females)

Sun-protective behaviour. The total variance explained was 12.3%, $F(4, 315) = 11.03$, $p < .001$. The SCSK scale explained an additional 3.6% of the variance in sun-protective behaviour, after controlling for age, skin type, and the KSPM measure, $F_{change}(1, 315) = 13.00$, $p < .001$. In the final model, only skin type and the SCSK scale were statistically significant.

Sun exposure. The total variance explained was 13.8%, $F(4, 315) = 12.58$, $p < .001$. The SCSK scale accounted for an additional 2.4% of the variance in sun exposure,

after controlling for age, skin type, and the KSPM measure, F_{change} (1, 315) = 8.93, p = .003. Age, skin type, and the SCSK scale were statistically significant in the final model.

Outdoor tanning. The total variance explained was 23.2%, F(4, 315) = 23.84, p < .001. The SCSK scale explained an additional 1.1% of the variance in outdoor tanning, after controlling for skin type, family history of skin cancer, and the KSPM measure, F_{change} (1, 315) = 4.57, p =.03. Skin type and the SCSK scale were statistically significant in the final model.

Raw and standardized regression coefficients of each step of these analyses are presented in Table 4.

Table 4

Summary of sequential multiple regression equations predicting frequency of outdoor tanning, average sun exposure, and sun-protective behaviour with demographic variables and skin cancer knowledge measures for females (n = 320).

	Sun-Protective Behaviour			*Average sun exposure*			*Frequency of outdoor tanning*		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Step 1									
Age	0.39	0.15	.15**	-0.12	0.03	-.18**	-	-	-
FHx	-	-	-	-	-	-	-0.06	0.27	.07
Skin Type	-1.07	0.25	-.23***	0.29	0.06	.26***	0.45	0.05	.44***
Step 2									
Age	0.39	0.15	.14**	-0.12	0.03	-.18**	-	-	-
FHx	-	-	-	-	-	-	0.18	0.13	.07
Skin Type	-1.04	0.25	-.22***	0.28	0.06	.25***	0.44	0.05	.43***
KSPM	0.88	0.46	.10	-0.20	0.11	-.10	-0.23	0.10	-.12*
Step 3									
Age	0.29	0.15	.11*	-0.10	0.03	-.15**	-	-	-
FHx	-	-	-	-	-	-	0.16	0.13	.06
Skin Type	-0.91	0.25	-.20***	0.26	0.06	.23***	0.43	0.05	.41***
KSPM	0.38	0.48	.04	-0.10	0.11	-.05	-0.17	0.10	-.09
SCSK	0.37	0.10	.20***	-0.07	0.02	-.17**	-0.04	0.02	-.11*

Note. FHx = Family history of skin cancer; KSPM = Knowledge of Sun-Protective Methods; SCSK = Skin Cancer and Sun Knowledge. Sun-Protective Behaviour: $R^2 = .08$ ($p < .001$) for Step 1, $\Delta R^2 = .01$ ($p = .06$) for Step 2, $\Delta R^2 = .04$ ($p < .001$) for Step 3. Average Sun Exposure: $R^2 = .10$ ($p < .001$) for Step 1, $\Delta R^2 = .01$ ($p = .07$) for Step 2, $\Delta R^2 = .02$ ($p = .003$) for Step 3. Frequency of Outdoor Tanning: $R^2 = .21$ ($p < .001$) for Step 1, $\Delta R^2 = .02$ ($p = .02$) for Step 2, $\Delta R^2 = .01$ ($p = .03$) for Step 3. *p < .05, **p < .01, ***p < .001.

Discussion

The present study examined the psychometric properties of a new, comprehensive measure of skin cancer and sun health knowledge in a sample of young adults of Western background. As hypothesized, in females skin cancer knowledge (as measured by SCSK) was associated with all three sun-related behaviours (i.e. outdoor tanning, sun exposure, and sun-protective behaviour). Conversely, skin cancer knowledge was not associated with sun-related behaviours in the male sample.

Psychometric Properties of the SCSK Scale

The 25-item SCSK scale was found to have adequate internal reliability and good 2-week test–retest reliability. Furthermore, face and content validity were established through a rigorous development process outlined above. Due to the centrality of skin cancer knowledge in sun health promotion campaigns and interventions, it is essential that this construct is measured accurately and its relationship with sun-related behaviours be reported. The SCSK scale was found to have much higher internal validity than the KSPM measure (KR-20 = .69 vs. KR-20 = .30). Furthermore, the predictive power of the SCSK was stronger than the KSPM in the female group, correlating with all three sun-related behaviours whereas the KSPM was only associated, minimally, with two (sun-protective behaviour and outdoor tanning).

The single-item measure of skin cancer knowledge “Does sun exposure cause skin cancer?” was not associated with any of the sun-related behavioural outcomes. Hence, incremental validity was established for the SCSK across all three sun-related behaviour outcomes in the female samples. These findings confirm the limitation associated with the use of single-item measures of skin cancer knowledge, the need for skin cancer knowledge to be measured comprehensively, and suggests the utility of the

newly developed SCSK scale.

Knowledge as a Predictor of Sun-Related Behaviours

While the SCSK scale was found to be a reliable and valid measure of skin cancer knowledge in young adult males, knowledge (measured by the single-item measure, the KSPM, and the SCSK) was not associated with any of the sun-related behaviour outcomes in this group. This suggests that knowledge is not a relevant factor in the sun-related choices of Australian young adult males. Previous studies in the area have almost all failed to report the relationship between skin cancer knowledge and sun-related behaviours by gender, and it may be that the nonassociation in those male groups was inadvertently "hidden" by the often high proportion of females in the sample (see data in Day, Wilson, et al., 2013). In a United States sample of male farmers, sun-protective knowledge was associated with behaviour (Parrott & Lemieux, 2003); however, this contrasting result may be due to age of participants or the additional occupational UV risk they faced. Our male sample size was fairly modest (n = 194), and future research focusing on males may provide different results. The young males in our sample reported suboptimal levels of sun-protective behaviour, and 42.3% reported deliberate outdoor tanning behaviour in the past few years. Young adult males spend a lot of time participating in outdoor activities, and research suggests they engage in lower levels of sun-protection than their female counterparts (D. B. Buller et al., 2011; Wickenheiser et al., 2013). Given our findings, we recommend that future research explore other factors relevant to sun-related behaviours, such as appearance motivations for tanning and social norms around sun protection, in this at-risk group.

As hypothesized, our measure of skin cancer knowledge (SCSK) was associated with all three sun-related behaviours in the female sample. Sun-protective

behaviour was positively associated with skin cancer knowledge, with a moderate effect. This result is consistent with results from a recent systematic review (Day, Wilson, et al., 2013). The effect found in this study was of similar size to those found in similar studies (Castle et al., 1999; de Vries et al., 2005; Martin, 1995). Higher levels of skin cancer knowledge were associated with lower levels of sun exposure and outdoor tanning. The strength of both these effects in the present study was moderate. Keesling and Friedman (1987) found a similar relationship for sun exposure in adults of both genders; however, a nonsignificant relationship was reported in a study including participants of mixed gender and unknown age (Berwick, Fine, & Bolognia, 1992). The outdoor tanning finding contrasts with a number of studies that found no significant relationship in a sample of similar age; however, those studies included both males and females (Felts et al., 2010; Keesling & Friedman, 1987; Vail-Smith & Felts, 1993). The comparisons of the findings in this study to previous works need to be considered in light of the measurement differences in skin cancer knowledge. We recommend that future research utilize the SCSK with other samples to establish the generality of the reported relationship between knowledge and behaviour.

Previous research has found a number of other predictors of sun-related behaviours. These include appearance motivation and sociocultural influence, perceived risk, and self-efficacy by (see reviews by Holman & Watson, 2013; Kasparian et al., 2009; D. Reynolds, 2007). We recommend that future research measures skin cancer and sun health knowledge in addition to other predictors in order have a more comprehensive understanding of the influence of skin cancer knowledge on sun-related behaviours. It is possible, for example, that skin cancer knowledge moderates the relationship between other predictors, such as self-efficacy, and sun-related behaviour.

Limitations

The findings of this study are subject to some limitations. Generalizability is restricted to university students; however, other studies reporting similar information have also used university student samples, which makes research comparisons meaningful (e.g., Cafri et al., 2008; Hillhouse, Turrisi, Stapleton, & Robinson, 2010; Stapleton, Turrisi, Hillhouse, Robinson, & Abar, 2010). As we were unable to determine an accurate response rate (see Method), sampling bias cannot be ruled out. The study was predominantly focused on testing a new measure of skin cancer and sun health knowledge, and model testing was limited to the inclusion of history of skin cancer and skin type. There are a number of other factors that have been found to be associated with sun-related behaviours, including appearance motivation and unrealistic optimism. Including these variables in multiple regression analyses is likely to give a more complete picture of the influence of skin cancer knowledge on sun-related behaviours.

Last, the appeal of tanned skin is unique to Western cultures, particularly Caucasians, and in a number of Asian cultures pale skin is commonly desired (Hunt et al., 2012). Culture, therefore, would affect sun-related behaviours, and possibly knowledge. Based on ethnicity data collected, it appears unlikely that a significant portion of our sample would identify as non-Western; however, the lack of an explicit measure of acculturation is a limitation of this work.

Conclusion

Despite the centrality of skin cancer knowledge in prevention campaigns and interventions, many different approaches to its measurement are reported in the literature. There are a number of studies that highlight the importance of continuing to include skin cancer knowledge as a predictor of sun-related behaviour and the need for

a demonstrably valid and reliable measure (see review by Day, Wilson, et al., 2013). The current results indicate that the 25-item SCSK scale has demonstrated reliability and validity and is associated with sun exposure, outdoor tanning, and sun protection in a group of Western women. We recommend that the SCSK be utilized in future skin cancer and sun tanning research, across a range of participant groups. In the female sample, skin cancer knowledge, skin type, and demographic variables accounted for a fairly modest amount of variance in sun-related behaviours, and in the male sample skin cancer knowledge was not associated with sun-related behaviours. Therefore, continued exploration of other factors is important.

3.3. Final Remarks

The items included in the SCSK came from a variety of sources; a number of the items had been used in previous measures of skin cancer knowledge, and remaining items were developed based on information provided by the World Health Organization (2011). The SCSK was developed with the aim of including items that assess procedural skin cancer knowledge, based on recommendations that this form of knowledge is likely to give more useful insight in terms of related behaviour than awareness-type knowledge (Schneider & Krämer, 2010). For example, items assessing knowledge of the meaning of SPF, the (lack of) protection provided by a fake tan, and signs of a skin cancer, allow a deeper understanding of the individual's knowledge of tangible ways to reduce their risk of skin cancer. In determining the format of included questions, a combination of multiple choice and true-false items were chosen based on suggestions by Haladyna (2004). Once the scale was developed, its psychometric properties and relationship to sun-related behaviours were measured in young adult students, aged 18-26, enrolled at the University of Adelaide.

Due to diversity in sun-related behaviours of those from Western versus non-Western backgrounds, the sample was split based on this demographic. The study reported within this chapter presented the results from a sample of 514 young adults who reported Western heritage.[1] The results indicated that the SCSK was a valid and reliable measure of skin cancer knowledge in young adults of Western ethnic background. Further, sun-protective behaviour, incidental sun exposure, and outdoor tanning behaviour were associated with skin cancer knowledge in the female sample. This suggests that skin cancer knowledge is relevant to sun-related behaviour.

[1] Of those participants who reported Asian heritage (n = 140), data assessing the relationship between sun-related behaviours and the SCSK measure of skin cancer knowledge are reported in Chapter 5. The n = 10 participants who were of African and/or Middle Eastern descent were excluded from the analyses.

However, effect sizes were small-to-moderate, reiterating the need to also explore other factors relevant to sun-related behaviours. Research indicates that appearance factors are fundamental motivators of tanning behaviour (e.g., Cafri et al., 2009; Hillhouse et al., 2000; Yoo & Kim, 2012). Furthermore, the role of sociocultural norms and appearance ideals have been shown to be strong predictors of a range of appearance motivated behaviours, including tanning behaviour (Cafri et al., 2009; Hoerster et al., 2007; Thompson et al., 1999b; van den Berg et al., 2002). Therefore, the final three papers presented in this thesis set out to explore the role of sociocultural norms and tanning ideals in explaining sun-related behaviour, across young adults of Western and non-Western background.

CHAPTER 4. PAPER THREE

4.1. Preamble

The results reported in Chapter 2 suggested that we would need to go beyond skin cancer knowledge to understand sun-related behaviours of young Western adults. As discussed in Chapter 1, an adapted version of the Tripartite Influence Model of disordered eating has recently been applied to solarium use in an effort to explain the behaviour (Cafri et al., 2009). The adapted model tested by Cafri and colleagues (2009) examined the potential for social influence and appearance-based motivations to impact upon outdoor tanning and solarium use, and found that appearance-based motivations for tanning mediated the relationship between sociocultural norms and tanning behaviour. Societal demands including peer pressure and media exposure may prevent engagement in healthy sun-related behaviours even in those with high knowledge (Heckman et al., 2012). In order to test this proposition, items measuring sociocultural norms and skin tone perceptions about ideal and actual skin tone were included in the same questionnaire that was used to test the SCSK (results described in Chapter 3). The paper reported in this chapter focuses on predictors of tanning behaviours (outdoor tanning and fake tanning) that are based on the theoretical pathways described by the Tripartite Influence Model.

A key component of the Tripartite Influence Model is the meditational pathway of internalisation of an ideal (tanned skin is attractive and desirable) on the relationship between sociocultural norm endorsement and behaviour (tanning) – see Figure 1. The study reported in this chapter seeks to test whether internalisation of a tanned ideal mediates the relationship between sociocultural normative influences on perceptions of attractiveness and subsequent tanning behaviour.

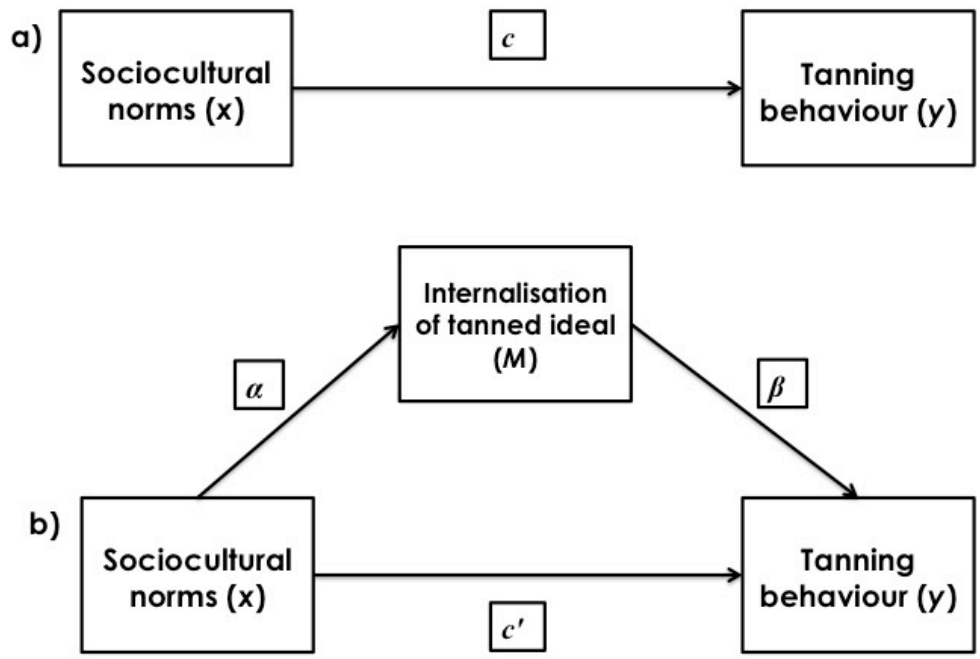


Figure 1. Proposed mediation pathway of Tripartite Influence Model. (**a**) Direct effect (pathway *c*), not including mediator. (**b**) Illustrating adjusted direct (pathway *c'*) and indirect effects (pathways *α* and *β*) through mediation by internalisation of tanned ideal.

Internalisation is the process of adopting societal appearance ideals as a personal goal and standard (Jones, 2004). Research has yet to directly measure internalisation of a tanned ideal. Frequently the internalisation subscales of the Sociocultural Attitudes Towards Appearance Questionnaire (SATAQ), a scale now in it's 3rd revision, are used to measure internalisation in the thinness domain (Thompson, van den Berg, Roehrig, Guarda, & Heinberg, 2004). These subscales refer broadly to wanting one's own body "to look like" those of athletes, and those seen on television and in magazines. However, these measures have not been adopted by all researchers, and measurement issues of internalisation have been debated (see Karazsia & Crowther, 2009; Thompson et al., 2004). Furthermore, the SATAQ does not measure attitudes to tanning directly.

Measuring appearance factors that are not specific to tanning in attempts to explain sun-related behaviours may confound the results (Cafri et al., 2009). Thus, the following study aims to measure internalisation of a tanned ideal directly, rather than using pre-existing scales that referred to broader aspects of appearance.

Rating scales of current and desired weight or figure are frequently utilised in the body image literature to measure appearance ideals (e.g., Fingeret, Gleaves, & Pearson, 2004). Such scales portray a progressive range of images (ranging from very thin to very overweight) and have participants identify images that correspond to their perceptions of their actual and their ideal body size. The discrepancy between the reported *ideal* figure and reported *self* figure is often calculated as a measure of dissatisfaction. Prichard, Kneebone, Hutchinson, and Wilson (2013) developed a figure rating scale of skin tone dissatisfaction, an extended version of which was used in this thesis (see Appendix A). The scale presents a range of female and male figures, featuring skin tone ranging from fair to tanned, and participants are asked to identify the figure with the skin tone that they felt best represents their (perceived) skin tone, and the figure that best represents their ideal skin. Although there is widely demonstrated support for this conceptualisation of dissatisfaction in body image research (e.g., Gleaves et al., 2000; Stevens & Tiggemann, 1998; Williamson, Gleaves, Watkins, & Schlundt, 1993), there are criticisms of the use of discrepancy scores based on figural rating scales (Cafri, van den Berg, & Brannick, 2010; Gardner, Friedman, & Jackson, 1998).

One of the arguments against using the discrepancy score is the tenuous underlying assumption that collapsing the two distinct cognitive appraisals of self and ideal ratings is a valid measure of a third and distinct construct - body image dissatisfaction (Cafri et al., 2010). A further criticism is that the reliability of the score

decreases as the covariance between the self and ideal measures increases (Cafri et al., 2010). Our samples had moderate-to-large correlations between self and ideal ratings, indicating noteworthy covariance (see Table 1), indicating that the reliability of utilising a discrepancy score may be low. Research has found ideal body shape to not differ significantly from reported most attractive body shape (Tiggemann & Dyer, 1995), suggesting that ideals serve as a proxy for perceived attractiveness, and, hence, internalisation of societal ideals. Furthermore, the ideal rating score is a better predictor of outcomes than the difference score (Cafri et al., 2010). Therefore, it may not be necessary to calculate a dissatisfaction or discrepancy score. The test-retest data presented in Table 1 indicates greater reliability of the ideal rating score compared to the discrepancy score across genders. Thus, in this research we followed the recommendation of Cafri and colleagues (2010) and used the ideal rating score as an independent measure of internalisation of a tanned ideal.

Table 1

Correlations Showing the Relationships Between Ratings of Self and Ideal Skin Tone, and Discrepancy Scores

	Western Participants	
	Female	Male
Correlation between Self and Ideal$_{T1}$	.57***	.64***
Correlation between Self and Ideal$_{T2}$	.51***	.68***
Test-Retest: Ideal Skin Tone	.78***	.57***
Test-Retest: Discrepancy Score	.71***	.53***

Note. n/a = not applicable; T1 = time one data collection; T2 = time two data collection. Female participants ($n = 320_{T1}$, $n = 168_{T2}$), male participants ($n = 194_{T1}$, $n = 78_{T2}$)
*** $p < .001$.

At the time of developing the questionnaire used in the study reported in Chapter 3, we were interested in participants' previous tanning behaviour over the past few years, to understand whether or not they ever, infrequently, or regularly engaged in

different forms of tanning behaviour. This information was sufficient for evaluating a measure of skin cancer knowledge (Chapter 2), however, it was later recognised that this measurement was not ideal for the objectives of study three; tanning behaviour was a key outcome and the items as they currently stood would impede meaningful comparisons to other literature, which typically ask participants' their behaviour over the past six months to a year, in open-ended format. In considering options, it was determined that re-engaging with the original participants in order to collect additional information about their tanning behaviour would be beneficial. This would provide a better understanding of participants' recent tanning behaviour, and would allow for longitudinal mediation analysis evaluating the effect of sociocultural norm endorsement and skin tone perceptions on subsequent tanning behaviour. Further, due to the large original sample of Western young adults (N = 514), we believed that even with the expectation of an incomplete response rate, worthwhile analyses would still be viable. A total of N = 246 participants responded at follow-up and were included in this study.

Understanding young adults' tanning behaviour: The role of ideal skin tone and sociocultural norms

- MANUSCRIPT UNDER REVIEW -

Ashley Day, University of Adelaide

Carlene Wilson, Flinders University and Cancer Council South Australia

Amanda Hutchinson, Flinders University and Cancer Council South Australia

Rachel Roberts, University of Adelaide

4.2. Statement of Authorship

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2014). *Understanding young adults' tanning behaviour: The role of ideal skin tone and sociocultural norms.* Manuscript submitted for publication.

Submitted to International Journal of Behavioral Medicine, May 27, 2014

Ashley Day (*Candidate)*

I was responsible for primary authorship of this paper, and collaborated with co-authors on its conceptualisation and design. I conducted the statistical analyses, and took the lead role in interpreting the results and writing and revising the manuscript, again with input and advice from co-authors. I served as corresponding author and was responsible for manuscript submission, revisions, and responses to journal reviews.

Signed: Ashley Day _____ Date: _____

Prof Carlene Wilson, Dr Amanda Hutchinson, and Dr Rachel Roberts (*Co-authors)*

We were the supervisors of the research programme that led to this publication and there was ongoing collaboration between Ashley Day and us in refining the direction of the research. The realisation of the idea, collection of data, and analysis of data were the work of Ashley Day. Ashley Day was responsible for writing this paper; our role was to comment on drafts, make suggestions on the methodology and presentation of material in the paper, and to provide editorial input. We also provided advice on responding to comments by the journal reviewers and editor. We hereby give our permission for this paper to be incorporated in Ashley Day's submission for the degree of Doctor of Philosophy from the University of Adelaide.

Signed: Carlene Wilson _____ Date: _____

Signed: Amanda Hutchinson _____ Date: _____

Signed: Rachel Roberts _____ Date: _____

Abstract

Decreasing intentional tanning behaviour is a critical area of skin cancer prevention. Research evidence exists that tanning behaviour is significantly influenced by appearance motivations. The Tripartite Influence Model (1999a) posits that internalisation of ideals about body image mediates the relationship between sociocultural norms and appearance-related behaviour, and has been demonstrated primarily in the domain of weight. This study aimed to assess whether ideal skin tone (internalisation of a tanned ideal) mediated endorsement of sociocultural norms about attractiveness of tanned skin and 12-month tanning behaviour. Young adult participants (N = 514) from the University of Adelaide were surveyed regarding their ideal skin tone and sociocultural norm endorsement. At 12-month follow-up, 246 participants reported their tanning behaviour over the previous year. Results indicated that internalisation of a tanned ideal mediated the relationship between sociocultural norms and tanning behaviour for females but not males. Young adult males also desired a tanned appearance and peer sociocultural perceptions were associated with male tanning behaviour. This research lends support to the proposition that the Tripartite Influence Model has explanatory power for tanning behaviour. We recommend that future research involving young adults incorporate skin tone and tanning as a component of body image, alongside body shape and eating behaviours.

Skin cancer continues to be both one of the most preventable and the most commonly diagnosed cancers in many Western countries, for example the United States and Australia (American Cancer Society, 2012; Cancer Council Australia, 2014a). Australian Institute of Health and Welfare (2011a) data indicate that the pattern of participation in behaviours that impact on skin cancer risk may vary between sexes. Young adult Caucasian females are widely reported to represent a high-risk group due to skin-type and sun exposure behaviour, and are often the focus of sun-behaviour research (Cafri et al., 2009). Males are less often included in such research, despite the fact that adolescent and young adult males have lower skin cancer knowledge than females, are less likely to engage in sun-protective behaviour, and share a similar desire for a tan and a dislike of pale skin compared to women (Abroms et al., 2003; Cottrell et al., 2005; Paul et al., 2008).

There is a growing body of literature that indicates appearance motivation is a key driver of sun-related behaviour in Caucasians (Cafri et al., 2009; Heckman et al., 2009; Hillhouse et al., 2000). A tanned appearance is generally desired in Western society due to the pervasive belief that a tan enhances personal physical attractiveness (e.g., Börner et al., 2009; Murray & Turner, 2004). Improving physical appearance has been proposed as the primary motivation for tanning (Abar et al., 2010; Hillhouse et al., 2000; Jackson & Aiken, 2000), and studies have found a significant relationship between endorsement of a tanned appearance as attractive and intentional tanning behaviour with medium to large effect sizes (e.g, Cafri et al., 2006; Heckman et al., 2009; Jackson & Aiken, 2000). It is essential to explore factors that influence this "tanned ideal" in order to reduce tanning behaviour and the associated risk for skin cancer.

Although studies have primarily utilised theories of health behaviour as

frameworks for understanding tanning behaviour, recent research has begun to explore determinants of sun-related (tanning, incidental sun exposure, and sun protection) behaviours in the context of body image theory, due to the significant appearance-based component (Cafri et al., 2009; Heckman et al., 2009; Hillhouse et al., 2000). The Tripartite Influence Model (Thompson et al., 1999a) posits that internalisation of societal (family, peer, and media) ideals of appearance mediates the relationship between sociocultural normative influence and behaviour. For example, it has been found that perceived family preference for a tanned appearance increases tanning intentions (Cafri et al., 2008), perceived friends' behaviour predicts outdoor tanning (Wichstrøm, 1994), and exposure to magazine images of tanned individuals predicts beliefs and attitudes regarding tanning (Cho et al., 2010). Further, provision of injunctive and descriptive norm information regarding sun protection has been found to improve subsequent protective behaviour compared to controls in a group of young adult females (Mahler et al., 2008). Research has also demonstrated that sociocultural influences (i.e. family, peer, and media norms) are internalised and subsequently result in pressure to have a socially and culturally valued body shape in both genders (e.g., Strahan et al., 2008; Tylka, 2011). This highlights the importance of investigating the role of sociocultural influences on peoples' perceptions of socially and culturally desirable skin tone and subsequent sun-related behaviour in both female and male samples.

This study seeks to test whether internalisation of a tanned ideal mediates the relationship between social normative influences on perceptions of attractiveness and subsequent tanning behaviour in both young adult females and males. This study seeks to build on the preliminary work of Cafri and colleagues (2009) by exploring sociocultural normative influences in a male sample, as well as measuring both outdoor

tanning and fake tanning behaviour as outcomes. Further, it is the first study to include both injunctive and descriptive norms in testing the Tripartite Influence Model in tanning behaviour. This allows for clearer understanding of the relevance of specific normative influences relative to one another.

Method

Participants

This study was part of a longitudinal research project being conducted at the University of Adelaide. Eligible participants were students aged 18 to 26 years (M_{age} = 20.76, SD = 2.06, reporting an ethnic background from predominantly White or Caucasian nations (Australian, European, North American). Participants were recruited from the University of Adelaide. At Time One (T1) there were N = 514 participants. At 12-month follow-up (Time Two; T2), 43 of the original participants (8%) were unable to be contacted due to inactive/incorrect e-mail addresses. Overall, 52% of the contactable participants (N = 246; 32% male, 68% female) participated at both time-points and were included in this study.

Measures

Participants were asked to indicate their age, gender, family history of skin cancer, and ethnicity.

Internalisation of a tanned ideal. The Ideal Skin Tone Scale is an extended subscale of the Skin Tone Rating Scale, developed by (developed by Prichard et al., 2013). The current version presents female and male figures, featuring skin tone from very pale to very tanned. Participants identified the figure that they felt best represented their ideal skin tone, ranging from one (*lightest skin tone figure*) to 12 (*darkest skin tone figure*), with a higher value indicated higher endorsement of a tanned ideal. Research has found ideal body shape to not differ significantly from reported most attractive

body shape (Tiggemann & Dyer, 1995), suggesting that ideals serve as a proxy for perceived attractiveness, and hence, internalisation of societal ideals. Twelve month test-retest reliability of this measure was high, r =.72, p < .001, n = 246.

Sociocultural norms. Nine items measured participants' sociocultural perceptions of tanning. For each of the three domains (i.e. family, peer, media), participants' injunctive norms were measured with questions like, "My friends like the way I look when I'm tanned" and "The media portrays images which make looking tanned an attractive ideal". Participants were also asked questions regarding descriptive norms (one question regarding fake tanning, the other regarding UV forms of tanning) for each of the three domains for example "My family use fake/chemical tanning products to look tanned" and "My friends tan in the sun/use solariums to look tanned". Participants indicated their agreement on a 5-point Likert scale (*never, rarely, sometimes, often, and always*). These items were based on items from the Physical Appearance Reasons to Tan Scale (Cafri et al., 2009) and adapted in order to clearly assess injunctive and descriptive norms regarding family, peer, and media influences.

Self-reported tanning behaviour. Participants were presented with definitions of outdoor tanning, solarium use, and fake tanning (referred to in the questionnaire as "sunless tanning products or spray tans") and asked how many times they had engaged in the aforementioned behaviours over the previous 12-month period (open-ended). Analysis of fake tanning was limited to females because only three males (3.9%) reported use. Analysis of solarium users was not possible because zero males and two females (1.2%) reported use.

Skin cancer and sun knowledge. The Skin Cancer and Sun Knowledge scale consists of 25-items (15 true-false and 10 multiple-choice) that assess skin cancer and sun health knowledge, for example "Solariums/sun beds are a safe way to get a tan"

(true-false) and "What does SPF mean?" (multiple-choice; Day, Wilson, Roberts, & Hutchinson, 2014). Scores range from 0-25, with higher scores indicating higher knowledge. In a sample of Western young adults, two week test-retest reliability was r = .83 (Day, Wilson, Roberts, et al., 2014).

Procedure

Upon receiving institutional ethics approval, the study was advertised online on the University of Adelaide's intranet website. Participants were contacted via e-mail to complete the follow-up questionnaire, with a link provided. Participants completed both the T1 and T2 questionnaires online. Demographic information, ideal skin tone, sociocultural norms, and skin cancer knowledge were measured at T1, with tanning behaviour measured at T2. Participation was voluntary and all information provided was confidential.

Statistical Analysis

IBM SPSS Statistics 20.0 was used for all analyses. A series of independent sample *t*-tests were conducted to examine potential gender differences in sociocultural influences and tanning behaviours. Mediating effects were tested using regression analysis and following the four steps outlined by Baron and Kenny (1986). The significance of the mediated effect was tested using the product of coefficients method and the Sobel test (Mackinnon & Dwyer, 1993; Sobel, 1982).

Results

Those females who did not participate at T2 reported a significantly darker ideal skin tone (M = 4.20, SD = 1.73) than those who completed surveys at both time points (M = 3.64, SD = 1.69), $t(318) = 1.95$, $p < .05$, d = .33. Noncompleters at T2 also reported higher endorsement of the peer descriptive fake tanning norm (M = 3.30, SD = 1.36 vs M = 2.99, SD = 1.32), $t(318) = 2.06$, p = .04, d = .23. There were no significant

differences in skin cancer knowledge, demographic variables, or other sociocultural norms in the female sample. Male T2 completers did not differ compared to noncompleters on any of the aforementioned variables.

Gender Differences

When exploring gender differences, Bonferroni's correction set the significance level at $p < .006$. Table 2[1] presents the means for ideal skin tone, sociocultural norms, and self-reported tanning behaviour, and Table 3 presents the correlation coefficients. Females reported significantly higher amounts of outdoor tanning than males $t(243) = -3.35$, $p = .001$, $d = .40$. Females were also significantly more likely to report that their peers engaged in UV tanning than males, $t(244) = -3.59$, $p < .001$, $d = .51$. There were no significant gender differences regarding any of the other sociocultural norms, or reported ideal skin tone.

Table 2

Demographic variables by gender

	Females (n = 168)		Males (n = 78)	
Variable	Mean	*SD*	Mean	*SD*
T1 Ideal Skin Tone	3.64	1.64	3.94	1.43
Sociocultural norms				
Injunctive Family	3.02	1.01	3.05	0.79
Injunctive Peer	3.38	1.05	3.21	0.80
Injunctive Media	4.29	0.78	4.32	0.80
D (UVT) Family	1.90	1.13	1.71	1.00
D (UVT) Peer	3.01	1.31	2.38	1.17
D (UVT) Media	4.01	0.75	4.01	0.79
D (FT) Family[a]	2.14	1.28		
D (FT) Peer[a]	3.66	1.19		
D (FT) Media[a]	4.01	0.82		
T2 Outdoor Tanning	4.47	8.73	1.68	4.35
T2 Fake Tanning	4.74	10.55		

Note. T1 = time one data collection; T2 = time two data collection; UVT = UV tanning norms; FT = fake tanning norms.

[a] Data reported for female participants only.

[1] As a note to the reader, the first table presented in this paper is referred to as Table 2 because of the table presented in Section 4.1. Preamble.

Mediational Analyses

Mediation models were tested for all sociocultural norms that were significantly associated with the three outcome variables (namely outdoor tanning in males, outdoor tanning in females, and fake tanning in females; see Table 3). The independent variables were centred, and categorical covariates were dummy coded.

Outdoor tanning.

Females. After the consideration of the covariates, perceived injunctive family and peer norms, and descriptive family and peer (outdoor or solarium tanning) norms significantly predicted self-reported outdoor tanning behaviour (Baron and Kenny's Step 1, see Table 4, Model 2, Block 1). After the consideration of covariates, ideal skin tone was significantly related to injunctive family and peer norms, and descriptive family and peer (outdoor or solarium tanning) norms (Step 2, see Table 4, Model 1). This indicated that internalisation of a tanned ideal was positively related with endorsing peer and family tanning norms in females. The results also showed that after controlling for covariates and the independent variables, ideal skin tone was a significant predictor of T2 outdoor tanning behaviour (Step 3, see Table 4, Model 2, Block 2).

The regression analyses established a mediating effect of ideal skin tone on the relationship between three of the sociocultural norms predictors (injunctive family and peer norms, and the descriptive peer [sun or solarium] norm) and outdoor tanning. Sobel's test for mediation confirmed each mediation model, $z = 2.03$, $z = 2.07$, and $z = 2.32$, respectively, all at $p < .05$. Results indicated that between 19-27% of the total effects of the sociocultural norms on outdoor tanning behaviour was mediated through ideal skin tone (see Table 4).

Males. After the consideration of age, skin cancer knowledge, and family history of skin cancer, ideal skin tone was not significantly associated with self-reported outdoor tanning behaviour. Thus, ideal skin tone did not mediate the relationship between sociocultural normative variables and outdoor tanning in the male sample.

Fake tanning. Ideal skin tone was found to have a significant mediating effect on the relationship between four of the sociocultural norms (family and peer endorsement of tanned skin, and family and peer [fake tanning] descriptive norms and self-reported fake tanning behaviour; see Table 4). Sobel's (1982) test for mediation confirmed each mediation model, $z = 2.95$, $z = 2.82$, $z = 2.45$, and $z = 2.45$, respectively, all at $p < .05$. Thus, ideal skin tone mediated the relationship between female participants' self-reported fake tanning behaviour and perceived family and peer endorsement of tanned skin, as well as perceived family and peer fake tanning behaviour. Further, the product of coefficients tests indicated that between 28-41% of the total effect of those sociocultural norms on fake tanning was mediated by ideal skin tone.

Table 3

Intercorrelations between independent and dependent variables

	1	2	3	4	5	6	7	8[a]	9[a]	10[a]	11	12[a]
1. T1 Ideal Skin Tone	–	.21	.20	.10	.20	.09	.13				.19	
2. Injunctive Family	**.40*****	–	**.81****	.16	.17	.06	.04				.16	
3. Injunctive Peer	**.47*****	**.76*****	–	.20	.09	.17	-.03				**.31****	
4. Injunctive Media	**.21****	.15	**.32*****	–	-.11	.08	**.54****				.17	
5. D (UVT) Family	**.18****	**.37*****	**.21****	.04	–	**.25***	.19				.00	
6. D (UVT) Peer	**.37*****	**.29*****	**.36*****	**.29*****	**.31*****	–	.15				**.35****	
7. D (UVT) Media	**.17***	-.05	.08	**.31*****	.05	**.18***	–				.13	
8. D (FT) Family[a]	.13	**.34*****	**.27*****	.07	**.41*****	**.17***	-.06	–				
9. D (FT) Peer[a]	**.25****	**.26****	**.40*****	**.18***	.05	**.59*****	**.17***	**.26****	–			
10. D (FT) Media[a]	.14	.01	**.16***	**.36*****	-.05	**.25****	**.53*****	-.05	**.28*****	–		
11. T2 Outdoor Tanning	**.34*****	**.35*****	**.31*****	.02	**.36*****	**.22****	.05	.12	.02	.08	–	
12. T2 Fake Tanning[a]	**.31*****	**.21****	**.33****	**.17***	.02	**.23****	.10	**.16***	**.27*****	.11	.08	1

Note. Intercorrelations for male participants (n = 78) are presented above the diagonal, and below the diagonal for female participants (n = 168).
D (UVT) = Descriptive (sun or solarium) norm; D (FT) = Descriptive fake tanning norm.
[a] Data reported for female participants only.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Table 4

Summary of mediation results (Female Participants, n = 168)

	Model 1: *IV* - Mediator				Model 2: Block 1				Model 2: Block 2					Mediated effect		Sobel
	B	*SE B*	*β*	R^2	*B*	*SE B*	*β*	R^2	*B*	*SE B*	*β*	F_{ch}	R^2	*ab*	%[a]	
DV = Outdoor Tanning																
Injunctive Family	0.61	.18	**.38*****	.18	3.06	.65	**.35*****	.13	2.29	.69	**.26****					
Ideal Skin Tone									1.25	.42	**.23****	**8.71****	.18	.08	25.93	**2.57***
Injunctive Peer	0.72	.11	**.46*****	.24	2.54	.63	**.30*****	.10	1.61	.70	**.19***					
Ideal Skin Tone									1.31	.45	**.24****	**8.45****	.15	.07	27.48	**2.64****
D (UVT) Family	0.24	.11	**.17***	.06	2.81	.57	**.36*****	.14	2.45	.56	**.32*****					
Ideal Skin Tone									1.51	.38	**.28*****	**15.41****	.21	.10	23.95	1.89
D (UVT) Peer	0.50	.09	**.40*****	.19	1.54	.51	**.23****	.06	0.78	.54	.12					
Ideal Skin Tone									1.54	.44	**.29****	**6.58***	.13	.07	35.72	**2.98****
DV = Fake Tanning																
Injunctive Family	0.61	.18	**.38*****	.18	1.97	.81	**.19***	.07	0.93	.85	.09					
Ideal Skin Tone									1.69	.53	**.26****	**10.30****	.17	.05	35.94	**2.33****
Injunctive Peer	0.72	.11	**.46*****	.24	3.14	.75	**.31*****	.13	2.25	.84	**.22****					
Ideal Skin Tone									1.24	.54	**.19***	**5.27***	.16	.06	21.12	**2.17***
Injunctive Media	0.48	.16	**.23****	.09	2.43	1.03	**.18***	.07	1.60	1.0	.12					
Ideal Skin Tone									1.73	.49	**.27****	**12.21****	.13	.05	28.83	**2.30***
D (FT) Peer	0.36	.10	**.26****	.10	2.40	.66	**.27*****	.11	1.86	.67	**.21****					
Ideal Skin Tone									1.51	.49	**.24****	**9.38****	.16	.07	23.58	**2.31****

Note. Sociocultural norm variables were centred at their means. D (UVT) = Descriptive (sun or solarium) norm; D (FT) = Descriptive fake tanning norm. Covariates age, skin cancer knowledge, and family history of skin cancer were entered in each of the above models at Step 1.

[a] Proportion of the total effect being mediated.

$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$

Discussion

Interestingly, internalisation of a tanned ideal, that is, ideal skin tone, did not differ significantly by gender. Although the media propagates tanned ideals for both genders (as suggested by both the literature and the responses of our participants), the notion of a tanned ideal is arguably targeted at females more directly with fake tanning products, for example, marketed almost entirely to females. Further, female participants reported higher levels of intentional tanning behaviour, both outdoor and fake tanning, than their male counterparts. This suggests that although both genders internalise the tanned ideal, the subsequent decision to engage in tanning behaviour is more common in young adult females. In the male sample, only the peer sociocultural norms were associated with reported tanning behaviour. Thus, it is possible that the social pressure to be tanned is not felt as strongly from family and media sources in young adult males than females. Studies could explore reasons for lower reported male engagement in tanning by asking them specific questions about how obtainable they feel this ideal is, how motivated to achieve this ideal they are, and how important media and family perceptions are, versus peer perceptions, regarding their appearance.

Mediational Analyses

In the female sample, ideal skin tone was found to mediate the relationship between injunctive family, injunctive peer (i.e. my family/friends like the way I look when I am tanned), and descriptive family (sun or solarium), and descriptive peer (sun or solarium) norms (i.e. My family/friends tan in the sun/use solariums to look tanned) and both outdoor and fake tanning behaviour. These findings are consistent with the Tripartite Influence Model (Thompson et al., 1999a). Future research should consider using ideal skin tone to measure internalisation of a tanned ideal and including a measure of social comparison as this is suggested to be another mediating factor in the

Tripartite Influence Model.

Ideal skin tone did not act as a mediator of any perceived media norms. Although Cafri and colleagues (2006) found media norm variables to be directly related to tanning behaviour, our findings did not replicate this. Although participants were keenly aware of the media's cultivation of a tanned ideal (injunctive norm), and this was associated with ideal skin tone, it was not associated with the tanning behaviour of this sample of young adults. Thus, it is also possible that those who endorse a tanned ideal are more likely to be aware of the media's cultivation of such an ideal.

Limitations

Approximately 8% of T1 participants were uncontactable at follow-up due to inactive/incorrect e-mail addresses. Due to the transient nature of undergraduate study, it is likely a portion of other participants who did not complete T2 data were no longer actively engaged in study and hence did not receive the e-mail inviting them to participate at T2. Because all measures were self-reported, findings may have been influenced by common method variance. The nonsignificant results in the male sample may be due to the small sample size, as the regression analyses with covariates entered were underpowered in that group.

Conclusions

Ideal skin tone, as measured by the Skin Tone Rating Scale, was found to mediate relationships between perceptions of sociocultural injunctive and descriptive norms and self-reported tanning behaviours in female young adults, lending support for the adaptation of the Tripartite Influence Model to the area of tanning behaviour. This research is the first to explore ideal skin tone and sociocultural norms in a male, young adult sample, and is the first to explore the mediating role of ideal skin tone in any sample. Results suggest that young adult males desire a tanned appearance, and that

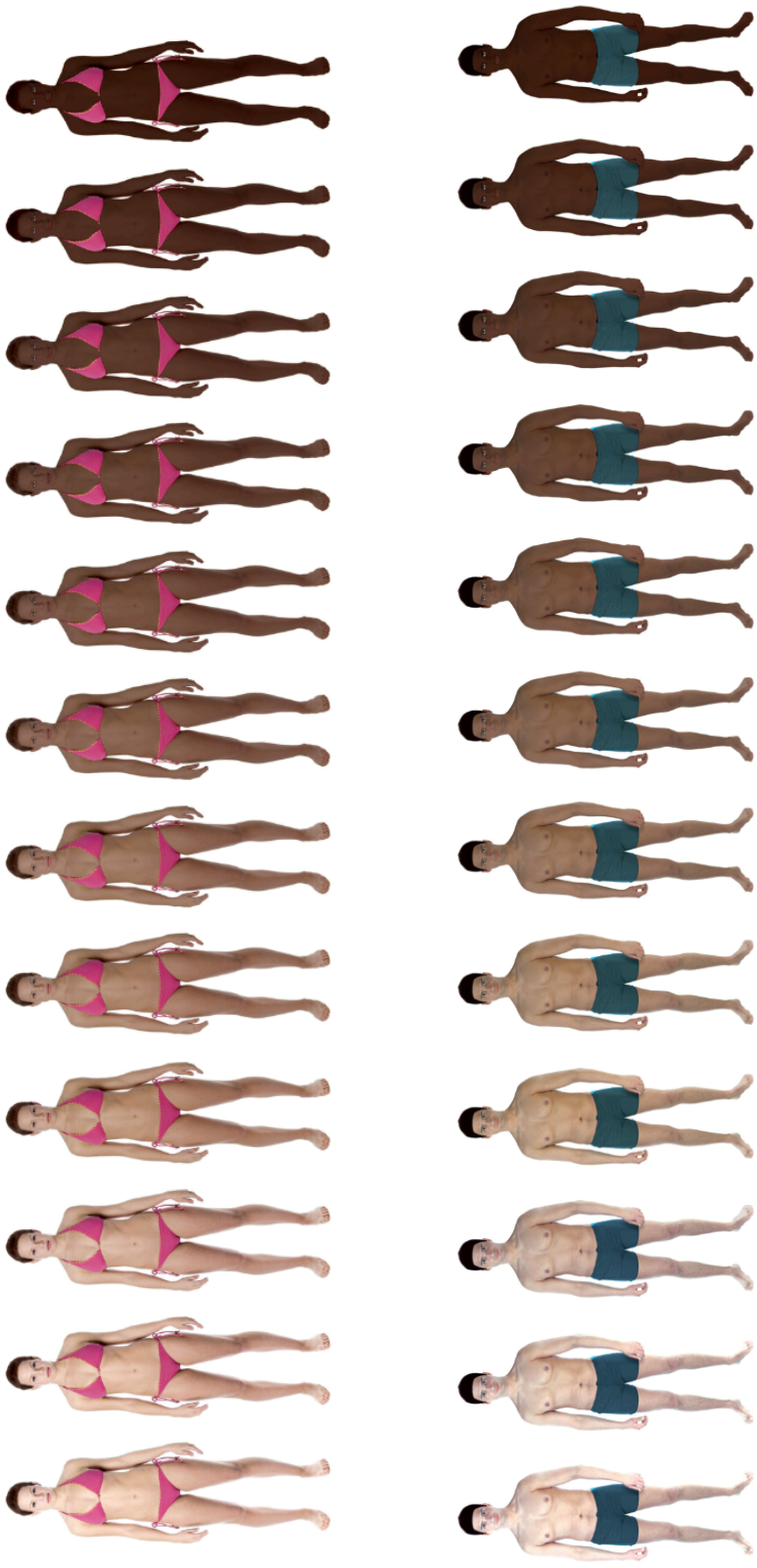
peer sociocultural perceptions are associated with male tanning behaviour. Therefore, we recommend that future research involving young adults incorporate skin tone and tanning as a component of body image, alongside body shape and eating behaviours. These findings lend support for ideal skin tone as a measure of internalisation of a tanned ideal, and we recommend future research in the area explore the relevance of the Tripartite Influence Model to tanning behaviour in more detail, and with consideration of cultural differences.

4.3. Final Remarks

The results of this study indicate that internalisation of a tanned ideal mediates relationships between sociocultural norms and subsequent tanning behaviours in females. These data support the application of the Tripartite Influence Model to the tanning behaviour of Western females. Although both genders internalised a tanned ideal, in the male group this internalisation was not associated with tanning behaviour. Previous research suggests that males endorse tanned skin tone ideals (e.g., Banerjee et al., 2008; Broadstock, Borland, & Gason, 1992), and that the Tripartite Influence Model predicts males' body image and body shape perceptions (Karazsia & Crowther, 2010; Smolak et al., 2005; Tylka, 2011). Due to the high rates of skin cancer in Australian men (Australian Institute of Health and Welfare, 2011a), it is important to understand influences on their sun-related behaviour. Future research that explores the social and/or appearance motivations for young men's outdoor sun behaviour may reveal additional information about the relationship between perceptions of ideal skin tone and behaviour among males. Due to the paucity of research exploring these factors in young men, qualitative research may be appropriate to inform our limited understandings of the motivations for sun-related behaviour in this group (Merriam, 2002).

4.4. Appendix A

Skin Tone Rating Scale Figures



CHAPTER 5. PAPER FOUR

5.1. Preamble

The paper reported in this chapter presents data collected at the same point in time as paper two (reported in Chapter 3), for those participants who reported Asian heritage ($N = 140$). When analysing the data reported in Chapter 3, it was clear that there were differences in the skin cancer knowledge levels and skin tone ideals between subsamples discriminated by Asian versus Western heritage.

Research suggests that despite significant consistency, perceptions of some aspects of attractiveness vary between people from different ethnic and cultural groups (e.g., Penton-Voak, Jacobson, & Trivers, 2004; Richmond, Austin, Walls, & Subramanian, 2012). For example, there are differences in the relationship between Body Mass Index (BMI) and perceived unattractiveness among African American females compared with other ethnic groups (e.g., Ali, Rizzo, & Heiland, 2013; Lovejoy, 2001; Richmond et al., 2012). Further, ideal body weight has been found to differ between those of Western and Asian heritage (Barnett, Keel, & Conoscenti, 2001; Nouri, Hill, & Orrell-Valente, 2011). The importance of culture to these perceptions has been reinforced in studies that document perceptions of attractiveness being associated with acculturation, or changing over time among migrants towards the mainstream beliefs held in their new country of residence (e.g., Olvera, Suminski, & Power, 2005; Tovée, Swami, Furnham, & Mangalparsad, 2006).

Skin colour is another attribute of attractiveness that appears to be influenced by cultural values, varying between Asian and Western cultures (Glenn, 2008; Hunt et al., 2012; Li et al., 2008). As the results reported in Chapter 4 show, sociocultural influences play an important role in skin cancer risk behaviours. Furthermore, research suggests that immigrants from Asian regions to countries with predominantly Western

cultures generally desire lighter skin than they currently have (Glenn, 2008; Li et al., 2008; Sahay & Piran, 1997). This desire provides the possibility for those of Asian heritage to be less likely to participate in sun exposure and tanning behaviours than Australians of Western heritage.

Furthermore, skin cancer prevention does not receive the funding or attention in Asian countries it has received, historically, in Australia (Montague et al., 2001). Although the incidence of skin cancers is lower in Asian cultures compared to predominately Caucasian nations (Kim et al., 2009), there are a number of factors that make people with an Asian background an important group for skin cancer prevention research. Skin cancer is typically diagnosed at later stages in this group than is generally the case for people with a Caucasian background (Bellew et al., 2009). This makes treatment more difficult, as later stage diagnosis typically means a larger sized tumour, and a greater chance that the cancer has metastasised (Bellew et al., 2009; Gloster & Neal, 2006). Furthermore, prognoses and morbidity is poorer in Asian skin cancer patients than their Caucasian counterparts, even after controlling for tumour size (Bradford, Goldstein, McMaster, & Tucker, 2009). Moreover, the physical presentation of skin cancer is often different to those seen in Caucasians, and can make early stage diagnoses more difficult (Bellew et al., 2009; Bradford et al., 2009). Exposure to UVR is associated with the development of a number of forms of melanoma, as well as nonmelanoma skin cancers, in populations with darker skin than that of Caucasian people (Bellew et al., 2009; Gloster & Neal, 2006; Kim et al., 2009). There is also evidence that, irrespective of disease form, diagnosis in Asian patients is delayed compared to Caucasian people (Lee, Chay, Tang, Chio, & Tan, 2012).

Given the skin cancer risk for those of Asian descent, and the paucity of research involving predictors of skin cancer-related behaviour among young people

with an Asian background, it is important to examine predictors of health promoting and health compromising behaviours related to skin cancer among this group. As the results reported in Chapter 4 show, sociocultural influences play an important role in skin cancer risk behaviours. The following study explores the role of knowledge, sociocultural norms about attractiveness, and skin tone perceptions in the prediction of behaviours linked to skin cancer among participants whose heritage is Asian. In this group societal ideals about skin tone and beauty are different to those commonplace in Western cultures (e.g., Glenn, 2008; Jang et al., 2013; Li et al., 2008) suggesting that factors identified as predictive in the previous chapter may apply differently here.

Sun-related behaviours among young Australians with Asian heritage: Differences according to sociocultural norms and skin tone perceptions

- MANUSCRIPT UNDER REVIEW -

Ashley Day, University of Adelaide

Carlene Wilson, Flinders University and Cancer Council South Australia

Amanda Hutchinson, Flinders University and Cancer Council South Australia

Rachel Roberts, University of Adelaide

5.2. Statement of Authorship

Day, A. K., Wilson, C., Hutchinson, A. H., & Roberts, R. M. (2014). *Sun-related behaviours among young Australians with Asian heritage: Differences according to sociocultural norms and skin tone perceptions.* Manuscript submitted for publication.

Submitted to European Journal of Cancer Care, May 16, 2014

Ashley Day (*Candidate)*

I was responsible for primary authorship of this paper, and collaborated with co-authors on its conceptualisation and design. I conducted the statistical analyses, and took the lead role in interpreting the results and writing and revising the manuscript, again with input and advice from co-authors. I served as corresponding author and was responsible for manuscript submission, revisions, and responses to journal reviews.

Signed: Ashley Day _____ Date: _____

Prof Carlene Wilson, Dr Amanda Hutchinson, and Dr Rachel Roberts (*Co-authors)*

We were the supervisors of the research programme that led to this publication and there was ongoing collaboration between Ashley Day and us in refining the direction of the research. The realisation of the idea, collection of data, and analysis of data were the work of Ashley Day. Ashley Day was responsible for writing this paper; our role was to comment on drafts, make suggestions on the methodology and presentation of material in the paper, and to provide editorial input. We also provided advice on responding to comments by the journal reviewers and editor. We hereby give our permission for this paper to be incorporated in Ashley Day's submission for the degree of Doctor of Philosophy from the University of Adelaide.

Signed: Carlene Wilson _____ Date: _____

Signed: Amanda Hutchinson _____ Date: _____

Signed: Rachel Roberts _____ Date: _____

Abstract

Deliberate tanning, poor sun protection, and sun exposure increase an individual's risk for skin cancer. Recent evidence suggests individuals of Asian heritage have lower incidence of skin cancer than Caucasians but that their post-diagnosis outcomes are often worse. In Western cultures tanning behaviours are often motivated by a desire for "attractive" tanned skin. Conversely, a light complexion is desired in a number of Asian cultures and may, consequently, serve to protect this group from excessive and risky sun exposure behaviours. This possibility is yet to be tested, with little known about the sun-related behaviours of Asian people residing in Australia. The present study involves 140 South Australian young adults who report having Asian heritage. Results show that the majority of female participants, and significantly fewer males, reported participating in deliberate outdoor tanning behaviour. Perceptions of family, peer, and media tanning norms influenced behaviour, with peer norms being the strongest predictor. The desire for a lighter skin tone was associated with increased sun-protective behaviour and a lower number of previous severe sunburns. As a significant proportion of participants engaged in deliberate tanning behaviour, it is recommended that future research continue to explore factors associated with tanning, including an explicit measure of culture.

Recent reviews of skin cancer in Asian populations have found that although people of Asian heritage have a lower incidence of melanoma and nonmelanoma skin cancers than Caucasians, the rate is rising (Bellew et al., 2009; Kim et al., 2009). There is a paucity of incidence data reported across Asian regions, however available data indicates that overall incidence of skin cancer in Singapore has more than doubled from 1968 to 1997 (Sng et al., 2009), and the rate of melanoma has risen in Japan during the period 1987-1996 (Ishihara et al., 2001). Further, those who receive a diagnosis often have more advanced cancer and have poorer outcomes (Bellew et al., 2009; Kim et al., 2009). According to the 2011 Australian census, over 1.7 million Australians were born in Asian countries (Australian Bureau of Statistics, 2011). It is important to understand the sun-related behaviours of this group to comprehend the potential for skin cancer in this segment of the Australian population.

Differences in health-related behaviours and beliefs across cultural groups are reflected in the diversity of rates and forms of cancers across the world, beyond those that can be accounted for by genetic differences (Vineis & Wild, 2014). Similarly, research suggests that cancer rates and forms change in immigrants. For example, risk of colorectal cancer increases among Chinese migrants for each year lived in North America (Whittemore et al., 1990), and breast cancer risk increases among female Asian migrants to the United States (Shimizu et al., 1991; Ziegler et al., 1993). Cultural beliefs affect cancer care throughout each stage of disease, including prevention and early detection (see review by Kagawa-Singer, 2000), and it is therefore important to consider cultural factors when addressing cancer control. Sun exposure, including deliberate tanning behaviour and lack of effective sun protection, increases skin cancer risk (Narayanan et al., 2010; Whiteman et al., 2001). Little is known about the sun-related behaviours (i.e. tanning, sun protection, sun exposure)

and beliefs of Asian Australians, and it is important to consider potential cultural differences among this minority group.

The perception of tanned skin as desirable is associated with tanning behaviour in young Caucasian adults from Western cultures (Cafri et al., 2008; Day, Wilson, Hutchinson, & Roberts, 2014b). Sociocultural influences regarding tanned skin, such as desiring darker skin in order to conform to perceptions of media, family, and peer views of attractiveness are also related to tanning behaviour in those from Western cultures (Cafri et al., 2008; Day, Wilson, et al., 2014b). Although tanned skin is considered desirable in Western cultures, in Asian countries, including the Philippines, Korea, Japan, India, and China, lighter skin is highly valued and this has long been linked to participation in skin lightening practices in these places (Hunt et al., 2012). Recent Australian qualitative research suggests that Chinese and Korean immigrants expressed a preference for fair skin and for protecting the skin when outdoors (Jang et al., 2013). This highlights the possibility that people of Asian heritage may have sociocultural driven influences regarding darkening their skin that may minimise their tanning behaviour. How these concerns operate in Western societies, where tanned skin is linked to attractiveness, is unknown.

Sociocultural norms can relate to perceptions of what others believe to be desirable (i.e. injunctive norms) and perceptions of what others do (i.e. descriptive norms). A number of theoretical models suggest the importance of sociocultural normative influence in understanding behaviour, including the Theory of Planned Behaviour (Ajzen, 1985), Social Norms Theory (Perkins & Berkowitz, 1986), and the Tripartite Influence Model (Thompson et al., 1999a). Research supports this theoretical claim, with a large body of literature indicating that sociocultural norms play an important role in sun-related behaviour. For example, the tanning behaviour of

Western heritage adolescents and young adults is predicted by family preference for a tanned appearance (e.g., Cafri et al., 2008; Hoerster et al., 2007), the perceived tanning behaviour of peers (Hoerster et al., 2007; Wichstrøm, 1994; Yoo & Kim, 2012). Further, celebrity or "image" norms are associated with outdoor tanning intentions (Jackson & Aiken, 2000), and exposure to images of individuals with tanned appearance in magazines predicts beliefs and attitudes regarding tanning (Cho et al., 2010). However, the relationships between family, peer, and media norms and sun-related behaviours have not been explored among people of Asian heritage.

People with Asian heritage living in Australia are an interesting group because sociocultural influences on perceptions of attractiveness are likely to be derived from both Western and Asian norms. For example, due to their Asian heritage, this group is likely to have family members with non-Western normative beliefs, such as a familial belief that tanned skin is unattractive. We would expect to find a negative relationship between Western sociocultural norms and tanning behaviour in Asian Australians. That is, we would expect that those who did not endorse Western tanned skin tone preferences would be unlikely to deliberately outdoor tan. However, the norms that Asian Australians conform to (Western versus Asian norms) are likely to be influenced by which cultural group they identify with.

The main aim of this study is to explore sun-related behaviour and its determinants in a group of Asian heritage students living in Australia. Given the dominant perception in many Asian cultures that light skin is attractive, we expect participants will desire lighter skin, and this will be associated with high sun-protective behaviour and an absence of deliberate tanning behaviour. Based on the literature, we believe that perceptions of both injunctive and descriptive sociocultural norms will influence the decision to not engage in deliberate tanning behaviour. A

secondary research aim is to explore levels of skin cancer knowledge in this sample, due to the delayed skin cancer treatment seeking reported in this cultural group (Bellew et al., 2009; Kim et al., 2009). A final aim is to explore gender differences in the sample, and we will accordingly report results by gender. Gender differences in sun-related behaviours are expected because they are consistently reported among Western samples (Abroms et al., 2003; Cottrell et al., 2005; Paul et al., 2008). There is a lack of literature exploring the sun-related behaviours and beliefs of Asian Australians. Only two studies have been recently published: One qualitative study reports that female Asian migrants to Australia avoid the sun due to perceptions of fair skin being attractive (Jang et al., 2013), the other study suggests that low acculturation to Australian lifestyle was associated with lower vitamin D levels in Asian migrants (Brock et al., 2013). Thus, the present research is the first attempt to explore deliberate tanning behaviour, skin cancer knowledge, and sociocultural tanning norms in an Asian Australian sample.

Method

Participants

Participants were 140 students aged between 18 and 26 (M = 21.36, SD = 2.04), who reported having Asian heritage/ethnic background, as described by the following categories: South-East Asian (e.g., Thai, Vietnamese, Indonesian, Singaporean), North-East Asian (e.g., Chinese, Japanese, Korean), or Southern and Central Asian (e.g., Indian, Pakistani, Afghan). Participants were recruited from the University of Adelaide, South Australia.

Procedure

Upon receiving institutional ethics approval, the online study was advertised on the university's intranet home page to all undergraduate students (approximately

37,000 students have access to this page). The advertisement, referring to a study about "The sun and your skin", contained a link to a page detailing information about the study and ethics approval. If potential participants were interested in engaging in the study they were able to indicate their consent and proceed to the survey, on a subsequent webpage. Measures were shown in consistent order for all participants. Following completion of the study, participants were given a link to the Australian Cancer Council skin cancer information website page. Due to confidentiality constraints, we were unable to determine an accurate number of eligible first year psychology students or undergraduate intranet users to calculate response rates. First year Psychology students were invited to participate for course credit; all other undergraduate student participants went into the draw for one of four $50 shopping vouchers.

Measures

Demographics. Participants indicated their age, gender, and were asked which of the previously mentioned options best describes their ethnic background.

Skin cancer knowledge. The Skin Cancer and Sun Knowledge (SCSK; Day, Wilson, Roberts, et al., 2014) scale consists of 25-items (15 true-false and 10 multiple-choice) that assess skin cancer and sun health knowledge, with scores ranging from 0-25, for example "Solariums/sun beds are a safe way to get a tan" (true-false) and "What does SPF mean?" (multiple-choice). Higher scores indicate higher knowledge. In a sample of Western young adults, two week test-retest reliability was $r = .83$.

Sociocultural norms. Six items measured participant reports of media, peer, and family norms related to tanning. For each of the three domains (i.e. family, peer, media), participants' perceived injunctive norms were measured with questions such as, "My friends like the way I look when I'm tanned" and "The media portrays images

which make looking tanned an attractive ideal". Participants were also asked questions measuring descriptive norms for each of the three domains, for example "My family tan in the sun/use solariums to look tanned", and "The media portrays images of people who have been or are tanning in the sun/using solariums to look tanned". Participants indicated their frequency of agreement on a 5-point Likert scale *(never, rarely, sometimes, often, and always*). Scores ranged between one and five for each item.

Skin tone perceptions. The Ideal Skin Tone Scale is an extended subscale of the Skin Tone Rating Scale, developed by Prichard and colleagues (2013). The current version presented 12 female and 12 male figures, featuring skin tone from very pale to very tanned). Participants were asked to identify the figure with the skin tone that they felt best represented their ideal skin tone, such that the range varied from one (*lightest skin tone figure*) to 12 (*darkest skin tone figure*), and a higher value indicated higher endorsement of a tanned skin tone preference. Participants were also asked to identify the figure with the skin tone they felt best represented their own (self) skin tone.

Tanning behaviour. Participants were presented with the following definition of outdoor tanning: "Exposing your body to direct sunlight outside for the purpose of tanning your skin". Participants were then asked whether they had deliberately engaged in this tanning behaviour over the past few years, with the categorical responses of never, once or twice a year, three to six times a year, seven to 12 times, and over 12 times a year. These categories were intended to allow for the distinction between very frequent tanners, frequent tanners, occasional tanners, "event" tanners, and nontanners. However, as frequent tanning was rare (less than 4% of participants (*n = 4*) engaged in outdoor tanning seven or more times a year), the responses were categorised into yes/no.

Sun exposure. The Sun Habits scale (Glanz et al., 2008) is a 3-item measure assessing participants' sun exposure during summer and sunburns during the past 12 months. Participants indicated the average number of hours spent outside per day in summer, between the hours of 10 a.m. and 4 p.m. on weekdays and weekends. Participants responded on a 7-point scale ranging from 30 minutes or less to 6 hours. Internal consistency between the two items was high, $\alpha = .74$. The weekday and weekend scores are combined and weighted (by 5 for weekdays and by 2 for weekends, then divided by 7) to enable an average daily sun exposure score ranging from one to seven, with higher scores reflecting greater levels of sun exposure. Participants also indicated how often during the last 12 months they experienced "red OR painful sunburn that lasted a day or more", ranging from zero to six (*0 times, 1, 2, 3, 4, 5 or more*). The sunburn score was analysed separately to the exposure score.

Sun-protective behaviour. The Sun Protection Behaviour Scale (Weinstock et al., 2000) is a 9-item measure assessing the frequency participants practiced sun protection when in the sun for more than 15 minutes (e.g., frequency of wearing hats) on a 5-point Likert scale (*never, rarely, sometimes, often, and always*) with higher scores reflecting more frequent use of sun-protective behaviours. Total scores range from nine to 45. The scale had high internal consistency, $\alpha = .77$.

Statistical Analysis

IBM SPSS Statistics 20.0 was used for all analyses. A series of independent sample *t*-tests and chi-square analyses were conducted to examine associations between skin tone perceptions and sun-related behaviour, as well as gender differences. *t*-tests and binomial logistic regression analyses were conducted to explore the relationship between sociocultural normative influences and tanning behaviour. Bonferroni's corrections were applied to control for Type 1 error due to

multiple comparisons.

Results

Demographic Information

Participants reported their heritage/ethnic background as follows: *n* = 55 (39.3%) South-East Asian, *n* = 56 (40%) North-East Asian, and *n* = 29 (20.7%) Southern and Central Asian. There were no significant differences in ideal skin tone across these groups. No participants reported a personal history of skin cancer, with *n* = 4 (2.9%) reporting a family history. Table 1 presents socio-demographic and tanning behaviour data, and Table 2 presents the means for sociocultural norms and ideal skin tone.

Table 1

Socio-Demographic and Tanning Data for all Participants

	Females		Males		Total	
Variable	*N*	%	*N*	%	*N*	%
Outdoor Tanning						
Yes	50	52.1	14	31.8	64	45.7
No	46	47.9	30	68.2	76	54.3
Skin Tone Rating						
Ideal tone lighter than self	37	38.5	12	27.3	49	35.0
No discrepancy	37	38.5	15	34.1	52	37.1
Ideal tone darker than self	22	22.9	17	38.6	39	27.9

Note. Females (*n* = 96); Males (*n* = 44); Total (*N* = 140).

Skin Tone Perceptions

Results reported in Table 1 indicate that most participants, regardless of gender, reported an ideal skin tone different to their perceived own skin tone (61.4% of women and 62.9% of men), and of these, the majority of women wanted a lighter tone, and men a darker tone. When exploring differences in sun-related behaviour among females who reported wanting lighter skin with those who desired darker skin (i.e. comparing those who had a lower ideal skin tone than their perceived own skin

tone versus those who had a darker ideal than perceived own), Bonferroni's correction set the significance level at $p < .013$. Those female participants who did not outdoor tan reported a significantly fairer ideal skin tone ($M = 2.95$, $SD = 1.78$) than those who did outdoor tan ($M = 5.25$, $SD = 1.66$), $t(94) = 4.22$, $p < .001$, Cohen's $d = 1.34$.

Table 2

Descriptive statistics for the study measures among participants, and between differences (n = 140)

	Females ($n = 96$)		Males ($n = 44$)		*t*-test
Variable	Mean (SD)	Range	Mean (SD)	Range	($df = 138$)
Skin Tone (Perceived Self)	3.5 (1.8)	1 – 10	4.6 (2.0)	1 – 10	2.06*
Skin Tone (Ideal)	3.2 (1.9)	1 – 8	4.9 (2.0)	1 – 10	4.83***
Discrepancy (Ideal - Self)	-0.23 (1.4)	-5 – 3	0.32 (1.4)	-3 – 3	2.25*
Sun Exposure	3.0 (1.4)	1 – 6.4	2.7 (1.2)	1 – 6	1.23
Number of Sunburns	1.6 (0.92)	1 – 5	1.6 (0.85)	1 – 5	0.61
Sun-Protective Behaviour	30.0 (6.2)	12 – 44	28.5 (5.9)	20 – 45	1.35
SCSK	14.7 (4.6)	3 – 23	15.1 (3.7)	5 – 23	0.51
Sociocultural norms					
Family Injunctive	2.3 (0.95)	1 – 5	2.5 (0.9)	1 – 5	1.16
Peer Injunctive	2.6 (1.1)	1 – 5	2.6 (0.95)	1 – 5	0
Media Injunctive	3.3 (1.2)	1 – 5	3.6 (0.97)	1 – 5	1.45
Family Descriptive	1.6 (0.89)	1 – 5	2.1 (1.1)	1 – 4	2.86**
Peer Descriptive	2.4 (1.2)	1 – 5	2.6 (1.2)	1 – 5	0.92
Media Descriptive	3.3 (1.1)	1 – 5	3.4 (0.85)	1 – 5	0.53

Note: SCSK = Skin cancer and sun health knowledge.
*$p < .05$. **$p < .01$. ***$p < .001$

Differences in sun protective behaviour among females desiring fairer versus darker skin ($M = 31.2$, $SD = 6.8$ vs. $M = 27.6$, $SD = 5.8$) did not reach significance $t(57) = 2.2$, $p = .04$, $d = .58$. Similarly, differences in number of reported sunburns among those desiring fairer versus darker skin ($M = 1.2$, $SD = 0.29$ vs. $M = 1.4$, $SD = 0.4$) was not significant after consideration of Bonferroni's correction, $t(57) = -2.3$, $p = .03$, $d = .60$. No significant difference in incidental sun exposure was found (fairer ideal $M = 2.87$, $SD = 1.27$, vs. darker ideal $M = 2.92$, $SD = 1.49$), $t(57) = 0.13$, $p = .90$, $d = .03$.

Ideal skin tone was not associated with incidental sun exposure, number of reported sunburns, outdoor tanning behaviour, or sun-protective behaviour in the male sample. When comparing males who reported wanting fairer skin with those who desired darker skin, no significant differences in any of the outcome variables were found.

Sociocultural Normative Influences and Tanning Behaviour

When the six Western sociocultural norms (family, peer, and media injunctive tanning norms and family, peer, and media descriptive tanning norms) were entered simultaneously into a binary logistic regression with tanning behaviour as the outcome variable, the model was significant (χ^2 (6) = 26.67, $p < .001$). The model predicts 71.9% of the responses correctly, and Cox & Snell's R^2 indicates that 24.3% of the total variance in females' outdoor tanning behaviour choice was accounted for. Partial effects were observed for peer injunctive norm endorsement, *Wald* = 6.04, $p = .01$.

After applying Bonferroni's correction ($p < .007$) each of the six relationships between sociocultural norms and outdoor tanning did not reach significance in the male sample.

Gender Differences

When exploring gender differences, Bonferroni's correction set the significance level at $p < .004$. Males reported significantly darker skin tone preferences than females $t(138) = 4.8$, $p < .001$, $d = .46$. While males were less likely to have engaged in outdoor tanning than females (χ^2 (1, n =140) = 5.0, $p = .03$, *phi* = .19), this did not reach statistical significance after applying Bonferroni's correction. There were no significant gender differences regarding any of the sociocultural norms, skin cancer knowledge, or reported sun exposure, sunburns, or sun-protective behaviour.

Skin Cancer Knowledge

Of the 25-item skin cancer knowledge scale, participants got an average of 14.79 (*SD = 4.28*) items correct. Skin cancer knowledge was not significantly related to sun exposure, sun-protective behaviour, or tanning behaviour in either gender.

Discussion

The results of this study show that sociocultural factors and ideal skin tone are associated with sun-related behaviours in a sample of participants with Asian heritage. Unexpectedly, a proportion of participants desired darker skin than their own perceived tone and engaged in behaviours associated with increased risk for skin cancer. Over half of female participants and over 30% of male participants reported having deliberately tanned outdoors at least once in the past few years, and participants of both genders averaged at least one severe sunburn in the previous 12 months. Such behaviour increases skin cancer risk through exposure to ultraviolet radiation (Kennedy et al., 2003). Although these reported rates of outdoor tanning are lower than those reported by Western young adults from the same institution (69% of females and 42% of males reported deliberate outdoor tanning; Day, Wilson, et al., 2014b), there is still a proportion of Asian-background students engaging in this risk-increasing behaviour. Results show that those females who had deliberately outdoor tanned endorsed Western sociocultural norms to a greater extent than those who did not, and were similarly more likely to desire more tanned skin.

The majority of participants reported discrepancy between their ideal skin tone and perceived self. It is unclear why some female participants who did not desire a darker skin tone reported engaging in outdoor tanning behaviour. It is possible that some of those participants who did not desire a darker skin tone engaged in the behaviour due to social expectations (i.e. spending time with peers who wanted to tan).

The measurement of outdoor tanning captures infrequent tanning, and it is likely that this explains the finding to some extent. In line with recent recommendations, future research should assess tanning behaviour with open-ended items (for a discussion of this measurement issue, see Hillhouse, Turrisi, Jaccard, & Robinson, 2012). There was no clear trend regarding participant's skin tone preferences for either fairer or darker skin, whereas in research conducted among Western-background students from the same institution there were no reports of wanting lighter skin (Day, Wilson, et al., 2014b). Similarly, a study conducted by Sahay and Piran (1997) found that South Asian-Canadian females wanted to have lighter skin than their European-Canadian counterparts.

Australian acculturation may play a role in perceptions of skin beauty and this may account for the diversity in this study. Acculturation to Western ideals predicts increased tanning behaviour and decreased levels of sun protection among those of Asian and Hispanic heritage living in the United States (Coups et al., 2012; Coups et al., 2013; Gorell, Lee, Munoz, & Chang, 2009). Unfortunately, it is not known how long the current participants had been living in Australia; it is possible that those who desired darker skin have higher levels of Western acculturation, and this should be taken into account in future studies. Participants who wanted lighter skin reported better sun-protective behaviour practices and fewer sunburns than those who desired darker skin. This suggests that skin tone preferences may influence skin cancer risk behaviours in a positive direction for those that consider untanned skin desirable. Thus, considering skin tone as a body image construct and promoting untanned skin as attractive could be useful in the promotion of sun protection in Western cultures.

This research supports the cross-cultural applicability of sociocultural models of tanning behaviour, particularly with females. As hypothesised, Western

sociocultural tanning norm endorsement predicted females' outdoor tanning behaviour. Sociocultural norms are an important determinant of sun-related behaviours (e.g., Cafri et al., 2008; Hoerster et al., 2007; Yoo & Kim, 2012). Until now, similar research regarding tanning has focused on Caucasians, most exploring the behaviour and attitudes of young adult female Caucasians. Further exploration of Asian sociocultural tanning norms is suggested, and future research would likely benefit from measurement of endorsement of both Asian and Western sociocultural tanning norms.

Of considerable concern are the low levels of skin cancer and sun-health knowledge in this sample. Compared with a sample of Western-background young adults from the same institution, who had an average of 18 correct answers, the current sample had significantly lower skin cancer knowledge (with large effects; $d = .94$ for Western vs. Asian females, $d = .88$ for males; *t*-tests calculated based on figures reported in Day, Wilson, et al., 2014b). This finding may be relevant to poorer outcomes reported for people of Asian heritage diagnosed with skin cancer (Bellew et al., 2009; Kim et al., 2009) because misunderstanding the risk factors for, and early signs of, skin cancer may lead to delayed treatment seeking. Thus, increasing skin cancer knowledge in this group is important, and future research should consider ways to address knowledge gaps between Western and Asian Australians. Skin cancer knowledge was not associated with behaviour in the current sample. Skin cancer prevention does not receive the funding or attention in Asian countries as it historically has in Australia (Montague et al., 2001). Research suggests that knowledge is important for long-term health protective behaviour (e.g., Frisch, Camerini, Diviani, & Schulz, 2012; Nutbeam, 2000; von Wagner, Knight, Steptoe, & Wardle, 2007), and that Australian skin cancer awareness campaigns improve skin

examination behaviour (Baade, Balanda, Lowe, & Del Mar, 1996; Lowe, Balanda, Del Mar, Purdie, & Hilsdon, 1994). Given the considerable skin cancer knowledge deficits of this group, a targeted attempt to increase baseline knowledge in this area may have a flow-on effect to behaviour.

The current research serves as an indicator of areas to explore in more depth, yet the findings of this brief study must be considered in light of limitations. Firstly, the sample size was modest, particularly in the male group. Secondly, the cross-sectional nature of the present study limits inferences regarding causality between variables. Further, data analysis was restricted to participants who reported Asian heritage. There are a vast number of cultural differences across Asian regions, and diversity in cultural perceptions of tanning is evident from ideal skin tone data. Based on the ethnicity data collected, and the fact that the only a minority of participants desired darker skin, it appears unlikely that a large portion of our sample would identify as Western, at least with respect to notions of attractiveness. Unfortunately, we did not collect data regarding participants' country of birth, length of Australian residence, and acculturation, and this is a limitation of the present study. Future research involving Asian Australians should consider including these variables in order to further explore the interaction between Asian and Australian cultural factors in sun-related behaviours.

Cultural factors play an important role in cancer control, including skin cancer prevention. The present study is the first to consider the tanning behaviours, skin cancer knowledge, and sociocultural tanning norm endorsement of Asian Australians. Results suggest that those living in Australia who identify as having Asian heritage have low skin cancer knowledge and diverse beliefs about the attractiveness of tanned skin; an ideal that is pervasive in Australian culture. As the Asian population in

Australia rises, so do the rates of skin cancer among Asian populations (Kim et al., 2009). In light of the rates of deliberate tanning and reported severe sunburns in this sample, it's important that we continue to explore factors that are relevant to sun-related behaviour in this high-risk group. The current research found that sociocultural perceptions were associated with tanning behaviours in this group, and that peer norms were particularly relevant. We recommend future research explore the interaction between sun-related behaviours, ideal skin tone, and sociocultural normative perceptions in a larger sample, with culture considered explicitly using a measure of acculturation.

5.3. Final Remarks

Results indicate that individuals with Asian heritage have low levels of skin cancer knowledge and engage in tanning behaviour, with the majority of females in this sample reporting past outdoor tanning behaviour. Furthermore, sociocultural norms regarding tanning were important predictors of sun-related behaviours. It was clear that not all participants endorsed a fair skin ideal, with 27% of participants reporting an ideal skin tone that was darker than their perceived skin tone. The present findings are limited by the classification used to determine Asian heritage; there was no consideration of length of time spent in Australia or acculturation to Australian society. Nevertheless, this study highlights diverse ideals and behaviours among those young adults who are Asian-Australian or Asians living in Australia. Based on the reported levels of risky sun-related behaviour, further investigation with this group is warranted.

CHAPTER 6. PAPER FIVE

6.1. Preamble

The results reported in Chapter 5 indicated that young adults with Asian heritage had poor levels of skin cancer knowledge, and engaged in risky sun-related behaviours. The main aim of the fifth paper is to consider the role of sociocultural variables, including Australian-acculturation, in sun-related behaviours among this group. A limitation of the research presented in Chapter 5 was the failure to consider participants' acculturation; ethnic heritage had been determined based on reported ethnic background, and thus our sample was not well defined in terms of cultural identity. As opposed to the research presented in Chapter 5, where data were collected at the same time as the data reported in Chapters 3 and 4, for this paper we sought participants who currently identified themselves as either Asian Australian or as an Asian person living in Australia. The aim of this was to recruit participants that currently identified with Asian culture, as opposed to those with Asian heritage that do not necessarily identify with Asian culture, particularly as participation in a tanning study may be more likely to appeal to those who identify with Western culture. Thus, detailed information was collected regarding acculturation, country of birth, and the number of years participants have lived in Australia. This chapter presents a manuscript prepared for submission to the International Journal of Behavioral Medicine for a special issue on Behavioral Medicine in the Asia Pacific.

Australian acculturation, sociocultural perceptions, and sun-related behaviours among young adult Asian Australians

- MANUSCRIPT UNDER REVIEW -

Ashley Day, University of Adelaide

Carlene Wilson, Flinders University and Cancer Council South Australia

Amanda Hutchinson, University of South Australia

Rachel Roberts, University of Adelaide

6.2. Statement of Authorship

Day, A. K., Wilson, C., Hutchinson, A. H., & Roberts, R. M. (2014). *Australian acculturation, sociocultural perceptions, and sun-related behaviours among young adult Asian Australians.* Manuscript submitted for publication.

Submitted to International Journal of Behavioral Medicine, July 11, 2014

Ashley Day (*Candidate)*

I was responsible for primary authorship of this paper, and collaborated with co-authors on its conceptualisation and design. I conducted the statistical analyses, and took the lead role in interpreting the results and writing and revising the manuscript, again with input and advice from co-authors. I served as corresponding author and was responsible for manuscript submission, revisions, and responses to journal reviews.

Signed: Ashley Day _____ Date: _____

Prof Carlene Wilson, Dr Amanda Hutchinson, and Dr Rachel Roberts (*Co-authors)*

We were the supervisors of the research programme that led to this publication and there was ongoing collaboration between Ashley Day and us in refining the direction of the research. The realisation of the idea, collection of data, and analysis of data were the work of Ashley Day. Ashley Day was responsible for writing this paper; our role was to comment on drafts, make suggestions on the methodology and presentation of material in the paper, and to provide editorial input. We also provided advice on responding to comments by the journal reviewers and editor. We hereby give our permission for this paper to be incorporated in Ashley Day's submission for the degree of Doctor of Philosophy from the University of Adelaide.

Signed: Carlene Wilson _____ Date: _____

Signed: Amanda Hutchinson _____ Date: _____

Signed: Rachel Roberts _____ Date: _____

Abstract

Australia has a notable proportion of residents of Asian heritage, particularly in the young adult university community (Australian Education International, 2012). Evidence suggests that although the incidence of skin cancer is lower in those of Asian heritage compared to Caucasians, prognosis is often worse. The aim of this study is to explore the role of sociocultural variables in the sun-related behaviours (sun protection, outdoor tanning, solarium and fake tan use) of Asian Australians. A sample of 399 young adults identifying as a person of Asian heritage or as Asian Australian participated in an online survey conducted in 2013. The results suggest that Asian Australians are a group at risk of skin cancer; the majority of participants reported not regularly engaging in sun-protective behaviour, and a notable proportion of the sample report engaging in outdoor and/or solarium tanning. After controlling for demographic factors, skin cancer knowledge, and other sociocultural variables, acculturation was a significant predictor of solarium use only. Skin tone perceptions and sociocultural tanning norm endorsement were significantly associated with tanning behaviour in the final models. Participants' low levels of skin cancer knowledge are of concern, and possibilities for improving knowledge levels in this group are considered. Further, it is recommended that future research investigate appearance-related beliefs associated with tanning behaviours in this population, in order to determine best avenues for intervention.

Australia has one of the highest rates of skin cancer in the world, with over 750,000 annual diagnoses (Cancer Council Australia, 2014a). This is despite the fact that skin cancer is largely preventable, through minimising ultraviolet radiation (UVR) exposure and utilising adequate UVR protection (B. K. Armstrong & Kricker, 2001). Over 8% of the 2011 Australian census population were born in Asian countries, and over 10% reported Asian ancestry (Australian Bureau of Statistics, 2011). Further, between 20 to 27% of all students enrolled in Australian universities in 2011 were international students from Asian nations (Australian Education International, 2012; Universities Australia, 2013). Diagnosis of skin cancer in those of Asian heritage is delayed compared to Caucasians, and skin cancers are often detected at a more advanced stage (e.g., thicker tumours with more ulcerations). This decreases the chances for successful treatment, and is likely to be a factor in the greater morbidity and mortality rates found (Bellew et al., 2009; Bradford et al., 2009; Gloster & Neal, 2006).

There is a paucity of literature reporting skin cancer incidence rates across Asian regions. The existing literature suggests that those in fairer skinned regions of Asia (i.e. Eastern counties including China, Japan, and Korea) have a higher incidence of skin cancer than those in South/Central Asia (e.g., India, Pakistan, and Sri Lanka [Sng, Koh, Siong, & Choo, 2009; Stern & Momtaz, 1984]). For example, a study that analysed Singaporean cancer registry data reported that Chinese residents had a higher incidence of all forms of skin cancer than both Indian and Malay residents (Sng et al., 2009). Though there are inconsistencies regarding changes in incidence rates of skin cancer in Asian countries (see Ishihara et al., 2001; D. Koh et al., 2003; Sng et al., 2009; Swerdlow, 1990), it appears that the rates have risen over the past 4-5 decades, albeit at a slower pace than in Western nations. Although skin cancer is less common among those of Asian heritage than Caucasian populations, it poses a significant health risk,

and the advanced stage of skin cancer at diagnosis is concerning.

The majority of Australian research on skin cancer knowledge and sun-related behaviours has focused on Caucasians exclusively, or ignored cultural variation when determining samples for inclusion (e.g., Fritschi et al., 1992; Gordon, Hirst, Green, & Neale, 2012; Paul, Paras, Harper, & Coppa, 2011). Pilot data found that Australian university students who identified as having Asian heritage had significantly lower skin cancer knowledge than those with a Western background (Day, Wilson, Hutchinson, & Roberts, 2014a). There is evidence to suggest that non-Caucasians living in sunny Western locations have a higher incidence of skin cancer than those residing in their home countries (Chuang, Reizner, Elpern, Stone, & Farmer, 1995; Nasseri, Mills, & Allan, 2007). Little is known regarding the role of cultural differences in the sun-related attitudes and practices of Asian Australians.

Although tanned skin is largely considered desirable and attractive in Western cultures, a number of Asian cultures herald fair skin as the ideal (Hunt et al., 2012). For example, there is a large market for skin whitening and lightening products across a number of Asian societies including Hong Kong, India, Japan, and Korea (Li et al., 2008). Conversely, appearance and sociocultural factors, such as desiring tanned skin and endorsing sociocultural tanning norms, are associated with tanning behaviour in young adults in Western cultures (Cafri et al., 2009; Cafri et al., 2006; Heckman et al., 2009). Cultural norms may differentially favour the perceived attractiveness of fair versus tanned skin in Asian and Caucasian Australians respectively, however people of Asian heritage may become acculturated to Caucasian beliefs about attractiveness over time.

Acculturation is a process that occurs when immigrants to a country interact with the native inhabitants and begin to internalise their attitudes, beliefs, and

behaviours. (Suinn, Ahuna, & Khoo, 1992). The implications of this for health-related behaviour are important to consider. Previous research has found that vitamin D deficiency in East-Asian Australian immigrants is associated with lower levels of acculturation to the Australian lifestyle (Brock et al., 2013). Acculturation has been shown to be a significant predictor of risky sun-protective and tanning behaviour among those of Asian and Hispanic heritage living in the United States (Coups et al., 2012; Coups et al., 2013; Gorell et al., 2009). This suggests potential for sun-related behaviours among young Asian Australians to become more like that of their Caucasian peers, and for this to impact skin cancer risk. Although Asian cultural norms about attractiveness might be hypothesised to serve as protective against skin cancer (Gorell et al., 2009; Jang et al., 2013), time spent residing in Australia and interacting with Caucasian peers and mainstream media may temper the influence of these norms. It can be hypothesised therefore, that the skin tone preferences and associated sun-tanning behaviours of students with Asian heritage living in Australia may be dependent upon the extent to which these students share local norms about what defines attractiveness.

This study aims to explore influences on sun-related behaviours in Asian Australians; namely demographics, level of skin cancer knowledge, skin tone perceptions, sociocultural tanning norms, and acculturation to Australian culture. Due to the centrality of sociocultural variables in the sun-related behaviours of those from Western cultures, this study will examine the role of sociocultural tanning norms, skin tone perceptions, and Australian-acculturation, once demographic variables and skin cancer knowledge have been taken into account. It is hypothesised that greater Australian-acculturation, sociocultural tanning norm endorsement, and preference for a tanned appearance will be associated with lower rates of sun-protective behaviour and higher rates of tanning, after controlling for demographic variables and skin cancer

knowledge.

Method

Participants

After excluding $n = 2$ respondents who reported a personal history of skin cancer, participants were 399 students (36.6% male) who identified as a young adult Asian Australian or as a person of Asian heritage living in Australia, aged between 17 and 26 ($M = 21.70$, $SD = 2.24$). Participants completed an online survey, and were recruited from the University of Adelaide's intranet website.

Procedure

Upon receiving institutional ethics approval, the study was advertised online on the university's intranet website, with an invitation for those who identified as either Asian Australian or as a person of Asian heritage living in Australia to participate. Participation was voluntary; participants could elect to enter a draw to win one of four $50 shopping vouchers. All information provided was confidential.

Measures

Demographics. Participants were asked to indicate their age, gender, ethnic heritage/background, and years lived in Australia. Participants were also asked about their personal and familial history of skin cancer (if they and/or anyone from their family had been diagnosed with skin cancer, yes/no).

Acculturation. Participants completed a 21-item measure of Acculturation (The Suinn-Lew Asian Self-Identity Acculturation Scale [SL-ASIA; Suinn et al., 1992]). The scale is one of the most commonly used measures in studies of people of Asian heritage in North America, and has previously been used in skin cancer research (Gorell et al., 2009). The scale was modified so that references to "American" were replaced by "Australian". Participants rated each item on a scale of one to five (e.g., "Whom do you

now associate with in the community: Almost exclusively Asians/Asian Australians, mostly Asians/Asian Australians, about equally Asian groups and Australian groups, mostly Australians, almost exclusively Australians), and scores were summed and divided by 21 so that the final score ranged from one (*low Australian-acculturation*) to five (*high Australian-acculturation*). Internal consistency has been reported at .88 in an Asian Australian sample (Hamid, Simmonds, & Bowles, 2009). Internal consistency in the present study was high, $\alpha = .91$

Skin cancer knowledge. The Skin Cancer and Sun Knowledge scale consists of 25-items (15 true-false and 10 multiple-choice) that assess skin cancer and sun health knowledge, with scores ranging from 0-25, for example "Solariums/sun beds are a safe way to get a tan" (true-false) and "What does SPF mean?" (multiple-choice), with higher scores indicating greater knowledge (Day, Wilson, Roberts, et al., 2014). Two week test-retest reliability was high in a sample of Caucasian young adults, $r = .83$ (Day, Wilson, Roberts, et al., 2014).

Sociocultural norms. Nine items measured the participant's reports of media, peer, and family perceptions of tanning. For each of the three domains (i.e. family, peer, media), participants' injunctive norms were measured with questions including, "My friends like the way I look when I'm tanned". Participants were also asked questions to measure descriptive norms for each of the three domains (family, friends and media) for example "My family use fake/chemical tanning products to look tanned", and "The media portrays images of people who have been or are tanning in the sun/using solariums to look tanned". Participants indicated their frequency of agreement on a 5-point Likert scale (*never, rarely, sometimes, often, and always*). These items have been used in previous studies (Day, Wilson, et al., 2014a, 2014b). For the purposes of these analyses, the sociocultural norms were summed into two variables: One that included

the three injunctive norms, and the three descriptive norms related to UVR tanning behaviour, and another that included the three injunctive norms and the three descriptive norms related to fake tanning behaviour. For both, scores were summed and divided by six, so that the minimum score was 1, and the maximum was 5, with a higher score indicating a higher endorsement of sociocultural norms promoting a tanned ideal.

Skin tone perceptions. The Ideal Skin Tone Scale is an extended subscale of the Skin Tone Rating Scale, developed by Prichard and colleagues (2013). The current version presents 12 female and 12 male figures, featuring skin tone from fair to dark. Participants were asked to identify the figure that they felt best represented their ideal skin tone, ranging from one (*lightest skin tone figure*) to 12 (*darkest skin tone figure*), with a higher value indicating higher endorsement of a tanned skin tone preference. Twelve month test-retest reliability of this measure was high, $r = .72$, $n = 246$, ($p < .001$). Six month test-retest in the current sample was high, $r = .77$, $n = 140$ ($p < .001$). Participants were also asked to identify the figure with the skin tone they felt best represented their own skin tone.

Tanning behaviour. Participants were presented with definitions of outdoor tanning, fake tanning, and solarium use. Participants were then asked whether they had deliberately engaged in each of the tanning behaviours over the past few years, with the categorical responses of never, once or twice a year, three to six times a year, seven to 12 times, and over 12 times a year. These categories were intended to allow for the distinction between very frequent tanners, frequent tanners, "event" tanners, and nontanners. However, as frequent tanning was rare (less than 2% of participants engaged in solarium use or fake tanning 7 or more times a year and less than 5% in outdoor tanning), the responses were categorised into ever: Yes/no.

Sun-protective behaviour. Participants answered nine items assessing their use of sun-protective behaviours when in the sun for more than 15 minutes (e.g., frequency of wearing hats, time spent in the shade [Weinstock, Rossi, Redding, Maddock, & Cottrill, 2000]). Participants indicated the frequency they practiced sun protection on a 5-point Likert scale *(never, rarely, sometimes, often, and always)* with higher scores reflecting more frequent use of sun-protective behaviours (range was nine to 45). Cronbach's alpha for the scale has been reported at .78 in Australian young adults (Day, Wilson, Roberts, et al., 2014). Consistency of $\alpha = .76$ was found in the current sample.

Statistical Analysis

IBM SPSS Statistics 20.0 was used for all analyses. Separate regression analyses were conducted for each of the behaviours (hierarchical linear regression for sun-protective behaviour; logistic regression for outdoor, solarium, and fake tanning). Demographic variables and skin cancer knowledge were entered at the first step, with sociocultural variables (including acculturation) entered at step two. A series of independent sample *t*-tests were conducted to examine potential gender differences in sun-related behaviours and levels of skin cancer knowledge. *P*-values were adjusted for multiple comparisons using the Bonferroni correction.

Results

Descriptive Statistics

Descriptive statistics for the study variables are shown in Table 1. The average number of years residing in Australia for those born elsewhere (69.2%, $n = 276$) was 4.04 ($SD = 5.14$). Seventeen participants (4.3%) reported a family history of skin cancer, $n = 5$ reported they were referring to a parent. When exploring gender differences, Bonferroni's correction set the significance level at $p < .005$. Analyses revealed no significant difference between genders on age, outdoor and fake tanning

behaviour, or sociocultural tanning norm endorsement (see Table 1). Females had higher levels of sun-protective behaviour, $d = 0.84$, and reported a fairer ideal skin tone, $d = 0.70$ than males. While females had higher levels of skin cancer knowledge, $d = 0.30$, $p < .01$, and were less likely to have used a solarium, $d = 0.30$, $p < .01$, these differences did not reach statistical significance after applying Bonferroni's correction.

Table 1

Descriptive statistics for the study measures among participants (n = 399)

	Females (n = 253)		Males (n = 146)		t-test
Variable	N (%)	Mean (SD)	N (%)	Mean (SD)	
Age, mean (SD)		21.72 (2.15)		21.65 (2.40)	0.29[a]
Family history of skin cancer	13 (5.1)		4 (2.7)		
Born in Australia	78 (30.8)		45 (30.8)		
Heritage					
South-East Asian	115 (45.5)		58 (39.7)		
North-East Asian	114 (45.1)		73 (50.0)		
Southern/Central Asian	15 (5.9)		11 (7.5)		
Other	9 (3.6)		4 (2.7)		
Acculturation		2.68 (0.65)		2.65 (0.64)	0.43[a]
Sun-protective behaviour		29.96 (5.82)		25.3 (5.32)	7.95[*a]
Skin cancer knowledge		14.99 (3.81)		13.77 (4.29)	2.86[b]
Sociocultural norms (UVT)		2.69 (0.64)		2.63 (0.56)	0.87[a]
Sociocultural norms (FT)		2.71 (0.64)		2.60 (0.56)	1.84[a]
Ideal skin tone		2.96 (1.68)		4.19 (1.82)	8.87[*]
Prefer fairer skin	99 (39.1)		21 (21.2)		
Satisfied with current	87 (34.3)		61 (41.8)		
Prefer darker skin	67 (26.5)		54 (37.0)		
Ever outdoor tan	105 (41.5)		54 (36.3)		1.05[c]
Ever use solarium	19 (7.5)		25 (17.1)		8.72[c]
Ever use fake tan	30 (11.9)		19 (13.0)		0.12[c]

Note. UVT = UV tanning norms; FT = fake tanning norms.
[a]df = 397. [b]df = 274.81. [c]Chi-square analyses with $df = 1$.
[*]$p < .005$.

The Role of Sociocultural Variables in Sun-Protective Behaviour

As shown in Table 2, acculturation was not significantly associated with sun-protective behaviour when entered in the hierarchical linear regression model. At the first step, demographic variables and skin cancer knowledge accounted for 14.9% of the total variance in sun-protective behaviour. Although the final model was significant, $F(11, 396) = 7.01$, $p < .001$, the inclusion of sociocultural variables including acculturation at Step 2 was not significant. Being male, and reporting a preference for darker skin (compared to those reporting a preference for fairer skin), were significantly associated with lower levels of sun-protective behaviour in the final model.

Table 2

Summary of Hierarchical Regression Analysis Predicting Sun-Protective Behaviour

	Step 1		Step 2	
Characteristic	*b*	95% CI	*b*	95% CI
Gender				
Male		[Reference]		[Reference]
Female	**4.59*****	(3.42 to 5.77)	**4.39*****	(3.19 to 5.60)
Family history of skin cancer				
No family history		[Reference]		[Reference]
Family history	-1.65	(-4.55 to 1.25)	-1.97	(-4.88 to 0.94)
Place of birth				
Not Australia		[Reference]		[Reference]
Australia	-1.18	(-2.55 to 0.20)	-0.24	(-2.01 to 1.54)
Heritage				
South-East Asian		[Reference]		[Reference]
North-East Asian	0.55	(-0.65 to 1.75)	0.33	(-0.86 to 1.56)
Southern/Central Asia	-0.18	(-2.54 to 2.19)	-0.09	(-2.37 to 2.31)
Other	-0.10	(-3.42 to 3.21)	0.32	(-3.01 to 3.65)
Skin cancer knowledge	0.05	(-0.11 to 0.20)	0.07	(-0.08 to 0.23)
Skin tone preferences				
Prefer fairer skin				[Reference]
Satisfied with current			-0.02	(-1.41 to 1.36)
Prefer darker skin			**-1.58***	(-3.09 to -0.07)
STN score			-0.02	(-1.06 to 1.03)
Acculturation			-0.92	(-2.31 to 0.46)
R^2		.15		.17
F for change in R^2		9.74***		2.04

Note. AOR = Adjusted Odds Ratio; STN = Sociocultural tanning norms.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

The Role of Sociocultural Variables in Intentional Tanning Behaviour

Hierarchical logistic regression analyses were used to assess the ability of sociocultural variables to predict tanning behaviours, after controlling for demographic variables and skin cancer knowledge. Results of the logistic regression analyses are reported in Table 3.

Outdoor tanning. After entry of demographic and skin cancer knowledge variables, the model predicted 59.2% of the responses correctly and Cox & Snell's R^2 indicates that 3.4% of the total variance in outdoor tanning was accounted for. After entry of sociocultural variables including acculturation, the model predicted 70.8% of responses correctly, and accounted for 18.4% of the variance. Although the final model was significant, χ^2 (11) = 80.57, $p < .001$, acculturation was not a significant predictor. Outdoor tanning behaviour was reported more frequently by those with no family history of skin cancer, who were born outside of Australia, those of South-East Asian compared to Southern and Central Asian heritage, those who preferred a darker skin tone compared to those with a fair skin tone preference, and those that more strongly endorsed the sociocultural tanning norms score.

Solarium use. At Step 1 the model predicted 88.2% of the responses correctly and Cox & Snell's R^2 indicates that 14.4% of the total variance in solarium use was accounted for. The final model was significant, χ^2 (11) = 73.25, $p < .001$, predicted 88.9% of responses correctly, and accounted for 16.8% of the variance. Solarium use was more commonly reported by those of North-East Asian or "other" heritage compared to South-East Asian, those who had lower skin cancer knowledge, higher sociocultural norm endorsement, and were less Australian-acculturated.

Table 3

Summary of Hierarchical Regression Analysis Predicting Tanning Behaviour

	Ever Outdoor Tan		Ever Use Solarium		Ever Use Fake Tan	
Characteristic	AOR	95% CI	AOR	95% CI	AOR	95% CI
Step 1						
Female	1.20	(0.78 to 1.85)	**0.54***	(0.23 to 0.91)	0.92	(0.49 to 1.73)
Family Hx of SC	0.42	(0.13 to 1.40)	1.71	(0.17 to 17.43)	1.19	(0.24 to 5.82)
Born in Australia	0.64	(0.39 to 1.07)	**0.16***	(0.03 to 0.75)	1.01	(0.47 to 2.17)
Heritage						
South-East Asian	1	[Reference]	**1****	[Reference]	1	[Reference]
North-East Asian	1.19	(0.77 to 1.83)	**7.50*****	(2.78 to 20.21)	**2.11***	(1.08 to 4.12)
S/C Asian	**0.34***	(0.12 to 0.96)	1.01	(0.11 to 9.40)	0.42	(0.05 to 3.38)
Other	1.41	(0.41 to 4.80)	**7.93***	(0.64 to 98.64)	0.90	(0.10 to 7.59)
SC knowledge	1.04	(0.99 to 1.11)	**0.87****	(0.79 to 0.96)	0.98	(0.88 to 1.07)
Step 2						
Female	1.43	(0.87 to 2.33)	0.51	(0.23 to 1.11)	0.97	(0.48 to 1.96)
Family Hx of SC	**0.26***	(0.07 to 0.92)	2.41	(0.22 to 26.38)	0.82	(0.16 to 4.25)
Born in Australia	**0.26*****	(0.12 to 0.54)	0.31	(0.05 to 1.91)	0.42	(0.15 to 1.16)
Heritage						
South-East Asian	**1***	[Reference]	**1****	[Reference]	**1***	[Reference]
North-East Asian	1.50	(0.92 to 2.45)	**7.30*****	(2.62 to 20.33)	**2.62***	(1.29 to 5.31)
S/Central Asian	**0.26***	(0.09 to 0.78)	1.24	(0.13 to 11.97)	0.38	(0.05 to 3.15)
Other	1.19	(0.31 to 4.64)	**16.59***	(1.21 to 227.03)	0.62	(0.07 to 5.63)
SC knowledge	1.04	(0.97 to 1.10)	**0.90***	(0.81 to 0.99)	0.96	(0.88 to 1.05)
Skin tone preferences						
Prefer fairer skin	**1*****	[Reference]	1	[Reference]	**1***	[Reference]
Satisfied with skin	1.19	(0.68 to 2.11)	0.84	(0.35 to 2.04)	1.05	(0.42 to 2.61)
Prefer darker skin	**3.95*****	(2.14 to 7.30)	1.11	(0.42 to 2.94)	**2.71***	(1.13 to 6.51)
STN score	**2.67*****	(1.70 to 4.21)	**2.25***	(1.15 to 4.40)	**2.48****	(1.29 to 4.76)
Acculturation	1.57	(0.89 to 2.75)	**0.29***	(0.11 to 0.79)	1.63	(0.76 to 3.50)

Note. AOR = Adjusted Odds Ratio; Hx = History; S/Central = Southern/Central; SC = Skin cancer; STN = Sociocultural tanning norms.
$^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Fake tan use. After entry of demographic and skin cancer knowledge variables, the model predicted 87.9% of the responses correctly and Cox & Snell's R^2 indicates that 2.1% of the total variance in fake tan use was accounted for. After entry of sociocultural variables including acculturation, the model predicted 88.2% of responses correctly, and accounted for 8.6% of the variance. Although the final model was significant, χ^2 (11) = 35.51, $p < .001$, acculturation was not a significant predictor. Fake tan use was more prevalent among those of North-East Asian heritage compared to South-East Asian, those who preferred a darker skin tone compared to those who had a fair skin tone preference, and those with had a higher endorsement of sociocultural tanning norms.

To summarise, Australian-acculturation made a unique statistically significant contribution to the solarium use model only; for every one unit increasing in Australian-acculturation, participants were 0.29 times less likely to use a solarium. Nonsignificant trends in the opposite direction were observed for Australian-acculturation and both outdoor and fake tanning behaviour. The other sociocultural variables (skin tone preference and sociocultural tanning norms) made significant contributions to predicting each of the tanning behaviours. Two additional analyses were conducted in order to understand how these sociocultural variables related to acculturation. Results of a one-way Analysis of Variance indicate that level of Australian-acculturation differs significantly by skin tone preferences, $F(2,398) = 5.48$, $p = .004$. Tukey's HSD post-hoc comparisons indicate that those with a preference for fair skin tone had lower levels of Australian-acculturation ($M = 2.52$, $SD = 0.58$) than both those who were satisfied with their skin tone ($M = 2.71$, $SD = 0.65$), and those who preferred a darker skin tone ($M = 2.78$, $SD = 0.68$). Bivariate correlations indicate medium to strong relationships between Australian-acculturation

and higher endorsement of both the sociocultural UV tanning norm score and the sociocultural fake tanning norm score, $r = .36$, $p < .001$, and $r = .45$, $p < .001$, respectively.

Discussion

The primary aim of this study was to examine the role of sociocultural influences, including Australian-acculturation, in sun-related behaviours among Asian Australian young adults. Contrary to our hypotheses, acculturation was not significantly associated with sun-protective behaviour, outdoor tanning, or fake tan use when included in multivariate regression analyses. Further, solarium use was associated with acculturation in the opposite direction than expected; solarium use was more likely among those who were less Australian-acculturated. Recent Australian studies have reported low rates of solarium use among Caucasian participants, and it is possible that the present results are a reflection of a downward trend in solarium use in Australian culture (Francis, Dobbinson, Wakefield, & Girgis, 2010). Interestingly, although perceptions of sociocultural endorsement of tanning were associated with solarium use, personal skin tone perceptions (i.e. preferring tanned skin tone versus fair skin tone) were not. Furthermore, the final model explained a modest 16.8% of variance in solarium use. It is possible, therefore, that there are other factors motivating solarium use besides appearance, such as perceived health or wellbeing benefits (Ezzedine et al., 2008; Levine et al., 2005).

Research conducted in Australia involving those of Asian heritage indicates attitudinal and behavioural differences with regards to sun-related behaviours (Brock et al., 2013; Day, Wilson, et al., 2014a; Jang et al., 2013). Previous work has found an association between acculturation and sun-related behaviour in individuals with Asian and Hispanic heritage in the United States (Coups et al., 2012; Coups et al., 2013;

Gorell et al., 2009). It is unclear why similar results were not found in this study, although this is possibly due to the inclusion of additional sociocultural variables in this paper. Though acculturation was not associated with behaviours, other sociocultural variables were, namely: Preference for a tanned appearance and endorsement of sociocultural tanning norms. Acculturation was moderately to strongly associated with these other sociocultural factors, and it is possible that their presence "captured" the variation in Australian-acculturation. Future research is warranted to further examine the association between acculturation and sun-related behaviours in Asian-Australians; longitudinal research exploring trends over time spent in Australia are likely to be informative, and qualitative interviews may improve understandings of the transition from living in Asia to Australia, and how tanning behaviour and skin cancer knowledge may or may not change.

Experts differ regarding the measurement of acculturation, although some suggest multi-item unidimensional approaches (e.g., the scale used in this study which scores participants on a continuum from Asian-acculturated to Australian-acculturated), other advocate dimensional methods (i.e. Asian-acculturated and Australian-acculturated as independent identifications; see Andrews, Bridges, & Gomez, 2013; Schwartz, Unger, Zamboanga, & Szapocznik, 2010). The unidimensional measure used in the current study has been previously used in skin cancer research (Gorell et al., 2009), and measures a variety of domains of acculturation including language preferences of the participant, ethnic origin of peers and parents, as well as cultural preferences regarding food, film, and music (Suinn et al., 1992). However, recent research involving skin cancer related behaviours of Hispanics in the United States measured (linguistic) acculturation using a bidimensional approach (Coups et al., 2013). Although we also measured participants'

bidimensional acculturation (Asian-acculturated, bicultural, or Australian-acculturated), analyses revealed similarly nonsignificant results as those reported in the current study (unpublished data).

A number of demographic and social factors were associated with sun-related behaviours, and these were largely consistent with research involving Caucasian populations. Preference for tanned skin tone was associated negatively with sun-protective behaviour, and positively with outdoor and fake tanning. Similar to other studies, endorsement of sociocultural tanning norms was associated with each of the tanning behaviours (e.g., Cho et al., 2010; Wichstrøm, 1994). This suggests that perceptions of tanned skin as an attractive ideal influences Asian Australians sun-related behaviour, and is an important potential area of focus in this group. Research is beginning to emerge that supports models of tanning behaviour that explain behaviour from a body image perspective (Cafri et al., 2009; Day, Wilson, et al., 2014b). Further, interventions that focus on the negative effects of UVR exposure on appearance show promise in Caucasian samples (e.g., Hillhouse et al., 2010; Mahler et al., 2008). Given the results of this paper, it is recommended that the appearance motivations behind skin cancer related behaviour among those of Asian heritage continues to be explored, and appearance-focused interventions are considered.

Skin cancer knowledge was not associated with sun-protective behaviour or any of the tanning behaviours. However, skin cancer knowledge levels in this group were low; on average females answered approximately 60% of items correctly, and males answered approximately 55% correctly. These rates are lower than has been reported by Caucasian Australian young adults using the same scale (Day, Wilson, Roberts, et al., 2014). Low skin cancer knowledge may influence the delayed diagnosis seeking of those of Asian heritage with skin cancers, which may in turn

contribute to poorer prognostic outcomes (Bellew et al., 2009; Bradford et al., 2009). Thus, it is imperative we improve skin cancer knowledge in this group. As a large proportion of Asian Australian migrants arrive in Australia during their adult years as students, they have missed important Australian skin cancer prevention interventions aimed at children (Montague et al., 2001). The migration process may be a viable opportunity to provide information on the risks of tanning and the importance of adequate sun protection. Further, Australian universities could incorporate brief skin cancer education into their pre-existing induction programs for international students.

Although being male was associated with lower levels of sun protection, there were no significant gender differences in any of the other multivariate sun-related behaviour analyses. These findings differ from what is typically seen in studies with Caucasian populations, where females typically engage in higher amounts of all three tanning behaviours (Day, Wilson, et al., 2014b; Dissel et al., 2009; Stapleton et al., 2008; Yoo & Kim, 2012). Importantly, the prevalence of outdoor and fake tanning behaviours in this sample, particularly among the females, are lower than those of Caucasian young adults (e.g., Day, Oxlad, et al., 2013; Day, Wilson, et al., 2014b). The lack of statistically significant gender differences in the present sample may be due to the lower than typical variance in female behaviour. Future research should continue to examine the sun-related behaviours of this sample, particularly to understand why the male fake and solarium tanning prevalence was higher than expected.

There are several limitations to the current study. The majority of participants were of South-East Asian or North-East Asian heritage, which limits the conclusions that can be drawn regarding associations between heritage and sun-related behaviours. As this study is cross-sectional in design, inferences cannot be drawn regarding the

evolving role Australian-acculturation may play with regards to sun and skin cancer related attitudes, knowledge, and behaviours. The average length of time participants born outside Australia had been in the country was 4 years; it is possible that a portion of the sample had poor English comprehension and were unable to understand all of the survey questions, however as the sample was recruited from a University population, we would expect language effects to be minimal. Future research should consider offering surveys in multiple languages, or including an option for participants to record if and when they do not understand any of the survey questions.

The results of this study suggest that Asians living in Australia are a group at risk of skin cancer; the majority of participants are not regularly engaging in sun-protective behaviour, and a notable proportion of the sample report engaging in outdoor and/or solarium tanning. Further, participants' low skin cancer knowledge levels are of concern. Similarly to Caucasian young adults, sociocultural appearance considerations appear to be central to understanding deliberate tanning in those of Asian heritage. It is therefore recommended that health practitioners be cognizant of the potential for skin cancer in this group, and consider providing relevant skin cancer information provision, highlighting the risks of the "Australian sun" as well as the potential for skin cancer among those of Asian heritage. Further, research should continue to explore appearance-related beliefs associated with tanning behaviours in this population, in order to determine best avenues for intervention.

6.3. Final Remarks

Results indicated that young adult Asian Australians are not regularly engaging in sun protective behaviour, and a notable proportion of the sample reported engaging in outdoor and/or solarium tanning. Consistent with the previous paper, there were low levels of skin cancer knowledge in the present sample, and knowledge was not associated with sun protection or tanning behaviour in this group. Based on the low levels of skin cancer knowledge found in this sample, it is recommended that health practitioners in Australia consider providing relevant skin cancer information provision to Asian Australians, highlighting the risks of the Australian sun as well as the potential for skin cancer among people of Asian heritage. Sociocultural tanning norms and skin tone perceptions were significantly associated with tanning behaviours in multivariate regression models, however acculturation was not. It is unclear why acculturation was not significantly related to tanning behaviour, and future research may consider exploring this relationship further. These results suggests that theoretical models that address appearance aspects of tanning behaviour may predict tanning behaviour in Asian Australians, and future research may consider conducting cross-cultural validation of Tripartite Influence Model pathways identified in Chapter 4. Further, due to the centrality of appearance factors in sun-related behaviour, appearance-based interventions, such as those that focus on the detrimental appearance effects of UVR exposure (e.g., wrinkles), or those that use UV photography interventions to show UVR damage to the skin that is not visible to the “naked eye”, may have utility among Asian Australians.

CHAPTER 7. CONCLUSION

7.1. Overview

The aim of this research was to test and validate predictors that contribute to young adults' sun-related behaviours (namely sun-protective behaviour, tanning behaviours, and incidental sun exposure). The studies reported in this thesis examined the role of skin cancer knowledge in explaining sun-related behaviour, explored the potential of sociocultural tanning norms and skin tone perceptions to explain individual differences in tanning behaviour, and considered these predictors in both Caucasian Australian and Asian Australian samples.

A systematic review of the literature and four quantitative studies were conducted, resulting in the five papers that are central to this thesis. Outcomes of the studies suggest that skin cancer knowledge has a role in sun-related behaviours, albeit small. Further, understanding this relationship is complicated by low levels of knowledge in the population, particularly among those of Asian heritage. Sociocultural norms and skin tone ideals predicted sun-related behaviours better than skin cancer knowledge in young adult samples, across cultural groups.

This final chapter reviews the findings of each study, examines the theoretical implications of this work to the field of skin cancer prevention, considers limitations of the presented studies, and outlines recommendations for future research.

7.2. Review of the Thesis Findings

7.2.1. Systematic Review of the Literature

There has been a significant Australian government investment in increasing skin cancer awareness (Australian Department of Health, 2010), despite a lack of consistency in previous reports of the relationship between skin cancer knowledge and sun-related behaviours (e.g., Hart & DeMarco, 2008; Keeney et al., 2009; Saraiya et

al., 2004). A systematic review of quantitative studies that assessed empirical evidence on the correlation between skin cancer knowledge and sun-related behaviours in the general population was conducted and reported in Chapter 2. Results from the 34 studies that met the inclusion criteria indicated a significant positive correlation between the level of skin cancer knowledge and sun-protective behaviour in 67% of the studies included, with generally small to moderate effect sizes. Results were less straightforward regarding tanning behaviour and sun exposure: Four of eleven tanning behaviour studies reported a relationship in the opposite direction expected, with higher skin cancer knowledge correlated with increased engagement in tanning, and four of six sun-exposure relationships were nonsignificant.

Results also suggest a number of important deficits in the general population's skin cancer knowledge, including low knowledge of the future impact of severe sunburns (Felts et al., 2010), or faulty beliefs about the necessity and/or utility about sun-protective methods (de Vries et al., 2005). Overall, the capacity to determine the impact of knowledge was compromised by heterogeneity in approaches taken to measure both skin cancer knowledge, as the predictor, and sun-related behaviours, as the outcome.

The review also highlighted the need for a standardised, multi-item measure of skin cancer knowledge for use in future research. Skin cancer knowledge is a multifaceted construct, however over 25% of the included studies measured skin cancer knowledge using five items or less. Furthermore, the area of skin cancer knowledge measured varied between studies, including those that focus exclusively on knowledge of sun protection, risk factors of skin cancer, or skin cancer prevalence. Additionally, unique measures of skin cancer knowledge were used in 32 of the 34 studies; the exception being consecutive studies by the same authors (Felts et al.,

2010; Vail-Smith & Felts, 1993). It was concluded that consistency in measurement in future research would allow for meaningful comparisons across groups and times.

Analysis of data from the systematic review suggested skin cancer knowledge is a significant positive predictor of sun protection behaviour and, consequently, should be included in interventions targeted at decreasing skin cancer incidence. The deficits in skin cancer knowledge reported indicate that there is room for improvement in the general population's skin cancer knowledge, and interventions that successfully improve skin cancer knowledge may increase sun-protective behaviour and decrease tanning behaviour.

7.2.2. The Influence of Knowledge on Sun-Related Behaviour – Validation of a Novel Measure

Based on the findings of the systematic review, the Skin Cancer and Sun Knowledge (SCSK) scale was developed and tested, and this study is reported in Chapter 3. The 25-item SCSK scale was found to have face and content validity, incremental validity over two pre-existing measures, and good 2-week test-retest reliability in a sample of $N = 514$ young adults reporting Western heritage. As hypothesized, skin cancer knowledge (as measured by the SCSK) was associated with outdoor tanning, sun exposure, and sun-protective behaviour in women in the sample. However, skin cancer knowledge, skin type, and demographic variables accounted for only a modest amount of variance (12.3 to 23.2%) in the three sun-related behaviours. The failure to discern a relationship between skin cancer knowledge and sun-related behaviour in men suggested that knowledge may not be a relevant factor in the sun-related choices of Australian young men. These results indicated the need for consideration of additional factors, beyond skin cancer knowledge, in order to understand the sun-related behaviours of male and female young adults.

7.2.3. Social Normative Influences and Internalisation of a "Tanned Ideal" as Predictors of Skin-Cancer Related Behaviour

The purpose of the study reported in Chapter 4 was to consider other variables, besides skin cancer knowledge, that might explain young adults' tanning behaviour. Previous research examining predictors of sun-related behaviours has established that social norms and appearance-related concerns are associated with tanning behaviour (e.g., Cafri et al., 2006; de Vries et al., 2005; Hillhouse et al., 2000). This study considered tanning behaviour from a body image perspective, adapting the Tripartite Influence Model (Thompson et al., 1999b) of disordered eating to tanning norms and behaviours in a sample of young adults ($N = 246$) who reported a Western heritage. Survey data were collected to determine whether internalisation of a tanned ideal mediated the relationship between endorsement of sociocultural (peer, family, and media) tanning norms (both injunctive and descriptive) and subsequent tanning behaviour in both young adult females and males.

Results from the study reported in Chapter 4 indicate that predictors based on the Tripartite Influence Model successfully explain at least part of the variance in tanning behaviour among young Western women. Moreover, internalisation of a tanned ideal mediated the relationship between injunctive and descriptive peer norms and both outdoor and fake tanning behaviours in young women; the relationship between endorsement of the injunctive family tanning norm ("my family likes the way I look when I am tanned") and both outdoor and fake tanning was mediated by internalisation of a tanned ideal, as was the relationship between endorsement of perceived injunctive media norm ("The media portrays images of people who have been or are using fake/chemical tanning products to look tanned") and fake tanning behaviour. The descriptive family tanning norm was not associated with either outdoor

or fake tanning behaviour, and media norms were not associated with outdoor behaviour. The lack of descriptive family norm influence may be due to the age of the participants; young women may be less influenced by the behaviour of their families than their peers. Alternatively, the nonsignificant result may be due to the tendency for highest levels of tanning behaviour to occur among young adults, thus family members may engage in less of these behaviours, and subsequently be less influential than peers. Although participants strongly endorsed that the media cultivates a tanned ideal (injunctive norm), and this was associated with internalisation of a tanned ideal, the norm was not associated with outdoor tanning behaviour. As the study was cross-sectional, it is not possible to determine the direction of the association; thus, it may be that those who internalise a tanned ideal are more likely to be aware of the media's cultivation of such an ideal, rather than the perceived media tanning norm leading to internalisation of such an ideal, as is assumed by the model.

Internalisation of a tanned ideal did not mediate relationships between sociocultural norms and tanning behaviour in the male group; although the results suggest that young men do desire a tanned appearance, and that peer sociocultural norms are associated with male tanning behaviour. Discussion of male sun-related behaviour is considered in more detail below (Section 7.2.4). Overall, results indicated that although both genders internalise a tanned ideal, influences on the decision to engage in tanning behaviour are gender specific.

7.2.4. Cultural Background and Sun-Related Behaviour

Although skin cancer prevention has received much funding and attention in Australia, this is not the case in Asian countries (Montague et al., 2001). There are differences in the prevalence and presentation of skin cancers based on ethnicity; those of Asian heritage have a lower risk of skin cancer but poorer prognoses than

Caucasians (Bellew, Del Rosso, & Kim, 2009; Bradford, Goldstein, McMaster, & Tucker, 2009). Although a tanned ideal is a pervasive cultural norm in a number of Western cultures including Australia and the United States (e.g., Dixon, Dobbinson, Wakefield, Jamsen, & McLeod, 2008; Hunt et al., 2012; Sahn, McIlwain, Magee, Veledar, & Chen, 2012), it is common for fair skin to be heralded as a beauty ideal in a number of Asian societies (Glenn, 2008; Li et al., 2008). Thus, two studies included in this thesis explored the potential for Asian cultural background to be protective against sun-related behaviours among young university students.

The study reported in Chapter 5 explored the same variables as in Chapters 3 and 4 (namely, skin cancer knowledge, sociocultural tanning norms, skin tone preferences, and sun-related behaviours) in a sample of young adults of Asian heritage (N = 140). Over half of female participants and over 30% of male participants reported having deliberately tanned outdoors at least once in the previous few years, and participants of both genders averaged at least one severe sunburn in the previous 12 months. Results indicated that tanning behaviour was more likely among those who endorsed Western sociocultural tanning norms, and that perceptions of peer tanning norms were particularly influential. Knowledge about skin cancer was not associated with sun-related behaviour. It is important to consider this finding in light of the considerable knowledge deficits of this group; on average participants answered approximately 60% of the knowledge items correctly.

Outcomes of the study reported in Chapter 5 indicated that further investigation of sun-related behaviours in Asian Australians was warranted. The aim of the final study, reported in Chapter 6, was to consider the role of sociocultural variables, including Australian-acculturation, in the prediction of participation in sun-related behaviours among young adults who identified as Asian Australian or as a

person with Asian heritage living in Australia (N = 399). Based on the results of reported in Chapters 3 to 5, as well as research involving those of Asian and Hispanic heritage living in the United States (Coups et al., 2012; Coups et al., 2013; Gorell et al., 2009) it was hypothesised that, after controlling for demographic variables and skin cancer knowledge, Australian-acculturation, sociocultural tanning norm endorsement, and preference for a tanned appearance would be associated with lower rates of sun-protective behaviour and higher rates of tanning. Interestingly, acculturation was not significantly associated with sun-protective behaviour, outdoor tanning, or fake tan use. Due to differences in sun-related behaviour and skin cancer patterns reported between those in Asian versus predominantly Caucasian countries (Bellew et al., 2009; Bradford et al., 2009; Hunt et al., 2012), and the significance of acculturation in sun-related behaviours among those of Asian and Hispanic heritage in the United States (Coups et al., 2012; Coups et al., 2013; Gorell et al., 2009), future research is warranted to further examine the role of acculturation in the sun-related behaviours of Asian Australians. Exploration of trends in sun-related behaviours over time spent in Australia is likely to be informative, and future research might consider a stratified random sampling approach to ensure an approximately even spread of length of time participants have lived in Australia. Explicitly asking participants about their perceptions of skin tone attractiveness and if/how this has changed over time, as well as measuring sun-related behaviours both when living in Asia and in Australia, would likely be an improvement on the current research. Furthermore, qualitative interviews may improve understandings of the role of transitioning from living in Asia to Australia in skin cancer beliefs and sun-related behaviours, would allow for exploration of issues in a level of depth and detail unable to be attained using quantitative methods (Merriam, 2002), and may inform development of subsequent

measures of Asian Australian sun-related behaviour.

Internalisation of skin tone perceptions that value dark over fair skin and endorsement of sociocultural tanning norms that favour darker skin were significantly associated with tanning behaviour in the final statistical model. The results of the study reported in Chapter 6 supported findings reported in Chapter 5 that suggested those with Asian heritage living in Australia are a group at risk of skin cancer; the majority of participants were not regularly engaging in sun-protective behaviour, and a notable proportion of the sample reported outdoor and/or solarium tanning behaviour. Similarly to findings reported in Chapter 5, participants' low levels of skin cancer knowledge are of concern. These results indicate the pervasiveness of the relevance of social appearance norms and perceptions in tanning behaviour across cultural groups.

7.3. Implications

7.3.1. The Need for Continuing Skin Cancer Prevention Education

This series of studies contributes to understanding the role of skin cancer knowledge in behaviour. Increasing disease knowledge is one of the key aims of public health campaigns (Cancer Council Australia, 2014b; Montague et al., 2001), and Australia is renowned for decades of public health campaigning regarding skin cancer (Buchanan, 2013; Montague et al., 2001). Given the large expenditure on such campaigns (Australian Department of Health, 2010), it is crucial to understand skin cancer knowledge levels and the impact skin cancer knowledge has on sun-related behaviours. The first two studies presented in this thesis (Chapters 2 and 3) highlight the need for consistent measurement of skin cancer knowledge in the research literature. This is necessary to enable meaningful comparisons across populations, and to ensure that, when referring to skin cancer knowledge, researchers are discussing the same construct (versus, for example, skin cancer awareness). The development of a

comprehensive skin cancer knowledge measure (Chapter 3) will benefit researchers continuing in the area.[1]

Despite attempts to explain the role of skin cancer knowledge and sun-related behaviour in this series of studies, the relationship remains unclear. Collectively, the findings from these studies provide evidence of a small association between skin cancer knowledge and sun-protective behaviour, and a relationship between higher skin cancer knowledge and healthier sun-related behaviours (i.e. higher levels of sun protection and lower levels of tanning) in females. However, it is important to acknowledge that skin cancer knowledge was not related to sun-related behaviours in male samples of both Western and Asian heritage. This may be due to differential relevance of knowledge in the behavioural choices of men and women. Women have more interest in health than males (Green & Pope, 1999), and are more likely to engage in health promoting behaviour such as sun protection and skin cancer screening (see review by Kasparian et al., 2009). Thus, it is possible that knowledge of the threat of skin cancer is of minimal perceived importance to males, and other factors such as appearance motivations to "achieve" a tan or perceived barriers to use sun protection are more relevant to male sun-related behaviour. Alternatively, floor effects may have been present; Western heritage Australian females had significantly higher levels of skin cancer knowledge than the other participant groups. Based on these findings, interventions should continue to focus on improving skin cancer knowledge, beyond disease awareness, particularly among young men and those of Asian heritage.

[1] Evidence suggests that there is interest in such a scale, with two international researchers (in Iran and Turkey) requesting permission to use the SCSK scale in their own research (S. Kabir, personal communication, May 15, 2014; M. Öztürk Haney, personal communication, April 19, 2014).

There are high levels of skin cancer awareness in Australia, and awareness campaigns have been shown to increase presentation for professional skin examinations in the short term (Baade et al., 1996; Lowe et al., 1994). Beyond disease awareness, knowledge is important for long-term health protective behaviour (e.g., Frisch et al., 2012; Nutbeam, 2000; von Wagner et al., 2007). The results presented in Chapters 3, 5, and 6 indicate deficits in both procedural sun protection knowledge (such as when or how to use sunscreen effectively) and declarative skin cancer knowledge (such as knowledge of rates and signs of skin cancer) among young adults of both Caucasian and Asian heritage. Recent research involving beachgoers in Spain has found similar results; with high awareness of the link between sunlight and skin cancer, but poor knowledge of the meaning of "SPF" (Cercato et al., 2014). Australia is in a strong position to decrease skin cancer rates; solarium use will likely decrease as nationwide commercial solarium bans come into effect in 2015 (Sinclair, Makin, Tang, Brozek, & Rock, 2014), and recent health campaigns have begun to move beyond awareness of the link between sun exposure and skin cancer (Buchanan, 2013; Cancer Institute NSW, 2014). Because there are high levels of awareness regarding the link between sun exposure and skin cancer, it is recommended that more sophisticated education campaigns be disseminated to the general population, providing specific information including explanation of the meaning of SPF, how to use sunscreen for maximum protective benefit, and how to identify a skin cancer. Since 2010, *The Dark Side of Tanning* campaign has run in six of the eight Australian States and Territories; this campaign highlights the consequences of skin cell damage, and the (1mm) depth of mole sufficient to cause metastasis (Cancer Institute NSW, 2014; Volkov, Dobbinson, Wakefield, & Slevin, 2013). Although such a campaign shows promise in disseminating knowledge beyond disease awareness, research needs to evaluate its

effect(s).

7.3.2. Female Tanning is a Body Image Behaviour

The work presented in this thesis supports the proposition that sociocultural appearance considerations are central to understanding tanning behaviour. The third study (Chapter 4) tested key components of the Tripartite Influence Model of disordered eating, adapted to tanning behaviour. Results indicate that pathways described by the model, particularly those involving endorsement of peer tanning norms, successfully predict tanning behaviour in young women. This has important implications for the theoretical conceptualisation of female tanning behaviour. Building on other work that has considered sociocultural influences on tanning behaviours (e.g., Cafri et al., 2008; Geller et al., 2002; Hillhouse et al., 2000; Hillhouse et al., 2010; Hoerster et al., 2007; Stapleton et al., 2008), there is increasing evidence to suggest that tanning can be considered as an appearance-control behaviour, similar to that of disordered eating (Stapleton et al., 2010; Thompson, Ata, Roehrig, & Chait, 2012). Thus, the results reported in Chapter 4 indicate that there is real potential for body image theories developed to predict disordered eating to add value in understandings of tanning behaviour, and subsequently provide avenues for intervention.

Strategies for intervention or prevention of disordered eating have included increasing awareness of the deleterious effects of social comparisons (Shaw & Waller, 1995), and having individuals actively engage in thoughts and behaviours to counter internalisation of a thin ideal (Stice, Mazotti, Weibel, & Agras, 2000). Similar techniques have been successfully incorporated in some sun-related behaviour interventions. For example, Mahler and colleagues (2008) found that providing information regarding injunctive and descriptive norms enhanced the efficacy of a sun

protection intervention in young adults. Similarly, Reid and Aiken (2013) found that correcting misperceptions of injunctive norms motivated sun-protective intentions. Furthermore, interventions that aim to counter tanned ideals show promising results (e.g., Cox et al., 2009; Hillhouse, Turrisi, Stapleton, & Robinson, 2008; Jackson & Aiken, 2006). The present research informs the utility of tanning prevention interventions that focus on sociocultural appearance considerations through clarification of pathways that predict tanning behaviour. Based on the present work, it is recommended that tanning intervention strategies in young women continue to target skin tone ideals and sociocultural tanning norms.

Although the application of the Tripartite Influence Model theoretical framework has important implications for consideration of female tanning behaviour, a fully adapted version of the Tripartite Influence Model was not tested in the current research. Importantly, the work in Chapter 4 focused on the mediational pathway of internalisation of a tanned ideal. Another key aspect of the Tripartite Influence Model that was not considered involves participants' tendency to make physical appearance comparisons. This was not assessed in the present work, and future research should explore whether the full model is successful in predicting tanning behaviour. Previous research has used the Physical Appearance Comparisons scale to assess appearance comparisons in disordered eating behaviour (Shroff & Thompson, 2006; van den Berg et al., 2002), however creation of a measure that addresses skin tone comparisons is likely to add value to testing the predictive validity of the full model.

Notwithstanding the potential benefit of a fuller exposition of the Tripartite Influence Model and tanning, the centrality of sociocultural tanning norms as well as skin tone ideals and perceptions in predicting tanning behaviours across each of the studies presented in Chapters 4 to 6 suggests that tanning is a body image behaviour.

Furthermore, this supports the increasing evidence that interventions with an exclusive focus on health-related factors are unlikely to decrease tanning behaviour in young women (see review by Williams et al., 2013). Moreover, research suggests that multi-component appearance-related tanning interventions are effective among those of low skin cancer knowledge (Stapleton et al., 2010). Rather than considering appearance motivation as a factor relevant to tanning, consideration of body image issues is more likely to lead to superior understanding of tanning behaviour among female young adults than considering the behaviour from an exclusively health-related perspective.

7.3.3. Considering Australia's Cultural Diversity

Situated in the Asia-Pacific region, Australia has a large proportion of temporary and permanent migrants from Asian countries (Australian Bureau of Statistics, 2011). Furthermore, international students account for more than 20% of all enrolments in Australian universities and the vast majority of international students in Australian universities have Asian heritage (Australian Education International, 2012; Universities Australia, 2013). Asian Australians are an under-represented group with regards to skin cancer prevention research; there is an absence of research exploring the rates of skin cancer among those of Asian heritage living in Australia, although evidence from other Western locations indicates that Asian Australians may be at elevated risk compared to their home nations residents (Chuang et al., 1995; Nasseri et al., 2007). The research involving Asian Australians presented in Chapters 5 and 6 provides a foundation for continued research. Similarly to Caucasian Australians, sociocultural tanning norms and skin tone perceptions were significantly associated with tanning behaviours among Asian Australians; those who endorsed tanning norms and internalised a tanned ideal were more likely to engage in tanning behaviours, particularly in females. Thus, it appears that appearance-focused interventions may be

successful in promoting healthier sun-related behaviours among female Asian Australians, and potentially males as well.

As discussed in Section 7.2.1, knowledge has an important, though small, influence on health behaviours (e.g., Nutbeam, 2000; von Wagner et al., 2007). The present work highlights the concerningly low levels of skin cancer knowledge among Asian Australians (see Chapters 5 and 6). It is recommended that future research focus on improving skin cancer knowledge in Asian migrants to Australia (see Chapter 6 for a discussion of recommendations). An intervention targeting Asian international students recently enrolled in Australian universities is likely to be beneficial in regards to encouraging healthy sun-related behaviour while living in Australia.

7.3.4. Sun-Related Behaviours Differ Fundamentally Between Genders

One of the most important insights from the work presented in this thesis is that sun-related behaviours differ significantly between young men and women. A common observation through the research reported here is that female sun-related behaviour was consistently better predicted by the variables incorporated than that of their male peers. A possible explanation is that young men's sun-protective and outdoor tanning behaviour are less influenced by skin cancer knowledge, sociocultural normative tanning perceptions, or personal skin tone preferences and ideals than female's. However, the Tripartite Influence Model has been shown to predict males' body image and perceptions of body shape (Karazsia & Crowther, 2010; Smolak et al., 2005; Tylka, 2011). Further, in addition to the present research, previous work has found that males endorse ideals that highlight the attractiveness of tanned skin (e.g., Banerjee et al., 2008; Broadstock et al., 1992). Thus, it appears unlikely that the consistency of nonsignificant results reported in these studies is due to the failure of these variables to influence male behaviour.

The nonsignificant associations between sun-related behaviours and skin cancer knowledge, sociocultural norms, and skin tone perceptions may have been due to small (under-powered) male sample sizes (see Chapters 4 and 5). Alternatively, the sun-related behaviour measures used in this series of studies may not be adequately constructed to capture the behaviours of young adult males. For example, items that measure tanning behaviour are based on ideals largely consistent with how females behave when seeking a tan (i.e. "sunbathing", or deliberately going outside to spend time in the sun for the purposes of getting a tan; e.g., Bränström, Brandberg, Holm, Sjöberg, & Ullén, 2001; Cafri et al., 2009; Yoo & Kim, 2012). Male tanning behaviour is likely to be more complex, and hence more difficult to capture using traditional measurement approaches.

Typical outdoor behaviour for young men involves the engagement in a variety of activities; whether organised (e.g., a team sport) or more informal (e.g., jogging, cycling, or informal sports games with friends). Existing research indicates that males are less likely than females to use sun-protective methods (see review by Kasparian et al., 2009), or are more likely to use them inappropriately, such as applying sunscreen only after becoming aware of being sunburnt (Abroms et al., 2003). It is certainly possible that males might see time spent outdoors as an opportunity to develop a tan, and may choose not to engage in sun protection, or be less motivated to engage in sun protection, due to the perceived benefits of a tan. Alternatively, young males might not be cognizant of the effects of the sun on both their immediate appearance and subsequent skin cancer risk; knowledge levels were low in the male samples in this research. Importantly, however, the main purpose of being outside during those times was likely not to seek a tan, but to engage in another activity (Arthey 1996 dissertation, as cited in Clarke et al., 1997; Potente, Coppa, Williams, & Engels,

2011). As the given outdoor activity is the "cause" for going outside, males would, perhaps rightly, not consider that action to be a deliberate outdoor tanning "event". Although a tan might not be explicitly sought, it may nevertheless be encouraged or welcomed by using the "opportunity" of being outdoors to expose unprotected skin to the sun. It is likely we are failing to capture male skin cancer risk behaviour by asking how many times they have tanned outdoors, or even how many times they have exposed their bodies to the sunlight for the purposes of getting a tan, and this should be considered when interpreting the reported results. There is, therefore, scope for refinement of the measurement of male run-related behaviour to account for this is future research.

7.4. Limitations

Some aspects of the study designs, sampling framework, and the measures used limit interpretations, generalizability, and conclusions that can be drawn from the results of the presented studies. These have been discussed in each of chapters and papers presented, and are summarised here.

7.4.1. Study Design

Apart from the systematic review of the literature reported in Chapter 2, each of the studies in this series involved data from online surveys; all were cross-sectional in design and only one followed up sun-related behaviour at a later point in time (Chapter 4). Although young adult populations were the target group considered in this research, the systematic review reported in Chapter 2 included all age groups because of the small literature size. Only two out of 34 studies reviewed involved exclusively young adult samples, and it is important to consider the findings of the systematic review in that context (general population) when drawing comparisons with the remainder of the presented studies, which specifically examined the behaviours of

young adults. Generalizability for the results reported in Chapters 3 to 6 is restricted to university students; however, young adults are a group with high levels of participation in behaviours that impact skin cancer risk (D. B. Buller et al., 2011; Heckman et al., 2013; Wickenheiser et al., 2013), and other studies reporting similar information have also used university student samples, which makes research comparisons meaningful (Cafri et al., 2008; Hillhouse et al., 2010; Spradlin et al., 2010; Stapleton et al., 2008). Future research should consider the sun-related behaviours of young adult Australians from diverse backgrounds, including those without tertiary (beyond school level) education.

7.4.2. Measurement Issues

The research presented here encountered the same measurement issues that are common in the field. The self-report nature of the sun-related behaviour measures used in the present research attracts broad criticism because of concerns over recall accuracy and measurement heterogeneity (see Glanz et al., 2008). Although rigorous measures, such as UV dosimeters and sun protection or tanning diaries, may have yielded more reliable results, it was concluded that respondent burden would be too great, and would risk a significantly compromised sample size. Where possible, sun-related behaviour and determinants thereof, were measured using validated, multi-item, self-report measures (Glanz et al., 2008; Weinstock et al., 2000). It has subsequently been argued that open-ended self-report measurement of sun-exposure and tanning behaviour is preferable to the standardised measure of sun exposure used in the current thesis (Hillhouse et al., 2012). Research conducted analysing differences in sun-related behaviours measured with behaviour diaries, standardised measures, and end-of-summer open-ended items found poor concordance between the standardised measure of sun exposure used in this thesis and a diary measure, with the standardised

measure overestimating summer-long exposure by 66% (Hillhouse et al., 2012). It is argued that variables influencing sun exposure, such as location, weather, or activities, make capturing summer long exposure by asking for average weekday and weekend sun exposure difficult for participants to accurately compute (Hillhouse et al., 2012). The research provides a strong argument for open-ended measurement, asking participants the days outside during peak UV times over summer, then the total hours outside over summer. However, it is important to consider potential coding difficulties with this format of response; establishment of standard practices for dealing with responses given as a range (e.g., responses given as "between three to four hours") versus a discrete numeric answer (e.g., "3" or "4") would be valuable. Although the results reported in Chapter 4 reflect a move to measurement utilising open-ended tanning questions, future researchers should also consider asking open-ended questions to capture incidental sun exposure. The measurement of sun-related behaviours continues to evolve, and research emerging in the United Kingdom utilising smartphone technology that allows instantaneous data recording shows promise as a quick, reliable measurement tool for both sun exposure and protection (Rodrigues, Sniehotta, Birch-Machin, & Araujo-Soares, 2014, April). Other emerging technologies should also be examined for their utility as data collection tools.

The Skin Tone Rating Scale (Prichard et al., 2013) was used to measure skin tone preferences and ideals. The scale presents a series of figures with skin tones ranging from fair to very tanned, and was developed from a modification to the Body Image Figure Rating Scale (Stunkard, Sorensen, & Schulsinger, 1983). This innovative method for considering skin tone perceptions is a quick, easy to understand measure, with sound theoretical groundings in the body image literature. Unfortunately, the scale is not available with colour gradient information, which

impedes validity of the skin tone range. Furthermore, feedback from participants indicated that the fairest skin tone on the scale was darker than their own skin tone, which may impede its generalisability to those with very fair skin. In addition to increasing the range of potential skin tone shades, it is suggested that scales are developed for different ethnic groups for use in future research, to account for differences in skin colouring across races.

7.5. Future Research Directions

7.5.1. Multifaceted Tanning Interventions for Young Women

Whether interventions considering tanning from a theoretical body image perspective are successful has been neither substantiated nor refuted by the results of this research. However, if evidence continues to validate the utility of the theoretical models that explain disordered eating for the prediction of tanning behaviour, implementation of interventions that address those relevant constructs could be considered.

Interventions that focus on body dissatisfaction, internalisation of thin ideals, and social comparisons have impacted disordered eating behaviours among young adult women (Shaw & Waller, 1995; Stice et al., 2000). Those interventions targeting appearance aspects of tanning, including interventions that use UV photography to illustrate the negative impact UVR exposure has on appearance via the development of sunspots and wrinkles (e.g., Gibbons, Gerrard, Lane, Mahler, & Kulik, 2005; Mahler, Kulik, Gerrard, & Gibbons, 2013), may succeed in challenging internalisations about attractiveness of a tanned appearance. Similarly, interventions that target social norms by attempting to influence perceptions of the behaviour and attitudes of peers, family, and the media may serve to encourage sun-protective behaviours. Certainly, there is some evidence for the efficacy of this approach for sun protection, but less so for

tanning behaviour (Mahler et al., 2008; Olson et al., 2007). Future research should continue to consider female tanning behaviour from a body image perspective, and use insights from this perspective to inform interventions.

7.5.2. Predicting Sun-Protective Behaviour with the Tripartite Influence Model

The Tripartite Influence Model was only applied to tanning behaviour within this thesis, and not sun protection. Tanning and sun protection behaviour are distinct constructs influenced by different processes (Jackson & Aiken, 2006). However, sun-protective intentions are associated with sociocultural tanning norms, as well as perceived appearance reasons to tan or not to tan (Cafri et al., 2008; Mosher & Danoff-Burg, 2005). Furthermore, appearance-based sun protection interventions have had success over short time periods (Jackson & Aiken, 2006; Mahler et al., 2008). Thus, given the success of the application of the model to young women's tanning behaviour reported in Chapter 4, the Tripartite Influence Model may predict sun protection behaviour, and future research should test the model, evaluating the role of sociocultural sun-protective norms.

7.5.3. Understanding the Sun-Related Behaviour of Young Asian Australians

Although the present research provides some insight into the sun-related behaviours and sociocultural attitudes towards tanning of Asian Australians, it builds on a very small literature. The prevalence of skin cancers in those of Asian heritage living in Australia is not known, and neither is the influence to skin cancer risk of time spent living in Australia, or acculturation. It is important to understand the potential for skin cancer in this group, and research should be conducted to answer these questions. Existing cancer registry data in Australia is a potential resource to inform the issue. Given the results of the present research, the Tripartite Influence Model of tanning behaviour may also have utility in predicting the tanning behaviours of Asian

Australian young women, and it is suggested that future research consider the cross-cultural validity of this model in Asian Australians. Further, interviews may be an appropriate mechanism for exploration of sociocultural tanning norms and skin tone perceptions in this group, particularly to understand the transition from living in Asia to Australia, and how behaviour and skin cancer knowledge may or may not change.

7.5.4. Mechanisms Underlying Male Sun-Related Behaviour

As discussed, it is likely that future research is needed in order to accurately conceptualise predictors of sun-related behaviour in young men. Although young women report higher rates of tanning behaviour than young men (e.g., Bränström et al., 2001; D. B. Buller et al., 2011; Yoo & Kim, 2012), this may be a consequence of measurement issues discussed earlier. It is important not to neglect this half of the population in future research, particularly because Australian males are 50% more likely to have a lifetime incidence of melanoma than women (Australian Institute of Health and Welfare, 2011a). Interviews that explore young men's patterns of outdoor behaviour, and the tan seeking behaviours that occur when outdoors, may lead to a more suitable measurement of male behaviour. Once existing measurement issues are overcome, it is likely that understandings of motivations and predictors of male behaviour will be easier to determine.

7.5.5. Solarium Use in Australia

Reported rates of solarium use by participants were low in the Caucasian Australian sample. In the study reported in Chapter 4, solarium use was excluded as a variable due to low prevalence of the reported behaviour; 1.2% of females and no males reported solarium use in the previous 12 months. This issue has similarly been reported in other recent Australian research; in a sample of 156 female university students in South Australia, 7.1% reported solarium use (Prichard et al., 2013), and of

2,867 office workers surveyed in Queensland in 2009, only 2.5% of participants had engaged in solarium use over the previous 12 months (Gordon et al., 2012). Although nationally representative research conducted in Australia reported a decline in rates of solarium use from 2003 to 2007, the exception was young adult women, whose solarium use remained relatively stable (Francis et al., 2010). Furthermore, Francis and colleagues (2010) reported that in 2006/07, 6.7% of women aged 18-24 reported using solaria in the prior 12 months. This rate is higher than that reported by the present sample (rate = 1.2%), and other recent Australian research (Gordon et al., 2012), although similar to rates reported recently by Prichard et al. (2013). Since the research conducted by Francis and colleagues, where data was collected in 2007, there has been considerable media attention to the link between solarium use and skin cancer, particularly following the death of Clare Oliver, a victim of melanoma who campaigned against solarium use until her death, at age 26, in 2007 (MacKenzie, Imison, Chapman, & Holding, 2008; Sinclair et al., 2014). This attention, together with advocacy from groups like Cancer Council Australia, has resulted in states instituting regulation and legislation that will see solariums banned in commercial settings in Australia from 2015 (Sinclair et al., 2014). Consequently, it is possible that Australian young adults' solarium use has declined due to publicity surrounding the skin cancer risk associated with solarium use in the six years since data was collected for the most recently published national survey (Francis et al., 2010). However, more recent Australian research (Prichard et al., 2013) contradicts rates of solarium use reported here and by Gordon and colleagues (2012). Alternatively, the media attention may have resulted in perception of this behaviour as being socially unacceptable, and future research in Australia should consider social desirability bias when attempting to measure solarium use.

7.6. Final Comments

The series of studies presented in this thesis improve understandings of young adults' sun-related behaviour. The results suggest that skin cancer knowledge may have a small influence on young women's sun-related behaviour, and emphasise the need for continued consistent measurement of skin cancer knowledge. The presented research adds to the literature by creation of a skin cancer knowledge scale, that incorporates recommendations of the systematic review. In addition, this research presents evidence that sociocultural tanning norms and skin tone preferences are central in understanding tanning behaviour across cultural groups, and that conceptualisation of female tanning as a body image behaviour may be appropriate. Furthermore, this series of studies suggests that male sun-related behaviours are likely different to that of females, and measurement improvement should be considered to facilitate clearer understanding of male sun-related behaviour. Additionally, because results here indicate that Asian Australians are a group with poor skin cancer knowledge who engage in skin cancer risk behaviour, it is important to account for cultural diversity when considering Australians' sun-related beliefs and behaviours.

REFERENCES

Abar, B. W., Turrisi, R., Hillhouse, J., Loken, E., Stapleton, J. L., & Gunn, H. (2010). Preventing skin cancer in college females: Heterogeneous effects over time. *Health Psychology, 29*, 574-582. doi: 10.1037/a0021236

Abroms, L., Jorgensen, C. M., Southwell, B. G., Geller, A. C., & Emmons, K. M. (2003). Gender differences in young adults' beliefs about sunscreen use. *Health Education and Behavior, 30*, 29-43. doi: 10.1177/1090198102239257

Ajzen, I. (1985). A theory of planned behavior. In J. Kuhl & J. Beckman (Eds.), *Action-control: From cognition to behavior* (pp. 11–39). Heidelberg, Germany: Springer.

Alberg, A. J., Herbst, R. M., Genkinger, J. M., & Duszynski, K. R. (2002). Knowledge, attitudes, and behaviors toward skin cancer in Maryland youths. *Journal of Adolescent Health, 31*, 372-377. doi: 10.1016/S1054-139X(02)00377-4

Ali, M. M., Rizzo, J. A., & Heiland, F. W. (2013). Big and beautiful? Evidence of racial differences in the perceived attractiveness of obese females. *Journal of Adolescence, 36*, 539-549. doi: 10.1016/j.adolescence.2013.03.010

American Cancer Society. (2012). *Cancer facts and figures 2012.* Retrieved from American Cancer Society website: http://www.cancer.org/research/cancerfactsfigures/cancerfactsfigures/cancer-facts-figures-2012

Andrews, A. R., III,, Bridges, A. J., & Gomez, D. (2013). A multi-study analysis of conceptual and measurement issues related to health research on acculturation in Latinos. *Journal of Transcultural Nursing, 24*, 134-143. doi: 10.1177/1043659612472199

Armstrong, A., Idriss, N. Z., & Kim, R. H. (2011). Effects of video-based, online

education on behavioral and knowledge outcomes in sunscreen use: A randomized controlled trial. *Patient Education and Counseling, 83*, 273-277. doi: 10.1016/j.pec.2010.04.033

Armstrong, B. K., & Kricker, A. (1993). How much melanoma is caused by sun exposure? *Melanoma Research, 3*, 395-401. Retrieved from http://journals.lww.com/melanomaresearch/pages/default.aspx

Armstrong, B. K., & Kricker, A. (2001). The epidemiology of UV induced skin cancer. *Journal of Photochemistry and Photobiology B: Biology, 63*, 8-18. doi: 10.1016/S1011-1344(01)00198-1

Australian Bureau of Statistics. (2011). *Geographical areas (usual residence) database (Table builds from; BPLP [Country of birth of person]; ANC1P [Ancestry1], LANP [Language Spoken at home])*. In 2011 Census - Cultural and language diversity data. Retrieved from Australian Bureau of Statistics website: http://www.abs.gov.au/websitedbs/censushome.nsf/home/tablebuilder

Australian Department of Health. (2010). *Evaluation of national skin cancer awareness campaign - Third phase (2009-2010)*. Retrieved from Australian Department of Health website: http://www.skincancer.gov.au/internet/skincancer/publishing.nsf/Content/back-eval10

Australian Education International. (2012). *International student enrolment data 2011 "Detailed monthly tables (December)"*. Retrieved from Australian Education International wesbite: http://aei.gov.au/research/International-Student-Data/Pages/InternationalStudentData2011.aspx

Australian Institute of Health and Welfare. (2005). *Health system expenditures on cancer and other neoplasms in Australia 2000-01*. Retrieved from Australian

Institute of Health and Welfare website: http://www.aihw.gov.au/publication-detail/?id=6442467719

Australian Institute of Health and Welfare. (2011a). *Melanoma of the skin for Australia - Australian cancer incidence & mortality book*. Retrieved from Australian Institute of Health and Welfare website: http://www.aihw.gov.au/acim-books/

Australian Institute of Health and Welfare. (2011b). *Non-melanoma skin cancer, all types - Australian cancer incidence & mortality book*. Retrieved from Australian Institute of Health and Welfare website: http://www.aihw.gov.au/acim-books/

Australian Institute of Health and Welfare. (2013). *Cancer*. Retrieved from Australian Institute of Health and Welfare website: http://www.aihw.gov.au/cancer/

Baade, P. D., Balanda, K. P., Lowe, J. B., & Del Mar, C. B. (1996). Effect of a public awareness campaign on the appropriateness of patient-initiated skin examination in general practice. *Australian and New Zealand Journal of Public Health, 20*, 640-643. doi: 10.1111/j.1467-842X.1996.tb01079.x

Banerjee, S. C., Campo, S., & Greene, K. (2008). Fact or wishful thinking? Biased expectations in "I think I look better when I'm tanned". *American Journal of Health Behavior, 32*, 243-252. doi: 10.5555/ajhb.2008.32.3.243

Banks, B. A., Silverman, R. A., Schwartz, R. H., & Tunnessen Jr, W. W. (1992). Attitudes of teenagers toward sun exposure and sunscreen use. *Pediatrics, 89*, 40-42. Retrieved from http://pediatrics.aappublications.org/

Barnett, H. L., Keel, P. K., & Conoscenti, L. M. (2001). Body type preferences in Asian and Caucasian college students. *Sex Roles, 45*(11-12), 867-878. doi: 10.1023/A:1015600705749

Baron, R. M., & Kenny, D. A. (1986). The moderator-mediator variable distinction in

social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology, 51*, 1173-1182. doi: 10.1037/0022-3514.51.6.1173

Beane Freeman, L. E., Dennis, L. K., Lynch, C. F., Lowe, J. B., & Clarke, W. R. (2005). Test-retest of self-reported exposure to artificial tanning devices, self-tanning creams, and sun sensitivity showed consistency. *Journal of Clinical Epidemiology, 58*, 430-432. doi: 10.1016/j.jclinepi.2004.09.004

Becker, M. H. (Ed.). (1974). *The health belief model and personal health behavior* (Vol. 2). Thorofare, NJ: Charles B Slack Inc.

Beckmann, K. R., Kirke, B. A., McCaul, K. A., & Roder, D. M. (2001). Use of fake tanning lotions in the South Australian population. *Medical Journal of Australia, 174*, 75-78. Retrieved from http://www.mja.com.au/

Bellew, S., Del Rosso, J. Q., & Kim, G. K. (2009). Skin cancer in Asians: Part 2: Melanoma. *The Journal of Clinical and Aesthetic Dermatology, 2*(10), 34-36. Retrieved from http://www.jcadonline.com/

Bernhard, G., Mayer, B., Seckmeyer, G., & Moise, A. (1997). Measurements of spectral solar UV irradiance in tropical-Australia. *Journal of Geophysical Research: Atmospheres, 102*, 8719-8730. doi: 10.1029/97JD00072

Berwick, M., Fine, J. A., & Bolognia, J. L. (1992). Sun exposure and sunscreen use following a community skin cancer screening. *Preventive Medicine, 21*, 302-310. doi: 10.1016/0091-7435(92)90029-H

Boldeman, C., Bränström, R., Dal, H., Kristjansson, S., Rodvall, Y., Jansson, B., & Ullén, H. (2001). Tanning habits and sunburn in a Swedish population age 13-50 years. *European Journal of Cancer, 37*, 2441-2448. doi: 10.1016/S0959-8049(01)00310-0

Booth, D. (2001). *Australian beach cultures: The history of sun, sand and surf*. Abingdon, United Kingdom: Routledge.

Börner, F. U., Schütz, H., & Wiedemann, P. (2009). A population-based survey on tanning bed use in Germany. *BMC Dermatology, 9*. doi: 10.1186/1471-5945-9-6

Bradford, P. T., Goldstein, A. M., McMaster, M. L., & Tucker, M. A. (2009). Acral lentiginous melanoma: Incidence and survival patterns in the United States, 1986-2005. *Archives of Dermatology, 145*, 427-434. doi: 10.1001/archdermatol.2008.609

Bränström, R., Brandberg, Y., Holm, L. E., Sjöberg, L., & Ullén, H. (2001). Beliefs, knowledge and attitudes as predictors of sunbathing habits and use of sun protection among Swedish adolescents. *European Journal of Cancer Prevention, 10*, 337-345. Retrieved from http://journals.lww.com/eurjcancerprev/pages/default.aspx

Broadstock, M., Borland, R., & Gason, R. (1992). Effects of suntan on judgements of healthiness and attractiveness by adolescents. *Journal of Applied Social Psychology, 22*, 157-172. doi: 10.1111/j.1559-1816.1992.tb01527.x

Brock, K. E., Ke, L., Tseng, M., Clemson, L., Koo, F. K., Jang, H., . . . Mason, R. S. (2013). Vitamin D status is associated with sun exposure, vitamin D and calcium intake, acculturation and attitudes in immigrant East Asian women living in Sydney. *Journal of Steroid Biochemistry and Molecular Biology, 136*, 214-217. doi: 10.1016/j.jsbmb.2012.12.005

Brooks, K., Brooks, D. R., Dajani, Z., Swetter, S. M., Powers, E., Pagoto, S. L., & Geller, A. C. (2006). Use of artificial tanning products among young adults. *Journal of the American Academy of Dermatology, 54*, 1060-1066. doi: 10.1016/j.jaad.2006.01.014

Buchanan, L. (2013). Slip, slop, slap, seek, slide - Is the message really getting across? *Dermatology Online Journal, 19*(8). Retrieved from http://escholarship.org/uc/doj

Buller, D. B., Callister, M. A., & Reichert, T. (1995). Skin cancer prevention by parents of young children: Health information sources, skin cancer knowledge, and sun-protection practices. *Oncology Nursing Forum, 22*, 1559-1566. Retrieved from http://www.ons.org/practice-resources/onf

Buller, D. B., Cokkinides, V. E., Hall, H. I., Hartman, A. M., Saraiya, M., Miller, E., . . . Glanz, K. (2011). Prevalence of sunburn, sun protection, and indoor tanning behaviors among Americans: Review from national surveys and case studies of 3 states. *Journal of the American Academy of Dermatology, 65*, S114-S123. doi: 10.1016/j.jaad.2011.05.033

Buller, M. K., Kane, I. L., Martin, R. C., Giese, A. J., Cutter, G. R., Saba, L. M., & Buller, D. B. (2008). Randomized trial evaluating computer-based sun safety education for children in elementary school. *Journal of Cancer Education, 23*, 74-79. doi: 10.1080/08858190701818267

Cafri, G., Thompson, J. K., Jacobsen, P. B., & Hillhouse, J. (2009). Investigating the role of appearance-based factors in predicting sunbathing and tanning salon use. *Journal of Behavioral Medicine, 32*, 532-544. doi: 10.1007/s10865-009-9224-5

Cafri, G., Thompson, J. K., Roehrig, M., Rojas, A., Sperry, S., Jacobsen, P. B., & Hillhouse, J. (2008). Appearance motives to tan and not tan: Evidence for validity and reliability of a new scale. *Annals of Behavioral Medicine, 35*, 209-220. doi: 10.1007/s12160-008-9022-2

Cafri, G., Thompson, J. K., Roehrig, M., van den Berg, P., Jacobsen, P. B., & Stark, S. (2006). An investigation of appearance motives for tanning: The development

and evaluation of the Physical Appearance Reasons For Tanning Scale (PARTS) and its relation to sunbathing and indoor tanning intentions. *Body Image, 3*, 199-209. doi: 10.1016/j.bodyim.2006.05.002

Cafri, G., van den Berg, P., & Brannick, M. T. (2010). What have the difference scores not been telling us? A critique of the use of self-ideal discrepancy in the assessment of body image and evaluation of an alternative data-analytic framework. *Assessment, 17*, 361-376. doi: 10.1177/1073191109357028

Cancer Council Australia. (2011a). *Preventing skin cancer*. Retrieved from Cancer Council Australia website http://www.cancer.org.au/cancersmartlifestyle/SunSmart/Preventingskincancer.htm

Cancer Council Australia. (2011b). *Skin cancer facts and figures*. Retrieved from Cancer Council website: http://www.cancer.org.au/cancersmartlifestyle/SunSmart/Skincancerfactsandfigures.htm

Cancer Council Australia. (2013). *Facts and figures*. Retrieved from Cancer Council website: http://www.cancer.org.au/about-cancer/what-is-cancer/facts-and-figures.html

Cancer Council Australia. (2014a). *Skin cancer statistics.* Retrieved from Cancer Council website: http://www.cancercouncil.com.au/74325/b1000/skin-cancer-30/skin-cancer-statistics/?pp=33858&cc=9561&&ct=23

Cancer Council Australia. (2014b). *Sun protection - Campaigns and events.* Retrieved from Cancer Council website: http://www.cancer.org.au/preventing-cancer/sun-protection/campaigns-and-events/

Cancer Institute NSW. (2014). *The dark side of tanning: The campaign.* Retrieved

from Cancer Institute NSW website: http://www.darksideoftanning.com.au/campaign/campaign.aspx

Cancer Research UK. (2011a). *Skin cancer statistics - Key facts*. Retrieved from Cancer Research UK website: http://info.cancerresearchuk.org/cancerstats/keyfacts/skin-cancer/

Cancer Research UK. (2011b). *Sun protection - Shade*. Retrieved from Cancer Research UK website: http://www.sunsmart.org.uk/advice-and-prevention/shade/

Castle, C. M., Skinner, T. C., & Hampson, S. E. (1999). Young women and suntanning: An evaluation of a heath education leaflet. *Psychology and Health, 14*, 517-527. doi: 10.1080/08870449908407344

Cathcart, S., DeCoster, J., Northington, M., Cantrell, W., Elmets, C. A., & Elewski, B. E. (2011). Interest in cosmetic improvement as a marker for tanning behavior: A survey of 1602 respondents. *Journal of Cosmetic Dermatology, 10*, 3-10. doi: 10.1111/j.1473-2165.2010.00522.x

Cercato, M. C., Ramazzotti, V., Sperduti, I., Asensio-Pascual, A., Ribes, I., Guillén, C., & Nagore, E. (2014). Sun protection among Spanish beachgoers: Knowledge, attitude and behaviour. *Journal of Cancer Education*, Advance online publication. doi: 10.1007/s13187-014-0671-5

Cho, H., Lee, S., & Wilson, K. (2010). Magazine exposure, tanned women stereotypes, and tanning attitudes. *Body Image, 7*, 364-367. doi: 10.1016/j.bodyim.2010.04.002

Choi, K., Lazovich, D., Southwell, B. G., Forster, J., Rolnick, S. J., & Jackson, J. (2010). Prevalence and characteristics of indoor tanning use among men and women in the United States. *Archives of Dermatology, 146*, 1356-1361. doi:

10.1001/archdermatol.2010.355

Chuang, T. Y., Reizner, G. T., Elpern, D. J., Stone, J. L., & Farmer, E. R. (1995). Nonmelanoma skin cancer in Japanese ethnic Hawaiians in Kauai, Hawaii: An incidence report. *Journal of the American Academy of Dermatology, 33*, 422-426. doi: 10.1016/0190-9622(95)91387-4

Clarke, V. A., Williams, T., & Arthey, S. (1997). Skin type and optimistic bias in relation to the sun protection and suntanning behaviors of young adults. *Journal of Behavioral Medicine, 20*, 207-222. doi: 10.1023/A:1025586829179

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hillsdale, NJ: Erlbaum.

Cokkinides, V. E., Bandi, P., Weinstock, M. A., & Ward, E. (2010). Use of sunless tanning products among US adolescents aged 11 to 18 years. *Archives of Dermatology, 146*, 987-992. doi: 10.1001/archdermatol.2010.220

Cokkinides, V. E., Weinstock, M. A., O'Connell, M. C., & Thun, M. J. (2002). Use of indoor tanning sunlamps by US youth, ages 11-18 years, and by their parent or guardian caregivers: Prevalence and correlates. *Pediatrics, 109*, 1124-1130. doi: 10.1542/peds.109.6.1124

Conti, M. A., Scagliusi, F., Queiroz, G. K., Hearst, N., & Cordás, T. A. (2010). Cross-cultural adaptation: Translation and Portuguese language content validation of the tripartite influence scale for body dissatisfaction. *Cadernos de Saude Publica, 26*, 503-513. doi: 10.1590/S0102-311X2010000300008

Cottrell, R., McClamroch, L., & Bernard, A. L. (2005). Melanoma knowledge and sun protection attitudes and behaviors among college students by gender and skin type. *American Journal of Health Education, 36*, 274-278. doi: 10.1080/19325037.2005.10608196

Coups, E. J. (2011). Rural-urban differences in sunscreen use: Clarification of results from the 2005 Health Information National Trends Survey. *Journal of the American Academy of Dermatology, 64*, 196. doi: 10.1016/j.jaad.2010.06.063

Coups, E. J., Manne, S. L., & Heckman, C. J. (2008). Multiple skin cancer risk behaviors in the U.S. population. *American Journal of Preventive Medicine, 34*, 87-93. doi: 10.1016/j.amepre.2007.09.032

Coups, E. J., Stapleton, J. L., Hudson, S. V., Medina-Forrester, A., Natale-Pereira, A., & Goydos, J. S. (2012). Sun protection and exposure behaviors among Hispanic adults in the United States: Differences according to acculturation and among Hispanic subgroups. *BMC Public Health, 12*, 985. doi: 10.1186/1471-2458-12-985

Coups, E. J., Stapleton, J. L., Hudson, S. V., Medina-Forrester, A., Rosenberg, S. A., Gordon, M. A., . . . Goydos, J. S. (2013). Linguistic acculturation and skin cancer-related behaviors among Hispanics in the southern and western United States. *JAMA Dermatol, 149*, 679-686. doi: 10.1001/jamadermatol.2013.745

Cox, C. R., Cooper, D. P., Vess, M., Arndt, J., Goldenberg, J. L., & Routledge, C. (2009). Bronze is beautiful but pale can be pretty: The effects of appearance standards and mortality salience on sun-tanning outcomes. *Health Psychology, 28*, 746-752. doi: 10.1037/a0016388

Day, A. K., Oxlad, M., & Roberts, R. M. (2013). Predictors of sun-related behaviors among young women: Comparisons between outdoor tanners, fake tanners, and tan avoiders. *Journal of American College Health, 61*, 315-322. doi: 10.1080/07448481.2013.806926

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2013). The role of skin cancer knowledge in sun-related behaviours: A systematic review. *Journal of*

Health Psychology, Advance online publication. doi: 10.1177/1359105313485483

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2014a). *Sun-related behaviours among young Australians with Asian heritage: Differences according to sociocultural norms and skin tone perceptions*. Manuscript submitted for publication.

Day, A. K., Wilson, C., Hutchinson, A. D., & Roberts, R. M. (2014b). *Understanding young adults' tanning behaviour: The role of ideal skin tone and sociocultural norms*. Manuscript submitted for publication.

Day, A. K., Wilson, C., Roberts, R. M., & Hutchinson, A. D. (2014). The Skin Cancer and Sun Knowledge (SCSK) scale: Validity, reliability, and relationship to sun-related behaviors among young western adults. *Health Education and Behavior, 41*, 440-448. doi: 10.1177/1090198114529129

de Vries, H., Lezwijn, J., Hol, M., & Honing, C. (2005). Skin cancer prevention: Behaviour and motives of Dutch adolescents. *European Journal of Cancer Prevention, 14*, 39-50. doi: 10.1097/00008469-200502000-00006

Demko, C. A., Borawski, E. A., Debanne, S. M., Cooper, K. D., & Stange, K. C. (2003). Use of indoor tanning facilities by white adolescents in the United States. *Archives of Pediatrics and Adolescent Medicine, 157*, 854-860. doi: 10.1001/archpedi.157.9.854

Diffey, B. (2009). Sunscreens: Expectation and realization. *Photodermatology Photoimmunology and Photomedicine, 25*, 233-236. doi: 10.1111/j.1600-0781.2009.00459.x

Dissel, M., Rotterdam, S., Altmeyer, P., & Gambichler, T. (2009). Indoor tanning in North Rhine-Westphalia Germany: A self-reported survey. *Photodermatology*

Photoimmunology and Photomedicine, 25, 94-100. doi: 10.1111/j.1600-0781.2009.00417.x

Dixon, H., Dobbinson, S., Wakefield, M., Jamsen, K., & McLeod, K. (2008). Portrayal of tanning, clothing fashion and shade use in Australian women's magazines, 1987-2005. *Health Education Research, 23*, 791-802. doi: 10.1093/her/cym057

Donaldson, M. R., & Coldiron, B. M. (2011). No end in sight: The skin cancer epidemic continues. *Seminars in Cutaneous Medicine and Surgery, 30*, 3-5. doi: 10.1016/j.sder.2011.01.002

Dreier, M., Borutta, B., Toppich, J., Bitzer, E. M., & Walter, U. (2012). Mammography and cervical cancer screening - A systematic review about women's knowledge, attitudes and participation in Germany. *Gesundheitswesen, 74*, 722-735. doi: 10.1055/s-0031-1286271

Easterbrook, P. J., Berlin, J. A., Gopalan, R., & Matthews, D. R. (1991). Publication bias in clinical research. *The Lancet, 337*, 867-876. doi: 10.1016/0140-6736(91)90201-Y

Elwood, J. M., & Jopson, J. (1997). Melanoma and sun exposure: An overview of published studies. *International Journal of Cancer, 73*, 198-203. doi: 10.1002/(SICI)1097-0215(19971009)73:2<198::AID-IJC6>3.0.CO;2-R

Ezzedine, K., Malvy, D., Mauger, E., Nageotte, O., Galan, P., Hercberg, S., & Guinot, C. (2008). Artificial and natural ultraviolet radiation exposure: Beliefs and behaviour of 7200 French adults. *Journal of the European Academy of Dermatology and Venereology, 22*, 186-194. doi: 10.1111/j.1468-3083.2007.02367.x

Fabrigar, L. R., Wegner, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychosocial research. *Psychological*

Methods, 4, 272–299. doi: 10.1037/1082-989X.4.3.272

Felts, W. M., Burke, S. C., Vail-Smith, K., & Whetstone, L. M. (2010). College students' knowledge, attitudes and perceptions of risks regarding intentional sun exposure: A 17-year follow-up. *American Journal of Health Education, 41*, 274-283. doi: 10.1080/19325037.2010.10599154

Fingeret, M. C., Gleaves, D. H., & Pearson, C. A. (2004). On the methodology of body image assessment: The use of figural rating scales to evaluate body dissatisfaction and the ideal body standards of women. *Body Image, 1*, 207-212. doi: 10.1016/j.bodyim.2004.01.003

Fink, B., Grammer, K., & Thornhill, R. (2001). Human (Homo sapiens) facial attractiveness in relation to skin texture and color. *Journal of Comparative Psychology, 115*, 92-99. doi: 10.1037//0735-7036.115.1.92

Fink, B., Matts, P. J., Klingenberg, H., Kuntze, S., Weege, B., & Grammer, K. (2008). Visual attention to variation in female facial skin color distribution. *Journal of Cosmetic Dermatology, 7*, 155-161. doi: 10.1111/j.1473-2165.2008.00382.x

Fishbein, M., Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.

Fitzpatrick, T. B. (1988). The validity and practicality of sun-reactive skin types I through VI. *Archives of Dermatology, 124*, 869-871. doi: 10.1001/archderm.1988.01670060015008

Francis, K., Dobbinson, S., Wakefield, M., & Girgis, A. (2010). Solarium use in Australia, recent trends and context. *Australian and New Zealand Journal of Public Health, 34*, 427-430. doi: 10.1111/j.1753-6405.2010.00578.x

Fransen, M., Karahalios, A., Sharma, N., English, D. R., Giles, G. G., & Sinclair, R. D. (2012). Non-melanoma skin cancer in Australia. *Medical Journal of Australia,*

197, 565-568. doi: 10.5694/mja12.10654

Frisch, A. L., Camerini, L., Diviani, N., & Schulz, P. J. (2012). Defining and measuring health literacy: How can we profit from other literacy domains? *Health Promotion International, 27*, 117-126. doi: 10.1093/heapro/dar043

Fritschi, L., Green, A. C., & Solomon, P. J. (1992). Sun exposure in Australian adolescents. *Journal of the American Academy of Dermatology, 27*, 25-28. doi: 10.1016/0190-9622(92)70150-E

Fylan, F. (1998). Screening for cervical cancer: A review of women's attitudes, knowledge, and behaviour. *British Journal of General Practice, 48*, 1509-1514. Retrieved from http://bjgp.org/

Gambichler, T., Dissel, M., Altmeyer, P., & Rotterdam, S. (2010). Evaluation of sun awareness with an emphasis on ultraviolet protection by clothing: A survey of adults in Western Germany. *Journal of the European Academy of Dermatology and Venereology, 24*, 155-162. doi: 10.1111/j.1468-3083.2009.03368.x

Gardner, R. M., Friedman, B. N., & Jackson, N. A. (1998). Methodological concerns when using silhouettes to measure body image. *Perceptual and Motor Skills, 86*, 387-395. doi: 10.2466/pms.1998.86.2.387

Garner, D. M., & Garfinkel, P. E. (1981). Body image in anorexia nervosa: Measurement, theory and clinical implications. *International Journal of Psychiatry in Medicine, 11*, 263-284. doi: 10.2190/R55Q-2U6T-LAM7-RQR7

Garside, R., Pearson, M., & Moxham, T. (2010). What influences the uptake of information to prevent skin cancer? A systematic review and synthesis of qualitative research. *Health Education Research, 25*, 162-182. doi: 10.1093/her/cyp060

Geller, A. C., Colditz, G. A., Oliveria, S., Emmons, K. M., Jorgensen, C. M., Aweh, G.

N., & Frazier, A. L. (2002). Use of sunscreen, sunburning rates, and tanning bed use among more than 10 000 US children and adolescents. *Pediatrics, 109*, 1009-1014. doi: 10.1542/peds.109.6.1009

Gibbons, F. X., Gerrard, M., Lane, D. J., Mahler, H. I., & Kulik, J. A. (2005). Using UV photography to reduce use of tanning booths: A test of cognitive mediation. *Health Psychology, 24*, 358-363. doi: 10.1037/0278-6133.24.4.358

Gillani, F., Rashid, A., Anis, A., Arif, S., Jamall, A., Iqbal, N., & Khan, A. (2001). The skin we are in: Knowledge and practices regarding skin cancer in pre-clinical medical students. *Journal of the Pakistan Medical Association, 51*, 373-378. Retrieved from http://jpma.org.pk/

Gillen, M. M., & Markey, C. N. (2012). The role of body image and depression in tanning behaviors and attitudes. *Behavioral Medicine, 38*, 74-82. doi: 10.1080/08964289.2012.685499

Gilpin, A. R. (1993). Table for conversion of Kendall tau to Spearman rho within the context of measures of magnitude of effect for meta-analysis. *Educational and Psychological Measurement, 53*, 87-92. doi: 10.1177/0013164493053001007

Glanz, K., Buller, D. B., & Saraiya, M. (2007). Reducing ultraviolet radiation exposure among outdoor workers: State of the evidence and recommendations. *Environmental Health: A Global Access Science Source, 6*. doi: 10.1186/1476-069X-6-22

Glanz, K., Lew, R. A., Song, V., & Cook, V. A. (1999). Factors associated with skin cancer prevention practices in a multiethnic population. *Health Education and Behavior, 26*, 344-359. doi: 10.1177/109019819902600305

Glanz, K., Yaroch, A. L., Dancel, M., Saraiya, M., Crane, L. A., Buller, D. B., . . . Robinson, J. K. (2008). Measures of sun exposure and sun protection practices

for behavioral and epidemiologic research. *Archives of Dermatology, 144*, 217-222. doi: 10.1001/archdermatol.2007.46

Gleaves, D. H., Cepeda-Benito, A., Williams, T. L., Cororve, M. B., Fernandez-Nieto, M. C., & Vila, J. (2000). Body image preferences of self and others: A comparison of Spanish and American male and female college students. *Eating Disorders, 8*, 269-282. doi: 10.1080/10640260008251236

Glenn, E. N. (2008). Yearning for lightness: Transnational circuits in the marketing and consumption of skin lighteners. *Gender and Society, 22*, 281-302. doi: 10.1177/0891243208316089

Gloster, H. M., Jr., & Neal, K. (2006). Skin cancer in skin of color. *Journal of the American Academy of Dermatology, 55*, 741-760; quiz 761-744. doi: 10.1016/j.jaad.2005.08.063

Gordon, L. G., Hirst, N. G., Green, A. C., & Neale, R. E. (2012). Tanning behaviors and determinants of solarium use among indoor office workers in Queensland, Australia. *Journal of Health Psychology, 17*, 856-865. doi: 10.1177/1359105311427476

Gorell, E., Lee, C., Munoz, C., & Chang, A. L. (2009). Adoption of Western culture by Californian Asian Americans: Attitudes and practices promoting sun exposure. *Archives of Dermatology, 145*, 552-556. doi: 10.1001/archdermatol.2009.39

Green, C. A., & Pope, C. R. (1999). Gender, psychosocial factors and the use of medical services: A longitudinal analysis. *Social Science and Medicine, 48*, 1363-1372. doi: 10.1016/S0277-9536(98)00440-7

Grubbs, L. M., & Tabano, M. (2000). Use of sunscreen in health care professionals: The health belief model. *Cancer Nursing, 23*, 164-167. Retrieved from http://journals.lww.com/cancernursingonline/pages/default.aspx

Guile, K., & Nicholson, S. (2004). Does knowledge influence melanoma-prone behavior? Awareness, exposure, and sun protection among five social groups. *Oncology Nursing Forum, 31*, 641-646. doi: 10.1188/04.onf. 633-639

Haladyna, T. M. (2004). *Developing and validating multiple-choice test items* (3rd ed.). Mahwah, N.J: Lawrence Erlbaum Associates.

Hamid, P. D., Simmonds, J. G., & Bowles, T. V. (2009). Asian Australian acculturation and attitudes toward seeking professional psychological help. *Australian Journal of Psychology, 61*, 69-76. doi: 10.1080/00049530701867839

Hart, K. M., & DeMarco, R. F. (2008). Primary prevention of skin cancer in children and adolescents: A review of the literature. *Journal of Pediatric Oncology Nursing, 25*, 67-78. doi: 10.1177/1043454208314499

Hay, J., Coups, E. J., Ford, J., & DiBonaventura, M. (2009). Exposure to mass media health information, skin cancer beliefs, and sun protection behaviors in a United States probability sample. *Journal of the American Academy of Dermatology, 61*, 783-792. doi: 10.1016/j.jaad.2009.04.023

Heckman, C. J., Darlow, S., Cohen-Filipic, J., Kloss, J. D., Manne, S. L., Munshi, T., & Perlis, C. S. (2012). Psychosocial correlates of sunburn among young adult women. *International Journal of Environmental Research and Public Health, 9*, 2241-2251. doi: 10.3390/ijerph9062241

Heckman, C. J., Egleston, B. L., Wilson, D. B., & Ingersoll, K. S. (2008). A preliminary investigation of the predictors of tanning dependence. *American Journal of Health Behavior, 32*, 451-464. doi: 10.5555/ajhb.2008.32.5.451

Heckman, C. J., Wilson, D. B., & Ingersoll, K. S. (2009). The influence of appearance, health, and future orientations on tanning behavior. *American Journal of Health Behavior, 33*, 238-243. doi: 10.5993/AJHB.33.3.2

Heckman, C. J., Zhu, F., Manne, S. L., Kloss, J. D., Collins, B. N., Bass, S. B., & Lessin, S. R. (2013). Process and outcomes of a skin protection intervention for young adults. *Journal of Health Psychology, 18*, 561-573. doi: 10.1177/1359105312449193

Higashi, M. K., Veenstra, D. L., & Langley, P. C. (2004). Health economic evaluation of non-melanoma skin cancer and actinic keratosis. *Pharmacoeconomics, 22*, 83-94. doi: 10.2165/00019053-200422020-00002

Higgins, J. P., & Green, S. (Eds). *Cochrane handbook for systematic reviews of interventions (Version 5.1.0)*. [updated March 2011]. Retrieved from Cochrane Collaboration website: http://www.cochrane-handbook.org

Hillhouse, J., Stair A. W., III., & Adler, C. M. (1996). Predictors of sunbathing and sunscreen use in college undergraduates. *Journal of Behavioral Medicine, 19*, 543-561. doi: 10.1007/BF01904903

Hillhouse, J., & Turrisi, R. (2012). Motivations for indoor tanning: Theoretical models. In C. J. Heckman & S. L. Manne (Eds.), *Shedding light on indoor tanning* (pp. 69-86). doi: 10.1007/978-94-007-2048-0_4

Hillhouse, J., Turrisi, R., Jaccard, J., & Robinson, J. K. (2012). Accuracy of self-reported sun exposure and sun protection behavior. *Prevention Science, 13*, 519-531. doi: 10.1007/s11121-012-0278-1

Hillhouse, J., Turrisi, R., & Kastner, M. (2000). Modeling tanning salon behavioral tendencies using appearance motivation, self-monitoring and the theory of planned behavior. *Health Education Research, 15*, 405-414. doi: 10.1093/her/15.4.405

Hillhouse, J., Turrisi, R., Stapleton, J. L., & Robinson, J. K. (2008). A randomized controlled trial of an appearance-focused intervention to prevent skin cancer.

Cancer, 113, 3257-3266. doi: 10.1002/cncr.23922

Hillhouse, J., Turrisi, R., Stapleton, J. L., & Robinson, J. K. (2010). Effect of seasonal affective disorder and pathological tanning motives on efficacy of an appearance-focused intervention to prevent skin cancer. *Archives of Dermatology, 146*, 485-491. doi: 10.1001/archdermatol.2010.85

Hoerster, K. D., Mayer, J. A., Woodruff, S. I., Malcarne, V., Roesch, S. C., & Clapp, E. (2007). The influence of parents and peers on adolescent indoor tanning behavior: Findings from a multi-city sample. *Journal of the American Academy of Dermatology, 57*, 990-997. doi: 10.1016/j.jaad.2007.06.007

Holman, D. M., & Watson, M. (2013). Correlates of intentional tanning among adolescents in the United States: A systematic review of the literature. *Journal of Adolescent Health, 52*, S52-S59. doi: 10.1016/j.jadohealth.2012.09.021

Hughes, B. R., Altman, D. G., & Newton, J. A. (1993). Melanoma and skin cancer: Evaluation of a health education programme for secondary schools. *British Journal of Dermatology, 128*, 412-417. doi: 10.1111/j.1365-2133.1993.tb00201.x

Hunt, Y., Augustson, E., Rutten, L., Moser, R., & Yaroch, A. L. (2012). History and culture of tanning in the United States. In C. J. Heckman & S. L. Manne (Eds.), *Shedding light on indoor tanning* (pp. 5-31). doi: 10.1007/978-94-007-2048-0_2

Hussainy, S. Y., & Dermele, N. (2011). Knowledge, attitudes and practices of health professionals and women towards medication use in breastfeeding: A review. *International Breastfeeding Journal, 6*, 11. doi: 10.1186/1746-4358-6-11

Ishihara, K., Saida, T., & Yamamoto, A. (2001). Updated statistical data for malignant melanoma in Japan. *International Journal of Clinical Oncology, 6*, 109-116. doi: 10.1007/PL00012091

Jackson, K. M., & Aiken, L. S. (2000). A psychosocial model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology, 19*, 469-478. doi: 10.1037/0278-6133.19.5.469

Jackson, K. M., & Aiken, L. S. (2006). Evaluation of a multicomponent appearance-based sun-protective intervention for young women: Uncovering the mechanisms of program efficacy. *Health Psychology, 25*, 34-46. doi: 10.1037/0278-6133.25.1.34

Jang, H., Koo, F. K., Ke, L., Clemson, L., Cant, R., Fraser, D. R., . . . Brock, K. E. (2013). Culture and sun exposure in immigrant East Asian women living in Australia. *Women and Health, 53*, 504-518. doi: 10.1080/03630242.2013.806386

Jerkegren, E., Sandrieser, L., Brandberg, Y., & Rosdahl, I. (1999). Sun-related behaviour and melanoma awareness among Swedish university students. *European Journal of Cancer Prevention, 8*, 27-34. Retrieved from http://journals.lww.com/eurjcancerprev/

Jones, D. C. (2004). Body image among adolescent girls and boys: A longitudinal study. *Developmental Psychology, 40*, 823-835. doi: 10.1037/0012-1649.40.5.823

Kagawa-Singer, M. (2000). A socio-cultural perspective on cancer control issues for Asian Americans. *Asian American and Pacific Islander Journal of Health, 8*, 12-17. Retrieved from http://pubmedcentralcanada.ca/pmcc/articles/PMC1618773/

Kakourou, T., Bakoula, C., Kavadias, G., Gatos, A., Bilalis, L., Krikos, X., & Matsaniotis, N. (1995). Mothers' knowledge and practices related to sun

protection in Greece. *Pediatric Dermatology, 12*, 207-210. doi: 10.1111/j.1525-1470.1995.tb00159.x

Kakourou, T., Klimentopoulou, A., Kavadias, G., Veltsista, A., Krikos, X., & Bakoula, C. (2006). Improvement of sun-related knowledge and protection practice. *European Journal of Dermatology, 16*, 172-176. Retrieved from http://www.jle.com/en/revues/ejd/revue.phtml

Karazsia, B. T., & Crowther, J. H. (2009). Social body comparison and internalization: Mediators of social influences on men's muscularity-oriented body dissatisfaction. *Body Image, 6*, 105-112. doi: 10.1016/j.bodyim.2008.12.003

Karazsia, B. T., & Crowther, J. H. (2010). Sociocultural and psychological links to men's engagement in risky body change behaviors. *Sex Roles, 63*, 747-756. doi: 10.1007/s11199-010-9802-6

Kasparian, N. A., McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine, 32*, 406-428. doi: 10.1007/s10865-009-9219-2

Keeney, S., McKenna, H., Fleming, P., & McIlfatrick, S. (2009). Attitudes, knowledge and behaviours with regard to skin cancer: A literature review. *European Journal of Oncology Nursing, 13*, 29-35. doi: 10.1016/j.ejon.2008.11.004

Keery, H., van den Berg, P., & Thompson, J. K. (2004). An evaluation of the tripartite influence model of body dissatisfaction and eating disturbance with adolescent girls. *Body Image, 1*, 237-251. doi: 10.1016/j.bodyim.2004.03.001

Keesling, B., & Friedman, H. S. (1987). Psychosocial factors in sunbathing and sunscreen use. *Health Psychology, 6*, 477-493. doi: 10.1037/0278-6133.6.5.477

Kennedy, C., Bajdik, C. D., Willemze, R., de Gruijl, F. R., & Bouwes Bavinck, J. N. (2003). The influence of painful sunburns and lifetime sun exposure on the risk

of actinic keratoses, seborrheic warts, melanocytic nevi, atypical nevi, and skin cancer. *Journal of Investigative Dermatology, 120*, 1087-1093. doi: 10.1046/j.1523-1747.2003.12246.x

Kim, G. K., Del Rosso, J. Q., & Bellew, S. (2009). Skin cancer in Asians: Part 1: Nonmelanoma skin cancer. *The Journal of Clinical and Aesthetic Dermatology, 2*(8), 39-42. Retrieved from http://www.jcadonline.com/

Koh, D., Wang, H., Lee, J., Chia, K. S., Lee, H. P., & Goh, C. L. (2003). Basal cell carcinoma, squamous cell carcinoma and melanoma of the skin: Analysis of the Singapore Cancer Registry data 1968-97. *British Journal of Dermatology, 148*, 1161-1166. doi: 10.1046/j.1365-2133.2003.05223.x

Koh, H. K., Geller, A. C., Miller, D. R., Grossbart, T. A., & Lew, R. A. (1996). Prevention and early detection strategies for melanoma and skin cancer: Current status. *Archives of Dermatology, 132*, 436-443. doi: 10.1001/archderm.1996.03890280098014

Køster, B., Thorgaard, C., Clemmensen, I. H., & Philip, A. (2009). Sunbed use in the Danish population in 2007: A cross-sectional study. *Preventive Medicine, 48*, 288-290. doi: 10.1016/j.ypmed.2008.12.012

Kripke, M. L. (1988). Impact of ozone depletion on skin cancers. *The Journal of Dermatologic Surgery and Oncology, 14*, 853-857. doi: 10.1111/j.1524-4725.1988.tb03589.x

Kristjánsson, S., Bränström, R., Ullén, H., & Helgason, A. R. (2003). Transtheoretical model: Investigation of adolescents' sunbathing behaviour. *European Journal of Cancer Prevention, 12*, 501-508. doi: 10.1097/01.cej.0000102805.33147.85

Lazovich, D., Stryker, J. E., Mayer, J. A., Hillhouse, J., Dennis, L. K., Pichon, L., . . . Thompson, J. K. (2008). Measuring nonsolar tanning behavior: Indoor and

sunless tanning. *Archives of Dermatology, 144*, 225-230. doi: 10.1001/archdermatol.2007.45

Leary, M. R., & Jones, J. L. (1993). The social psychology of tanning and sunscreen use - Self-presentational motives as a predictor of health risk. *Journal of Applied Social Psychology, 23*, 1390-1406. doi: 10.1111/j.1559-1816.1993.tb01039.x

Lee, H. Y., Chay, W. Y., Tang, M. B., Chio, M. T., & Tan, S. H. (2012). Melanoma: Differences between Asian and Caucasian patients. *Annals of the Academy of Medicine, Singapore, 41*, 17-20. doi: 10.1001/jamadermatol.2013.5941

Lessin, S. R., Perlis, C. S., & Zook, M. B. (2012). How ultraviolet radiation tans skin. In C. J. Heckman & S. L. Manne (Eds.), *Shedding light on indoor tanning* (pp. 87-94). doi: 10.1007/978-94-007-2048-0_5

Levine, J. A., Sorace, M., Spencer, J., & Siegel, D. M. (2005). The indoor UV tanning industry: A review of skin cancer risk, health benefit claims, and regulation. *Journal of the American Academy of Dermatology, 53*, 1038-1044. doi: 10.1016/j.jaad.2005.07.066

Li, E. P., Min, H. J., Belk, R. W., Kimura, J., & Bahl, S. (2008). Skin lightening and beauty in four Asian cultures. *Advances in Consumer Research, 35*, 444-449. Retrieved from http://www.acrwebsite.org/

Loo, R. (2002). A caveat on using single-item versus multiple-item scales. *Journal of Managerial Psychology, 17*, 68–75. doi: 10.1108/02683940210415933

Lovejoy, M. (2001). Disturbances in the social body: Differences in body image and eating problems among African American and white women. *Gender and Society, 15*, 239-261. doi: 10.1177/089124301015002005

Lowe, J. B., Balanda, K. P., Del Mar, C. B., Purdie, D., & Hilsdon, A. M. (1994). General practitioner and patient response during a public education program to

encourage skin examinations. *Medical Journal of Australia, 161*, 195-198. Retrieved from http://www.mja.com.au/

Lowe, J. B., Balanda, K. P., Gillespie, A. M., Del Mar, C. B., & Gentle, A. F. (1993). Sun-related attitudes and beliefs among Queensland school children: The role of gender and age. *Australian Journal of Public Health, 17*, 202-208. doi: 10.1111/j.1753-6405.1993.tb00136.x

Lupton, D., & Gaffney, D. (1996). Discourses and practices related to suntanning and solar protection among young Australians. *Health Education Research, 11*, 147-159. doi: 10.1093/her/11.2.147

MacKenzie, R., Imison, M., Chapman, S., & Holding, S. (2008). Mixed messages and a missed opportunity: Australian news media coverage of Clare Oliver's campaign against solaria. *Medical Journal of Australia, 189*, 371-374. Retrieved from http://www.mja.com.au/

Mackinnon, D. P., & Dwyer, J. H. (1993). Estimating mediated effects in prevention studies. *Evaluation Research, 14*, 144-158. doi: 10.1177/0193841X9301700202

MacNeal, R. J., & Dinulos, J. G. H. (2007). Update on sun protection and tanning in children. *Current Opinion in Pediatrics, 19*, 425-429. doi: 10.1097/MOP.0b013e3282294936

Mahler, H. I., Kulik, J. A., Butler, H. A., Gerrard, M., & Gibbons, F. X. (2008). Social norms information enhances the efficacy of an appearance-based sun protection intervention. *Social Science and Medicine, 67*, 321-329. doi: 10.1016/j.socscimed.2008.03.037

Mahler, H. I., Kulik, J. A., Gerrard, M., & Gibbons, F. X. (2013). Effects of photoaging information and UV photo on sun protection intentions and behaviours: A cross-regional comparison. *Psychology and Health, 28*, 1009-1031. doi:

10.1080/08870446.2013.777966

Marks, R., & Hill, D. (1988). Behavioural change in adolescence: A major challenge for skin-cancer control in Australia. *Medical Journal of Australia, 149*, 514-515. Retrieved from http://www.mja.com.au/

Martin, R. H. (1995). Relationship between risk factors, knowledge and preventive behaviour relevant to skin cancer in general practice patients in South Australia. *British Journal of General Practice, 45*, 365-367. Retrieved from http://bjgp.org/

Mawn, V. B., & Fleischer Jr, A. B. (1993). A survey of attitudes, beliefs, and behavior regarding tanning bed use, sunbathing, and sunscreen use. *Journal of the American Academy of Dermatology, 29*, 959-962. doi: 10.1016/0190-9622(93)70274-W

Merriam, S. B. (2002). *Qualitative research in practice: Examples for discussion and analysis*. San Francisco, C.A.: John Wiley & Sons, Inc.

Miyamura, Y., Coelho, S. G., Schlenz, K., Batzer, J., Smuda, C., Choi, W., . . . Hearing, V. J. (2011). The deceptive nature of UVA tanning versus the modest protective effects of UVB tanning on human skin. *Pigment Cell and Melanoma Research, 24*, 136-147. doi: 10.1111/j.1755-148X.2010.00764.x

Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. *International Journal of Surgery, 8*, 336-341. doi: 10.1016/j.ijsu.2010.02.007

Montague, M., Borland, R., & Sinclair, C. (2001). Slip! Slop! Slap! and SunSmart, 1980-2000: Skin cancer control and 20 years of population-based campaigning. *Health Education and Behavior, 28*, 290-305. doi: 10.1177/109019810102800304

Mosher, C. E., & Danoff-Burg, S. (2005). Social predictors of sunscreen and self-tanning product use. *Journal of American College Health, 54*, 166-168. doi: 10.3200/jach.54.3.166-168

Murray, C. D., & Turner, E. (2004). Health, risk and sunbed use: A qualitative study. *Health, Risk and Society, 6*, 67-80. doi: 10.1080/1369857042000193039

Narayanan, D. L., Saladi, R. N., & Fox, J. L. (2010). Ultraviolet radiation and skin cancer. *International Journal of Dermatology, 49*, 978-986. doi: 10.1111/j.1365-4632.2010.04474.x

Nasseri, K., Mills, P. K., & Allan, M. (2007). Cancer incidence in the Middle Eastern population of California, 1988-2004. *Asian Pacific Journal of Cancer Prevention, 8*, 405-411. Retrieved from http://www.apocpcontrol.org/

National Cancer Institute. (2013). *Skin cancer*. Retrieved from National Cancer Institute website: http://www.cancer.gov/cancertopics/types/skin

National Health and Medical Research Council. (1999). *How to review the evidence: Systematic identification and review of the scientific literature.* NHMRC. Canberra, ACT, Commonwealth of Australia. Retrieved from National Health and Medical Research Council website http://www.nhmrc.gov.au/guidelines/publications/cp65

National Health and Medical Research Council. (2000). *Psychosocial clinical practice guidelines: Providing information, support, and counselling for women with breast cancer*. Canberra, ACT, Commonwealth of Australia: NHMRC.

Neale, R. E., Williams, G., & Green, A. C. (2002). Application patterns among participants randomized to daily sunscreen use in a skin cancer prevention trial. *Archives of Dermatology, 138*, 1319-1325. doi: 10.1001/archderm.138.10.1319

Newman, W. G., Agro, A. D., Woodruff, S. I., & Mayer, J. A. (1996). A survey of

recreational sun exposure of residents of San Diego, California. *American Journal of Preventive Medicine, 12*, 186-194.

Nouri, M., Hill, L. G., & Orrell-Valente, J. K. (2011). Media exposure, internalization of the thin ideal, and body dissatisfaction: Comparing Asian American and European American college females. *Body Image, 8*, 366-372. doi: Media exposure, internalization of the thin ideal, and body dissatisfaction: Comparing Asian American and European American college females

Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International, 15*, 259-267. doi: 10.1093/heapro/15.3.259

O'Riordan, D. L., Field, A. E., Geller, A. C., Brooks, D. R., Aweh, G. N., Colditz, G. A., & Frazier, A. L. (2006). Frequent tanning bed use, weight concerns, and other health risk behaviors in adolescent females (United States). *Cancer Causes and Control, 17*, 679-686. doi: 10.1007/s10552-005-0453-9

O'Riordan, D. L., Geller, A. C., Brooks, D. R., Zhang, Z., & Miller, D. R. (2003). Sunburn reduction through parental role modeling and sunscreen vigilance. *Journal of Pediatrics, 142*, 67-72. doi: 10.1067/mpd.2003.9

Olson, A. L., Gaffney, C., Starr, P., Gibson, J. J., Cole, B. F., & Dietrich, A. J. (2007). SunSafe in the middle school years: A community-wide intervention to change early-adolescent sun protection. *Pediatrics, 119*, 247-256. doi: 10.1542/peds.2006-1579

Olvera, N., Suminski, R., & Power, T. G. (2005). Intergenerational perceptions of body image in hispanics: Role of BMI, gender, and acculturation. *Obesity Research, 13*, 1970-1979. doi: 10.1038/oby.2005.242

Oncken, C., McKee, S., Krishnan-Sarin, S., O'Malley, S., & Mazure, C. M. (2005). Knowledge and perceived risk of smoking-related conditions: A survey of cigarette smokers. *Preventive Medicine, 40*, 779-784. doi: 10.1016/j.ypmed.2004.09.024

Pagoto, S. L., Schneider, K. L., Oleski, J., Bodenlos, J. S., Merriam, P., & Ma, Y. (2009). Design and methods for a cluster randomized trial of the Sunless Study: A skin cancer prevention intervention promoting sunless tanning among beach visitors. *BMC Public Health, 9*. doi: 10.1186/1471-2458-9-50

Papp, I., Urbán, R., Czeglédi, E., Babusa, B., & Túry, F. (2013). Testing the tripartite influence model of body image and eating disturbance among Hungarian adolescents. *Body Image, 10*, 232-242. doi: 10.1016/j.bodyim.2012.12.006

Parrott, R., & Lemieux, R. (2003). When the worlds of work and wellness collide: The role of familial support on skin cancer control. *Journal of Family Communication, 3*, 95–106. doi: 10.1207/S15327698JFC0302_02

Patel, S. S., Nijhawan, R. I., Stechschulte, S., Parmet, Y., Rouhani, P., Kirsner, R. S., & Hu, S. (2010). Skin cancer awareness, attitude, and sun protection behavior among medical students at the University of Miami Miller School of Medicine. *Archives of Dermatology, 146*, 797-800. doi: 10.1001/archdermatol.2010.140

Paul, C., Paras, L., Harper, A., & Coppa, K. (2011). Harm minimization in tan seekers: An exploration of tanning behaviour and the potential for substitutional use of sunless tanning products. *Journal of Health Psychology, 16*, 929-937. doi: 10.1177/1359105310396393

Paul, C., Tzelepis, F., Parfitt, N., & Girgis, A. (2008). How to improve adolescents' sun protection behavior? Age and gender issues. *American Journal of Health Behavior, 32*, 387-398. doi: 10.5555/ajhb.2008.32.4.387

Penton-Voak, I. S., Jacobson, A., & Trivers, R. (2004). Populational differences in attractiveness judgements of male and female faces: Comparing British and Jamaican samples. *Evolution and Human Behavior, 25*, 355-370. doi: 10.1016/j.evolhumbehav.2004.06.002

Perkins, H. W., & Berkowitz, A. D. (1986). Perceiving the community norms of alcohol use among students: Some research implications for campus alcohol education programming. *International Journal of the Addictions, 21*, 961-976.

Pichon, L. C., Corral, I., Landrine, H., Mayer, J. A., & Adams-Simms, D. (2010). Perceived skin cancer risk and sunscreen use among African American adults. *Journal of Health Psychology, 15*, 1181-1189. doi: 10.1177/1359105310364177

Potente, S., Coppa, K., Williams, A., & Engels, R. (2011). Legally brown: Using ethnographic methods to understand sun protection attitudes and behaviours among young Australians 'I didn't mean to get burnt - it just happened!'. *Health Education Research, 26*, 39-52. doi: 10.1093/her/cyq066

Prichard, I., Kneebone, A., Hutchinson, A. D., & Wilson, C. (2013). The relationship between skin tone dissatisfaction and sun tanning behaviour. *Australian Journal of Psychology*, Advance online publication. doi: 10.1111/ajpy.12039

Prochaska, J. O., & Velicer, W. F. (1997). The transtheoretical model of health behavior change. *American Journal of Health Promotion, 12*, 38-48. doi: 10.4278/0890-1171-12.1.38

Putnam, G. L., Brannon, B., & Yanagisako, K. L. (1982). Multimedia public/professional skin cancer education in a multiethnic setting. *Progress in Clinical and Biological Research, 83*, 437-448.

Ramirez, R., & Schneider, J. (2003). Practical guide to sun protection. *Surgical Clinics of North America, 83*, 97-107. doi: 10.1016/S0039-6109(02)00186-X

Randle, H. W. (1997). Suntanning: Differences in perceptions throughout history. *Mayo Clinic Proceedings, 72*, 461-466. doi: 10.1016/S0025-6196(11)64867-2

Reid, A. E., & Aiken, L. S. (2013). Correcting injunctive norm misperceptions motivates behavior change: A randomized controlled sun protection intervention. *Health Psychology, 32*, 551-560. doi: 10.1037/a0028140

Reynolds, D. (2007). Literature review of theory-based empirical studies examining adolescent tanning practices. *Dermatology Nursing, 19*, 440-443. Retrieved from http://www.medscape.com/viewpublication/786

Reynolds, K. D., Buller, D. B., Yaroch, A. L., Maloy, J. A., & Cutter, G. R. (2006). Mediation of a middle school skin cancer prevention program. *Health Psychology, 25*, 616-625. doi: 10.1037/0278-6133.25.5.616

Richmond, T. K., Austin, S. B., Walls, C. E., & Subramanian, S. V. (2012). The association of body mass index and externally perceived attractiveness across race/ethnicity, gender, and time. *Journal of Adolescent Health, 50*, 74-79. doi: 10.1016/j.jadohealth.2011.05.007

Rodrigues, A. M., Sniehotta, F. F., Birch-Machin, M. A., & Araujo-Soares, V. L. (2014, April). *Acceptability and feasibility of a mobile-phone intervention to promote sun safe behaviors amongst holidaymakers: Findings from the internal pilot of the Miskin randomized trial*. Paper presented at the annual meeting of the Society of Behavioral Medicine, Philadelphia, PA.

Rogers, R. W. . (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91*, 93-114. doi: 10.1080/00223980.1975.9915803

Sahay, S., & Piran, N. (1997). Skin-color preferences and body satisfaction among South Asian-Canadian and European-Canadian female university students.

Journal of Social Psychology, 137, 161-171. doi: 10.1080/00224549709595427

Sahn, R. E., McIlwain, M. J., Magee, K. H., Veledar, E., & Chen, S. C. (2012). A cross-sectional study examining the correlation between sunless tanning product use and tanning beliefs and behaviors. *Archives of Dermatology, 148*, 448-454. doi: 10.1001/archdermatol.2011.2072

Sandford, A. (2008). Trends in smoking among adolescents and young adults in the United Kingdom: Implications for health education. *Health Education, 108*, 223-236. doi: 10.1108/09654280810867097

Saraiya, M., Glanz, K., Briss, P. A., Nichols, P., White, C., Das, D., . . . Rochester, P. (2004). Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation: A systematic review. *American Journal of Preventive Medicine, 27*, 422-466. doi: 10.1016/j.amepre.2004.08.009

Sayre, R. M., & Dowdy, J. C. (2003). Sunbathing vs. indoor tanning: A realistic perspective. *Photodermatology Photoimmunology and Photomedicine, 19*, 105-107. doi: 10.1034/j.1600-0781.2003.00028.x

Schneider, S., & Krämer, H. (2010). Who uses sunbeds? A systematic literature review of risk groups in developed countries. *Journal of the European Academy of Dermatology and Venereology, 24*, 639-648. doi: 10.1111/j.1468-3083.2009.03509.x

Schwartz, S. J., Unger, J. B., Zamboanga, B. L., & Szapocznik, J. (2010). Rethinking the concept of acculturation: Implications for theory and research. *American Psychologist, 65*, 237-251. doi: 10.1037/a0019330

Shaw, J., & Waller, G. (1995). The media's impact on body image: Implications for prevention and treatment. *Eating Disorders, 3*, 115-123. doi: 10.1080/10640269508249154

Shimizu, H., Ross, R. K., Bernstein, L., Yatani, R., Henderson, B. E., & Mack, T. M. (1991). Cancers of the prostate and breast among Japanese and white immigrants in Los Angeles County. *British Journal of Cancer, 63*, 963-966. doi: 10.1038/bjc.1991.210

Shoveller, J. A., Lovato, C. Y., Peters, L., & Rivers, J. K. (2000). Canadian national survey on sun exposure & protective behaviours: Outdoor workers. *Canadian Journal of Public Health, 91*, 34-35. Retrieved from http://journal.cpha.ca/index.php/cjph

Shroff, H., & Thompson, J. K. (2006). The tripartite influence model of body image and eating disturbance: A replication with adolescent girls. *Body Image, 3*, 17-23. doi: 10.1016/j.bodyim.2005.10.004

Sinclair, C. A., Makin, J. K., Tang, A., Brozek, I., & Rock, V. (2014). The role of public health advocacy in achieving an outright ban on commercial tanning beds in Australia. *American Journal of Public Health, 104*(2), 7-9. doi: 10.2105/ajph.2013.301703

Sjöberg, L., Holm, L. E., Ullén, H., & Brandberg, Y. (2004). Tanning and risk perception in adolescents. *Health, Risk and Society, 6*, 81-94. doi: 10.1080/1369857042000193020

Smith, K. L., Cornelissen, P. L., & Tovée, M. J. (2007). Color 3D bodies and judgements of human female attractiveness. *Evolution and Human Behavior, 28*, 48-54. doi: 10.1016/j.evolhumbehav.2006.05.007

Smolak, L., Murnen, S. K., & Thompson, J. K. (2005). Sociocultural influences and muscle building in adolescent boys. *Psychology of Men and Masculinity, 6*, 227-239. doi: 10.1037/1524-9220.6.4.227

Sng, J., Koh, D., Siong, W. C., & Choo, T. B. (2009). Skin cancer trends among Asians

living in Singapore from 1968 to 2006. *Journal of the American Academy of Dermatology, 61*, 426-432. doi: 10.1016/j.jaad.2009.03.031

Sobel, M. E. (1982). Asymptotic confidence intervals for indirect effects in structural equation models. *Sociological Methodology, 13*, 290-312. doi: 10.2307/270723

Spradlin, K., Bass, M., Hyman, W., & Keathley, R. (2010). Skin cancer: Knowledge, behaviors, and attitudes of college students. *Southern Medical Journal, 103*, 999-1003. doi: 10.1097/SMJ.0b013e3181eda64f

Staples, M. P., Elwood, M., Burton, R. C., Williams, J. L., Marks, R., & Giles, G. G. (2006). Non-melanoma skin cancer in Australia: The 2002 national survey and trends since 1985. *Medical Journal of Australia, 184*, 6-10. Retrieved from http://www.mja.com.au/

Stapleton, J. L., Turrisi, R., & Hillhouse, J. (2008). Peer crowd identification and indoor artificial UV tanning behavioral tendencies. *Journal of Health Psychology, 13*, 940-945. doi: 10.1177/1359105308095068

Stapleton, J. L., Turrisi, R., Hillhouse, J., Robinson, J. K., & Abar, B. W. (2010). A comparison of the efficacy of an appearance-focused skin cancer intervention within indoor tanner subgroups identified by latent profile analysis. *Journal of Behavioral Medicine, 33*, 181-190. doi: 10.1007/s10865-009-9246-z

Stern, R. S., & Momtaz, K. (1984). Skin typing for assessment of skin cancer risk and acute response to UV-B and oral methoxsalen photochemotherapy. *Archives of Dermatology, 120*, 869-873. doi: 10.1001/archderm.1984.01650430055010

Stevens, C., & Tiggemann, M. (1998). Women's body figure preferences across the life span. *Journal of Genetic Psychology, 159*, 94-102. doi: 10.1080/00221329809596137

Stice, E., Mazotti, L., Weibel, D., & Agras, W. S. (2000). Dissonance prevention

program decreases thin-ideal internalization, body dissatisfaction, dieting, negative affect, and bulimic symptoms: A preliminary experiment. *International Journal of Eating Disorders, 27*, 206-217. doi: 10.1002/(SICI)1098-108X(200003)27:2<206::AID-EAT9>3.0.CO;2-D

Stone, V. B., Parker, V., Quarterman, M., & Lee, C. (1999). The relationship between skin cancer knowledge and preventive behaviors used by parents. *Dermatology Nursing, 11*, 411-416.

Strahan, E. J., Lafrance, A., Wilson, A. E., Ethier, N., Spencer, S. J., & Zanna, M. P. (2008). Victoria's dirty secret: How sociocultural norms influence adolescent girls and women. *Personality and Social Psychology Bulletin, 34*, 288-301. doi: 10.1177/0146167207310457

Stunkard, A. J., Sorensen, T., & Schulsinger, F. (1983). Use of the Danish adoption register for the study of obesity and thinness. In S. S. Kety, L. P. Rowland, R. L. Sidman & S. W. Matthysse (Eds.), *The genetics of neurological and psychological disorders* (pp. 115-120). New York: Raven Press.

Suinn, R. M., Ahuna, C., & Khoo, G. (1992). The Suinn-Lew Asian Self-Identity Acculturation scale: Concurrent and factorial validation. *Educational & Psychological Measurement, 52*, 1041-1046. doi: 10.1177/0013164492052004028

Swerdlow, A. J. (1990). International trends in cutaneous melanoma. *Annals of the New York Academy of Sciences, 609*, 235-251. doi: 10.1111/j.1749-6632.1990.tb32071.x

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics.* Boston MA: Allyn and Bacon.

Thompson, J. K., Ata, R., Roehrig, M., & Chait, S. (2012). Tanning: Natural and

artificial. In T. F. Cash (Ed.), *Encyclopedia of Body Image and Human Appearance*, Vol 2 (pp. 775-782). doi: 10.1016/B978-0-12-384925-0.00122-X

Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999a). *Exacting beauty: Theory, assessment, and treatment of body image disturbance* doi:10.1037/10312-000

Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999b). Future directions: Integrative theories, multidimensional assessments, and multicomponent interventions. In J. K. Thompson, L. J. Heinberg, M. Altabe & S. Tantleff-Dunn (Eds.), *Exacting beauty: Theory, assessment, and treatment of body image disturbance* (pp. 311-332). doi: 10.1037/10312-011

Thompson, J. K., Heinberg, L. J., Altabe, M., & Tantleff-Dunn, S. (1999c). The scope of body image disturbance: The big picture. In J. K. Thompson, L. J. Heinberg, M. Altabe & S. Tantleff-Dunn (Eds.), *Exacting beauty: Theory, assessment, and treatment of body image disturbance* (pp. 19-50). doi: 10.1037/10312-001

Thompson, J. K., van den Berg, P., Roehrig, M., Guarda, A. S., & Heinberg, L. J. (2004). The Sociocultural Attitudes Towards Appearance Scale-3 (SATAQ-3): Development and validation. *International Journal of Eating Disorders, 35*, 293-304. doi: 10.1002/eat.10257

Thornton, C. M., & Piacquadio, D. J. (1996). Promoting sun awareness: Evaluation of an educational children's book. *Pediatrics, 98*, 52-55. Retrieved from http://pediatrics.aappublications.org/

Tiggemann, M., & Dyer, G. M. (1995). Ideal body shape preferences and eating disorder scores in adolescent women. *Psychology and Health, 10*, 345-347. doi: 10.1080/08870449508400248

Tiggemann, M., & Miller, J. (2010). The internet and adolescent girls' weight

satisfaction and drive for thinness. *Sex Roles, 63*, 79-90. doi: 10.1007/s11199-010-9789-z

Tovée, M. J., Swami, V., Furnham, A., & Mangalparsad, R. (2006). Changing perceptions of attractiveness as observers are exposed to a different culture. *Evolution and Human Behavior, 27*, 443-456. doi: 10.1016/j.evolhumbehav.2006.05.004

Tsao, H., Rogers, G. S., & Sober, A. J. (1998). An estimate of the annual direct cost of treating cutaneous melanoma. *Journal of the American Academy of Dermatology, 38*, 669-680. doi: 10.1016/S0190-9622(98)70195-1

Turner, L. R., & Mermelstein, R. J. (2005). Psychosocial characteristics associated with sun protection practices among parents of young children. *Journal of Behavioral Medicine, 28*, 77-90. doi: 10.1007/s10865-005-2565-9

Tylka, T. L. (2011). Refinement of the tripartite influence model for men: Dual body image pathways to body change behaviors. *Body Image, 8*, 199-207. doi: 10.1016/j.bodyim.2011.04.008

U.S. Food and Drug Administration. (2006). *Sunless tanners and bronzers*. Retrieved from U.S. Food and Drug Administration website: http://www.fda.gov/cosmetics/productsingredients/products/ucm134064.htm

Udelhofen, P. M., Gies, P., Roy, C., & Randel, W. J. (1999). Surface UV radiation over Australia, 1979-1992: Effects of ozone and cloud cover changes on variations of UV radiation. *Journal of Geophysical Research: Atmospheres, 104*, 19135-19159. doi: 10.1029/1999JD900306

Universities Australia. (2013). *Australian universities data snapshot 2013*. Retrieved from Universities Australia website: http://www.universitiesaustralia.edu.au/australias-universities/key-facts-and-

data

Vail-Smith, K., & Felts, W. M. (1993). Sunbathing: College students' knowledge, attitudes, and perceptions of risks. *Journal of American College Health, 42*, 21-26. doi: 10.1080/07448481.1993.9940452

van den Berg, P., Thompson, J. K., Obremski-Brandon, K., & Coovert, M. (2002). The tripartite influence model of body image and eating disturbance: A covariance structure modeling investigation testing the mediational role of appearance comparison. *Journal of Psychosomatic Research, 53*, 1007-1020. doi: 10.1016/S0022-3999(02)00499-3

Vineis, Paolo, & Wild, Christopher P. (2014). Global cancer patterns: Causes and prevention. *The Lancet, 383*, 549-557. doi: 10.1016/S0140-6736(13)62224-2

Volkov, A., Dobbinson, S., Wakefield, M., & Slevin, T. (2013). Seven-year trends in sun protection and sunburn among Australian adolescents and adults. *Australian and New Zealand Journal of Public Health, 37*, 63-69. doi: 10.1111/1753-6405.12012

von Wagner, C., Knight, K., Steptoe, A., & Wardle, J. (2007). Functional health literacy and health-promoting behaviour in a national sample of British adults. *Journal of Epidemiology and Community Health, 61*, 1086-1090. doi: 10.1136/jech.2006.053967

Weinstock, M. A., & Fisher, D. E. (2010). Indoor ultraviolet tanning: What the data do and do not show regarding risk of melanoma and keratinocyte malignancies. *Journal of the National Comprehensive Cancer Network, 8*, 867-873. Retrieved from http://www.jnccn.org/

Weinstock, M. A., Rossi, J. S., Redding, C. A., & Maddock, J. E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched

intervention to increase sun protection among beachgoers. *Preventive Medicine, 35*, 584-592. doi: 10.1006/pmed.2002.1114

Weinstock, M. A., Rossi, J. S., Redding, C. A., Maddock, J. E., & Cottrill, S. D. (2000). Sun protection behaviors and stages of change for the primary prevention of skin cancers among beachgoers in southeastern New England. *Annals of Behavioral Medicine, 22*, 286-293. doi: 10.1007/BF02895664

Whiteman, D. C., Whiteman, C. A., & Green, A. C. (2001). Childhood sun exposure as a risk factor for melanoma: A systematic review of epidemiologic studies. *Cancer Causes and Control, 12*, 69-82. doi: 10.1023/A:1008980919928

Whittemore, A. S., Wu-Williams, A. H., Lee, M., Shu, Z., Gallagher, R. P., Deng-ao, J., . . . Henderson, B. E. (1990). Diet, physical activity, and colorectal cancer among Chinese in North America and China. *Journal of the National Cancer Institute, 82*, 915-926. doi: 10.1093/jnci/82.11.915

Wichstrøm, L. (1994). Predictors of Norwegian adolescents' sunbathing and use of sunscreen. *Health Psychology, 13*, 412-420. doi: 10.1037/0278-6133.13.5.412

Wickenheiser, M., Baker, M., Gaber, R., Blatt, H., & Robinson, J. K. (2013). Sun protection preferences and behaviors among young adult males during maximum ultraviolet radiation exposure activities. *International Journal of Environmental Research and Public Health, 10*, 3203-3216. doi: 10.3390/ijerph10083203

Williams, A. L., Grogan, S., Clark-Carter, D., & Buckley, E. (2013). Appearance-based interventions to reduce ultraviolet exposure and/or increase sun protection intentions and behaviours: A systematic review and meta-analyses. *British Journal of Health Psychology, 18*, 182-217. doi: 10.1111/j.2044-8287.2012.02089.x

Williamson, D. A., Gleaves, D. H., Watkins, P. C., & Schlundt, D. G. (1993). Validation of self-ideal body size discrepancy as a measure of body dissatisfaction. *Journal of Psychopathology and Behavioral Assessment, 15*, 57-68. doi: 10.1007/BF00964324

World Health Organization. (1992). *Melanoma and other malignant neoplasms of skin*. In International statistical classification of diseases and related health problems (10th ed.). Retrieved from World Health Organization website: http://apps.who.int/classifications/apps/icd/icd10online2007/gc43.htm

World Health Organization. (2011). *Sun protection*. Retrieved from World Health Organization website: http://www.who.int/uv/sun_protection/en/

Yamamiya, Y., Shroff, H., & Thompson, J. K. (2008). The tripartite influence model of body image and eating disturbance: A replication with a Japanese sample. *International Journal of Eating Disorders, 41*, 88-91. doi: 10.1002/eat.20444

Yoo, J.-J., & Kim, H.-Y. (2012). Adolescents' body-tanning behaviours: Influences of gender, body mass index, sociocultural attitudes towards appearance and body satisfaction. *International Journal of Consumer Studies, 36*, 360-366. doi: 10.1111/j.1470-6431.2011.01009.x

Youl, P. H., Janda, M., & Kimlin, M. (2009). Vitamin D and sun protection: The impact of mixed public health messages in Australia. *International Journal of Cancer, 124*, 1963-1970. doi: 10.1002/ijc.24154

Ziegler, R. G., Hoover, R. N., Pike, M. C., Hildesheim, A., Nomura, A. M. Y., West, D. W., . . . Hyer, M. B. (1993). Migration patterns and breast cancer risk in Asian-American women. *Journal of the National Cancer Institute, 85*, 1819-1827. doi: 10.1093/jnci/85.22.1819

Zwemer, E. K., Mahler, H. I., Werchniak, A. E., & Recklitis, C. J. (2012). Sun exposure

in young adult cancer survivors on and off the beach: Results from project REACH. *Journal of Cancer Survivorship, 6*, 63-71. doi: 10.1007/s11764-011-0201-y

APPENDIX A

Paper One Reprint

Day, A.K., Wilson, C.J., Hutchison, A.D. & Roberts, R.M. (2013) The role of skin cancer knowledge in sun-related behaviours: A systematic review. *Journal of Health Psychology, v. 19(9), pp. 1143-1162*

APPENDIX B

Paper Two Reprint

Day, A.K., Wilson, C., Roberts, R.M. & Hutchison, A.D. (2014) The skin cancer and sun knowledge (SCSK) scale: validity, reliability and relationship to sun-related behaviors among young western adults.
Health Education and Behavior, v. 41(4), pp. 440-448