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An exploration of adolescent sun-related behaviours and their measurement

Melinda Joy Williams
University of Wollongong

Faculty Health and Behavioural Sciences

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Melinda Joy Williams, BNursing, MPH

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CERTIFICATION

I, Melinda Williams, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the School of Health Sciences, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Melinda Williams

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PUBLICATIONS CONSTITUTING THIS THESIS

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Williams, M., Caputi, P., Jones, S.C. & Iverson, D. (2011), Sun-protecting and Sun-exposing Behaviours: Testing Their Relationship Simultaneously with Indicators of Ultraviolet Exposure among Adolescents. *Photochemistry and Photobiology*, 87(5), 1179-1183.

Williams, M., Jones, S.C., Caputi, P., & Iverson, D. (2011), Understanding the behaviour of the target market: What do adolescents think about when asked questions about their behaviour in the sun? In Proceedings of the *Australian and New Zealand Marketing Academy (ANZMAC) Conference 2011*; Perth, Australia

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Williams, M., Jones, S.C., Caputi, P., Iverson, D. (Submitted), Validity of adolescent self-reported sun protection behaviours in a school setting: Association of direct observations with a self-report diary and survey. *Photochemistry and Photobiology*.

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Publications as appendices to this thesis

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (2011), Adolescent Sun Protection: An examination of the prevalence of UV exposure indicators among brand loyalty segments, In Proceedings of the *2011 World Social Marketing Conference*, Dublin Ireland, 11-12 April 2011.

Williams, M., Jones, S.C., Iverson, D., Caputi, P. & Potente, S. (2010), 'Case Study in Academic and Industry Collaboration: The development of an adolescent targeted sun protection intervention in NSW', in Proceedings of the *2010 International Non-profit and Social Marketing Conference*, Brisbane Australia, 15-16 July 2010

This statement verifies that the greater part of the work in the above-named manuscripts is attributed to the candidate. Melinda Williams contributed to study design, undertook data collection and analysis, and prepared the first draft of each manuscript. She then responded to editorial suggestions of co-authors, and prepared the articles for submission to the relevant journals. Co-authors, who were also supervisors to the candidate, contributed to this thesis by providing guidance on the design and structure of the studies throughout this thesis as well as reviewing and providing feedback on every article prior to submission.

Professor Sandra C. Jones (Primary Supervisor)

Melinda Williams (Candidate)

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ABSTRACT

Adolescents are an important target group for interventions to reduce the incidence of skin cancer. Despite efforts to improve their sun protection behaviours, there is limited evidence of the effectiveness of programs targeting adolescents. In Australia, adolescents continue to exhibit sub-optimal sun-protection behaviours. One of the main challenges highlighted in studies is the need for the development of behavioural outcome measures to evaluate programs, specifically composite measures of adolescent sun-related behaviours. To facilitate the identification of outcome measures, conceptual models are useful tools as they necessitate the identification of outcomes of interest. However, there has been limited research exploring adolescent sun-related behaviours at a conceptual level. This thesis explored adolescent sun-related behaviours from a conceptual perspective as well as a measurement perspective, addressing major conceptual and methodological limitations of previous research.

This thesis contains two literature reviews and six empirical papers. A systematic literature search was completed to identify composite measures of adolescent sun-related behaviours used to evaluate skin cancer prevention programs (Chapter 2); each measure was compared in terms of the range of behaviours included in the measure, as well as the method used to calculate the composite score. Given the variation in measures identified in Chapter 2, a review of the literature was undertaken to identify a comprehensive conceptual model of adolescent sun-related behaviours. A range of conceptual models were identified; however, the review failed to identify a model specific to adolescent sun-related behaviours. An extended conceptual model of adolescent sun-related behaviours was developed (Chapter 3). To confirm that the range of behaviours in the newly developed conceptual model was accurate, a think-aloud

study using a self-report survey of sun-related behaviours was undertaken (Chapter 4). A cross-sectional survey was then conducted using a convenience sample (n= 692) of adolescents, to explore key relationships within the conceptual model. Data were analysed to determine the relationship between sun protection behaviours and sun-exposing behaviours with indicators of ultraviolet (UV) exposure (Chapter 5). Since fake tanning products are a relatively recent phenomenon and their relationship with UV exposure is not well understood, the use of fake tanning products among adolescents was then explored in terms of associated sun-protection behaviours (Chapter 6), followed by an exploration of the range of sun-protection behaviours adolescent perform across contexts (Chapter 7). A sub-group from the convenience sample also participated in a concurrent study to determine the validity of adolescent self-report in the school context by comparing observation data to self-report (Chapter 8). Finally, the utility of a composite measure of adolescent sun-related behaviours aimed at detecting behaviour change in evaluating a secondary school based intervention targeting adolescent sun-related behaviours was determined (Chapter 9).

The results suggest adolescents exhibit a range of behaviours that influence their UV exposure from the sun. While composite measures of sun protection behaviours exist, these measures frequently include an incomplete range of sun-protection behaviours and rarely include sun-exposing behaviours. Testing an extended conceptual model of adolescent sun-related behaviours confirmed that differences in sun-protecting behaviours exist across contexts; fake tan use was associated with more frequent sunburns; and the unique contribution of sun-protecting and sun-exposing behaviours to indicators of UV exposure were identified. The validation study of adolescent self-report yielded conflicting results, indicating adolescent self-report is valid using a diary

measure but not using a survey of 'usual' behaviours. The utility of a composite measure based on the conceptual model of adolescent sun-related behaviours demonstrated ability to detect small changes in behaviour over time when used to evaluate a program targeting adolescents in secondary schools.

This thesis contributes to our understanding of adolescent sun-related behaviours and their measurement. The development of a conceptual model provides an important contribution to conceptual clarity of adolescent sun-related behaviours. This thesis addressed a gap with regard to our understanding of the range of behaviours adolescents perform in the sun and provided data on the validity of adolescent self-report. Understanding sun-related behaviours are important as adolescents' exposure to UV radiation from the sun is the primary preventable risk factor for developing both melanoma and non melanoma skin cancers. Since adolescents demonstrate the highest level of risk behaviours in terms of low compliance with recommended sun protection behaviours, long periods of exposure to UV radiation and a high incidence of sunburns they are an important group for skin cancer prevention programs to target. For prevention programs to reverse the current negative trend in behaviours seen among adolescents, innovative program strategies are required. The results presented in this thesis have potential practical implications as they identify an increased range of behaviours that influence UV exposure which program planners can target. Furthermore, the use of a composite measure of sun-related behaviours such as presented in this thesis may provide a useful indicator of the overall effectiveness of skin cancer prevention programs targeting adolescents.

LIST OF KEY TERMS AND DEFINITIONS

Adolescent: For the purposes of this thesis, meaning aged between 12 and 18 years.

Composite Measure: For the purpose of this thesis, a measure of sun-related behaviours that combines a minimum of two behaviours.

Solarium: Ultraviolet radiation emitting devices, often referred to as tanning beds.

Fake tan: Fake tan products are lotions and sprays which temporarily pigment the skin without requiring exposure to ultraviolet radiation.

Sun-exposing behaviour: May be intentional or incidental. Intentional sun-exposing behaviour is exposure to the sun with the primary purpose of achieving a tan, whereas incidental exposure occurs as a result of being outdoors without adequate protection (Dobbinson and Hill, 2004).

Sun-protecting behaviour: Minimises the skins exposure to UV radiation, and includes wearing sunscreen, wearing a hat, wearing sunglasses, avoiding peak UV hours, seeking shade and wearing protective clothing.

Sun-related behaviour: Behaviour that increases or decreases exposure of the skin or the eyes to solar ultraviolet radiation (Dobbinson and Hill, 2004).

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CHAPTER 1: INTRODUCTION AND AIMS

This thesis explores adolescent sun-related behaviours from both a conceptual, and a measurement perspective. By addressing these two areas, this thesis contributes to our understanding of adolescent sun-related behaviours and their measurement, which has implications for the design and evaluation of skin cancer prevention programs. This introductory chapter provides a brief background to skin cancer, skin cancer prevention programs, adolescent sun-related behaviours and their measurement. This chapter also outlines a series of studies which aimed to address major conceptual and measurement limitations of previous research.

1.1 Background

1.1.1 Skin cancer

Australia has the highest incidence of skin cancer in the world. It is the most common form of cancer in Australia, with new cases estimated to outnumber all other forms of cancer by a ratio of four to one (AIHW, 2008). Skin cancer is also a significant burden to the health system in Australia, with more money spent on the diagnosis and treatment of skin cancer than any other cancer, an estimated $300 million each year (Cancer Council New South Wales and NSW Health Department, 2001). There is considerable evidence that exposure to ultraviolet (UV) radiation in sunlight leads to, or at least contributes to, skin cancer (Elwood and Jopson, 1997; Diffey, 2004; Baum and Cohen, 1998; Marks, 2000; Diepgen and Mahler, 2002; Slaper and de Gruijl, 2004). Furthermore, the majority of skin cancers could be prevented if the public were to be persuaded to adequately protect themselves from the sun (Severi and English, 2004). More specifically, the most significant gains could be made through targeting the most

vulnerable life stages of childhood and adolescence (Cancer Council New South Wales and NSW Health Department, 2001; Weinstock et al., 1989). With its high prevalence, large burden on the health system and established aetiology that is amenable to prevention, skin cancer remains an important and alterable public health issue in Australia, particularly for adolescents.

1.1.2 A history of skin cancer prevention programs

Population wide programs promoting sun protection and awareness of skin cancer have been in place for over 25 years in Australia. The Anti-Cancer Council of Victoria launched the *Slip! Slop! Slap!* Campaign in 1980 which targeted the sun protection behaviours of wearing a shirt, wearing a hat and applying sunscreen, expanding in the late 1980's to take a broader structural change approach to sun protection with the launch of the SunSmart Program (Montague et al., 2001). Programs of the late 1990's were characterised by the inclusion of hard hitting media messages (Montague et al., 2001). More recently, adolescents have been the target group for media campaigns with messages designed to shock them into action. Specific adolescent targeted campaigns include the NSW Cancer Institute's 'Darker Side of Tanning', as well as a graphic skin cancer awareness media campaign called 'Tattoo' implemented by the NSW Cancer Institute in 2006-2007. With a continued focus on adolescents as a target group for intervention programs, there is a need for further evidence on the effectiveness of those programs.

1.1.3 Effectiveness of programs targeting adolescents

The effectiveness of skin cancer prevention programs has been the topic of recent systematic reviews (Saraiya et al., 2004; Johnson, 2009, Lin et al., 2011). Saraiya

et al.'s (2004) review focused on programs to prevent skin cancer by reducing UV exposure across all age groups in different settings such as child care centres, primary schools, secondary schools, healthcare settings and recreational settings. Lin et al., (2011) focused solely on primary care counselling whereas Johnson's (2009) systematic review was specific to programs targeting adolescents and young adults across settings. Both Saraiya et al. (2004) and Johnson (2009) identified the lack of evidence available on the effectiveness of programs targeting adolescents and highlighted the need for further development of behavioural outcome measures to evaluate programs. Furthermore, Johnson (2009) suggested the field would be advanced by the development of composite measures of behaviours that enable determination of the overall effectiveness of programs. This gap has been identified previously by Lovato et al. (2000) who recommended the development and validation of scales and indices that provide a composite score representing exposure and protective behaviours. However, the development of appropriate measures of adolescent sun- related behaviours, including composite measures, requires a thorough understanding of the behaviours adolescents perform in the sun.

1.1.4 Adolescents and sun protection

Recommended sun protection behaviours include wearing a hat, wearing sunscreen, seeking shade, wearing protective clothing, wearing sunglasses and avoiding peak UV hours (Cancer Council Australia, 2011). While recommendations for sun protection behaviours are the same for adolescents as they are for the rest of the population, adolescents present unique challenges for health promotion planners. Available data suggest that adolescents generally engage in fewer sun protective strategies than adults (Dobbinson et al., 2008a). This decline begins in pre-adolescence,

continues to decline to around 15 to 17 years of age, and then improves as adolescents move into young adulthood (Lowe et al., 1993; Coogan et al., 2001; Schofield et al., 2007). Furthermore, despite interventions having successfully increased knowledge and positive attitudes to the need for sun protection, few have resulted in a positive change in behaviours (Cokkinides et al., 2002; Kristjansson et al., 2003a; Saraiya et al., 2004). The dissonance between sun protection knowledge and behaviours is highlighted in a cross sectional study of adolescents by Broadstock et al. (1996). They identified that adolescents whose skins were moderately sensitive tended to report similar attitudes and behaviour to their less at risk (non-sensitive skinned) peers. Broadstock et al. (1996) asserted this was not simply a consequence of ignorance as the moderately sensitive adolescents were the most knowledgeable; rather they proposed that adolescents are attempting to balance their desire to protect themselves from the sun with the desire to get a suntan, and they seek knowledge of sun protection to test the limits of what they can do without getting sunburnt. The potential that adolescents balance their risk by performing both sun-protecting and sun-exposing behaviours has implications for how adolescent sun-related behaviours are conceptualised as well as for how they are measured.

1.1.5 Adolescents and tanning

Since there is evidence to suggest adolescents protect their skin from the sun as well as intentionally expose their skin to the sun to tan, there is a need for both types of behaviours to inform the design and evaluation of programs. Among adolescents, the desire for a tan appears to be a strong influence on inadequate sun protection behaviours. Four cross sectional surveys of Australian adolescent sun-related behaviours (conducted in 1993, 1996, 1999 and 2002) identified that as desire for a tan

increased, routine practice of sun protection behaviours decreased (Livingston et al., 2007). The Australian National Sun Survey (2006/2007) found 22% of adolescents surveyed had attempted to suntan during summer; however, 51% desired a suntan, with 71% responding that friends think that a suntan is a good thing (Centre for Behavioural Research in Cancer, 2007). To obtain a tan, adolescents can use various strategies, one of which is intentionally exposing the skin to the sun. Other strategies include using a solarium and using fake tanning creams, sprays or lotions. A national survey of US adolescents reported 10% of respondents using solarium facilities during the previous year (Geller et al., 2002), and a survey of Swedish adolescents and young adults found 37% of females and 19% of males reported currently using solarium facilities, with the majority of users being 17 to 29 years old (Boldeman et al., 2001). Solarium use has been associated with increased skin cancer risk (Cust et al., 2011), whereas fake tanning products enable the user to appear tanned without the need for UV exposure. While less evidence exists regarding the use of fake tanning products among adolescents and the effect these products have on UV exposure, these products have been proposed as a harm minimisation strategy to high risk UV exposure (Chapman, 1999). Tanning behaviours influence adolescent UV exposure; therefore a thorough understanding of adolescent tanning behaviours is needed to develop appropriate behavioural outcome measures.

1.1.6 Composite measures of sun-related behaviours

Identified in the literature is a need for the development of behavioural outcome measures to evaluate skin cancer prevention programs (Lovato et al., 2000). On the basis that the underlying principle of adequate sun protection is to take an integrated approach to protect all skin, a useful measure is one that enables determination of the

overall protection provided by the combination of behaviours employed to reduce UV exposure (Dobbinson and Hill, 2004). Composite measures are potentially advantageous over counting behaviours separately as they enable the overall effectiveness of programs to be determined, yet composite measures present important challenges to researchers. Three major considerations are: the range of behaviours included in measures; the method used to combine the range of behaviours; and the validity and reliability of the measurement strategy being used. In a review of UV measurement strategies used in skin cancer prevention research, Creech and Mayer (1997) identified strategies for UV measurement reported as self-report, parental report, observation, visual inspection, polysulphone film, spectrophotometer and colorimeter. Each measurement strategy has inherent limitations. Self-reported behaviours are most frequently used because of their ease of use and low cost, despite their subjective nature and proneness to memory lapse and response bias. Level of recall is an important consideration in self-reported measures of sun-related behaviours as measures need to be sensitive to change within the context of a planned intervention. Furthermore, to fully understand the effectiveness of programs, composite measures should enable examination of the individual behaviors included in the measure. This would allow program planners and evaluators to determine which behaviors were most successfully changed by the program. Thus, composite measures should take into account key methodological issues in terms of the range of behaviours to include, the validity and reliability of the measurement strategy used, and the method used to combine the range of behaviours.

1.1.7 Conclusion

To evaluate adolescent targeted skin cancer prevention programs there is a need for behavioural outcome measures, including composite measures of sun-related behaviours. However, to develop appropriate measures, a thorough understanding of sun-related behaviours is required. Conceptual clarity of adolescent sun-related behaviours would facilitate the development of appropriate outcome measures. Adolescent sun-related behaviours are complex, and the adolescent group presents unique challenges for health promotion planners. There is a need to better understand adolescent sun-related behaviours so that valid and reliable measures of sun-related behaviours can be developed.

1.2 Aims

This thesis aimed to contribute to our understanding of adolescent sun-related behaviours and their measurement by addressing major conceptual and methodological limitations of previous research examining adolescent sun-related behaviours.

This included the following objectives:

1. Review available research data and identify major approaches used to evaluate skin cancer prevention programs using composite measures of adolescent sun-related behaviours
2. Based on the outcome from the review of literature, develop and conduct a cross-sectional self-report survey examining adolescent sun-related behaviours. This addressed four research questions:
    a. What is the face validity of a newly developed measure of adolescent sun-related behaviours?
    b. What is the relationship between specific sun protection behaviours and sun-exposing behaviours with indicators of UV exposure?
    c. Do adolescent fake tan users practice better sun-protection behaviours than non-users?
    d. To what extent do adolescent sun-protection behaviours vary across key contexts relevant to adolescents during summer?

These data were then used to:

3. Determine the validity of adolescent self-report sun-related behaviours in a school setting, and
4. Develop and pilot test the utility of a composite measure of adolescent sun-related behaviours in detecting behaviour change by evaluating a secondary school based skin cancer prevention intervention.

1.3 Structure of the thesis

This thesis adopted an innovative approach to explore adolescent sun-related behaviours and consisted of five stages:

Stage One

Stage one consisted of a systematic literature search of major approaches used to create composite measures of adolescent sun-related behaviours. The results of this review are presented in Chapter 2.

Stage Two

Stage two consisted of a systematic literature search of conceptual models of adolescent sun-related behaviours. The results are presented in Chapter 3 and provided an important conceptual model that was used to guide the subsequent empirical Chapters 4, 5, 6, 7 and 8.

Stage Three

Stage three consisted of a think-aloud study of 24 adolescents and consultation with seven experts in the cancer control field to develop a measure of adolescent sun-related behaviours based on the conceptual model presented in Chapter 3. The results are presented in Chapter 4.

Stage Four

Stage four consisted of a survey (called the 'Summer Lifestyle Survey') using a convenience sample of 692 adolescents. This was an extensive survey exploring adolescent sun-related behaviours and included a validation study of adolescent self-report with data from 244 adolescents from the sample. Using data from the Summer Lifestyle Survey, separate elements of the conceptual model were explored. These elements included: the relationship between sun-related behaviours and UV exposure (Chapter 5); the relationship between fake tanning products and sun-protection behaviours (Chapter 6); and the relationship between sun-protection behaviours and different contexts during summer (Chapter 7). Results from the validation study of adolescent self-report is presented in Chapter 8

Stage Five

Stage five consisted of a school based intervention and evaluation testing the utility of a composite measure of adolescent sun-related behaviours in detecting behaviour change. A pre-post matched intervention and comparison group design was used with a sample of 352 adolescents. The results are presented in Chapter 9.

1.4 Methods Section

The overall design of this research was multi-stage, mixed methods approach, combining exploratory qualitative research as well as quantitative data collection. The initial stage of the research involved two extensive literature reviews, which resulted in the development of a conceptual model of adolescent sun-related behaviours (Chapter 3). This conceptual model was then used to develop a survey instrument of adolescent sun-related behaviours, called the Summer Lifestyle Survey. After the Summer

Lifestyle Survey was developed, it was used in four separate studies which form this thesis. Below is a summary of the data collection tool, the sample population, the methods and the analysis for each study.

Think-aloud study (July 2009)

The first empirical study was testing the face validity of the Summer Lifestyle Survey with adolescents.

The data collection tool

A new survey instrument was developed based on the findings of the two literature reviews, as well as the newly developed conceptual model of adolescent sun-related behaviour, called the Summer Lifestyle Survey. The instrument contained 38 questions about sun-related behaviours and included questions about specific behaviours that were considered relevant to UV exposure among adolescents.

The sample population

A convenience sample of 24 adolescents was identified through academic staff and students from a university in Wollongong on the south coast of New South Wales, Australia. Participants were aged between 12 and 18 years.

Methods

This was a qualitative stage of the research process whereby participants were asked to think aloud while completing the survey to determine their understanding and thought processes. Their responses were probed throughout the interview, and responses recorded on audio tape.

Analysis

On completion of the interviews, transcripts were made from the audio tapes and a content analysis completed to identify themes that emerged from participant responses. These findings are presented in Chapter 4.

Cross-sectional survey of adolescents (September 2009)

The second empirical study involved a cross-sectional survey with a convenience sample of 692 adolescents. The aim of the cross-sectional survey was to use the adapted Summer Lifestyle Survey to test key relationships identified in the conceptual model (Chapter 3). This included exploring the relationship between sun-related behaviours and indicators of UV exposure (Chapter 5), exploring the relationship between fake tan use and sun protection (Chapter 6), exploring differences in sun protection behaviours across contexts (Chapter 7) and determining the validity of adolescent self-report data (Chapter 8).

The data collection tool

The instrument contained 40 questions and was based on the results of the think-aloud study. Items were included to prompt recall of behaviours specific to the individual contexts sun exposure occurs within, and an explanation provided as to what 'sun-protection' includes, that is sun protection includes wearing a hat, wearing sunscreen, wearing sunglasses, seeking shade and wearing protective clothing.

The sample population

The sample was a convenience sample of 692 adolescents. Three methods of recruitment were used: schools, online and via a regional Australian university's promotional events. Schools were selected based on their geographic location. All schools were located within a single local government area of a coastal community in eastern Australia. All schools meeting the eligibility criteria were invited to participate

in the study (a total of six independent and Catholic secondary schools); two schools agreed to participate, one independent school and one Catholic school. An advertisement for the survey was placed on the social networking site, Facebook. The advertisement was promoted to individuals with a Facebook account who were aged between 12 and 18 years of age. Participants were also recruited at information evenings held by the regional university for Year 12 students; none of these students were from the participating schools.

Methods

This was a quantitative stage of the research whereby participants were invited to complete the Summer Lifestyle Survey. Participants recruited via Facebook completed the survey on-line, whereas participants recruited in schools or at the university information evenings were asked to complete the survey on paper. Data was then entered into SPSS-version 17.0.

Analysis

Data collected using the cross-sectional survey was analysed and findings reported in four separate chapters of this thesis, Chapters 5, 6, 7 and 8.

Validation Study (September 2009)

A validation study of adolescent self-report was completed among a sub-sample of 376 adolescents.

The data collection tools

Participants had already completed the Summer Lifestyle Survey as part of the cross-sectional study. An additional two instruments were used in the validation study, a one day sun behaviours diary which was completed by participants at school, and an

observation tool which was used by trained observers who observed students during outdoor intervals in the school environment.

The sample population

The sample was a sub-group (n=376) of the adolescent population who had already completed the cross-sectional survey (n=692) and was not a completely new group of participants. Schools referred to in the validation study are the same schools that participated in the cross-sectional study.

Methods

This was a quantitative study where participants' data were matched across the three data collection tools and compared to determine the validity of self-report. At the beginning of the school day participants were asked to complete a written Summer Lifestyle Survey. After returning the survey, participants were given a diary record which they were instructed to complete after each outdoor interval; recess, lunch and PE. Recess was held each day from 10:50-11.10am, lunch from 12:50-1:30pm, and PE time varied depending on individual student timetables. During each outdoor interval, trained observers walked around the school grounds in pairs observing participants' behaviours in the sun. The trained observers recorded the observed behaviours on a standardised form.

Analysis

Data collected using the cross-sectional survey, the sun behaviour diary and the observation tool was analysed and results are reported in Chapter 8.

Intervention Study (December 2009- March 2010)

The final empirical study in this thesis is an evaluation study of a school-based intervention using the Summer Lifestyle Survey in a matched pre-post test with comparison group design.

The data collection tools

Data was collected using a paper version of the Summer Lifestyle Survey. Questions were adapted to allow the recall period to be appropriate to the duration of the intervention.

Methods

The school-based intervention was evaluated using a matched pre and post test design with a comparison group. There were two intervention regions and one comparison region. Participating schools were selected on the basis on their geographic location. Baseline surveys of self-reported sun-related behaviours and cognitions were completed by adolescents in Year 8 and 9 at the beginning of summer during Term 4, Intervention activities were conducted within each school in the intervention regions at the beginning of Term 1. Follow-up self-report surveys were completed by students across the three regions at the end of Term 1 in March 2010 (Time 2), four weeks after the intervention.

Analysis

Data collected in the pre and post test survey were analysed using SPSS- version 17 and the findings are reported in Chapter 9.

1.5 Style of the Thesis

This thesis is submitted in fulfilment of the requirements of a Doctor of Philosophy in Style 2, where chapters are prepared as journal articles. Chapters 2 through to 9 comprise eight articles, three of which have been published in peer-reviewed journals, one published in a conference proceeding as a peer-reviewed conference paper, and four submitted for editorial review to peer-review journals. While articles are formatted according to the guidelines for each journal, the referencing has been changed to Author-Date style and language set to English (Australia) for consistency within the thesis. An integrated reference list has been included at the end of this thesis.

CHAPTER 2: A REVIEW OF COMPOSITE MEASURES OF ADOLESCENT SUN-RELATED BEHAVIOURS USED IN THE EVALUATION OF SKIN CANCER PREVENTION PROGRAMS

Williams M., Caputi P., Jones S.C. & Iverson, D. (Submitted), A review of composite measures of adolescent sun-related behaviours used in the evaluation of skin cancer prevention programs. *American Journal of Preventive Medicine*.

2.1 Executive Summary

This article provides a review of the literature on composite measures of adolescent sun-related behaviours used in the evaluation of skin cancer prevention programs. It describes the variation in behaviours assessed in composite measures and reports the psychometric properties of composite measures. This article was written by the candidate with co-authors Associate Professor Peter Caputi, Professor Sandra Jones and Professor Don Iverson, and was submitted to the *American Journal of Preventive Medicine* and is currently under review.

2.2 Abstract

Objective: To review, via a systematic search of articles, composite measures of adolescent sun-related behaviours used in the evaluation of skin cancer prevention programs.

Methods: We searched MEDLINE, CINAHL and PsycINFO for relevant intervention studies that included the adolescent population and reported a composite measure of sun-related behaviours. Abstracts and full texts of studies meeting eligibility criteria were reviewed. For each identified composite measure we reviewed the behaviours assessed, measurement strategies used, calculation methods applied, and psychometric properties reported.

Results: Twelve studies met the eligibility criteria and 13 composite measures were identified. The specific sun-related behaviours included, as well as the methods for calculating composite scores, varied substantially between studies. Overall, there is a lack of psychometric evidence on the validity and reliability of composite measures.

Conclusion: This review has highlighted the variation in composite measures used to evaluate skin cancer prevention programs among the adolescent population. To advance the field, there is a need for a more complete construct definition of adolescent sun-related behaviours, as well as agreement on the specific behaviours to include in composite measures. The field would be advanced by further research that builds evidence on the validity and reliability of composite measures of adolescent sun-related behaviours.

Key words: Measurement, composite measures, sun protection behaviours, evaluation, adolescents.

2.3 Introduction

There is currently no universally accepted gold standard measure for quantifying personal ultraviolet (UV) exposure. In a systematic review of interventions to prevent skin cancer by reducing UV exposure, Saraiya et al. (2004) highlighted that the range of behavioural outcome measures being used in intervention research limits our ability to determine and compare the effectiveness of interventions. Given that the underlying principle of adequate sun protection is to take an integrated approach to protect all of the skin, a comprehensive measure would enable determination of the overall protection provided by the combination of behaviours employed that influence UV exposure (Dobbinson and Hill, 2004a). A standardised, valid and reliable composite measure of adolescent sun-related behaviours is needed to more accurately determine program effects as well as enable comparison of behavioural outcomes between studies.

Composite measures of sun-related behaviours are potentially advantageous over assessing behaviours separately, as a composite measure can account for the alternatives available to individuals to reduce their UV exposure (Hill, 2004a), and thereby provide an indicator of the overall protection provided by the combined sun-related behaviours (Dobbinson and Hill, 2004). Composite measures, at least theoretically, can improve our ability to identify effective interventions as the use of a number of separate outcomes can prevent the detection of positive changes. For example, in a study of 211 female university students, Jackson (1997) found that significant changes in sun protection behaviour were detected using a composite measure of sun protection but changes in each of the individual behaviours did not reach significance levels. Composite measures of sun-related behaviours can also facilitate the interpretation of studies with mixed results, for example, studies where a

significant increase was observed in one behaviour and a concurrent decrease was observed in another. In the evaluation of the Falmouth Safe Skin Project to promote sun protection in children, wearing a shirt or a hat at the beach decreased while use of sunscreen increased (Miller et al., 1999). Without a composite measure of sun protection behaviour it is difficult to determine the net effectiveness of an intervention in reducing total UV exposure.

Multiple reviews have called for increased use of standardised measures of sun-related behaviours in skin cancer prevention programs to enable synthesis of intervention outcomes (Lovato et al., 2000; Saraiya et al., 2004; Glanz and Mayer, 2005; Kasparian et al., 2009). To some extent, however, the variation in behavioural outcome measures used reflects the complicated nature of sun-related behaviours. Protection from the sun is multi-faceted, contingent on the environment, and behaviours are not equivalent in the level of UV protection they provide. Sun protection behaviours include a combination of wearing protective clothing, wearing a hat, wearing sunglasses, using sunscreen, using shade, and avoiding sun exposure during peak hours. Contingent factors include the temperature, environment, presence of peers or family and access to facilities such as the availability of shade (Dobbinson and Hill, 2004a).

Notwithstanding the complexity of sun-related behaviours in general, the adolescent segment presents unique challenges. Adolescents are a high risk group for excess UV exposure, with available evidence suggesting they both protect their skin from the sun and intentionally expose it to the sun (Keesling and Friedman, 1987; Arthey and Clarke, 1995; Jackson and Aiken, 2000). In a study by Lupton and Gaffney (1996), for example, adolescents reported deliberately using a sunscreen with a low sun protection factor (SPF) and delaying the application of sunscreen to get a tan. Whereas

sun protection behaviours reduce exposure of the skin to UV radiation, sun-exposing behaviours increase exposure of the skin the UV radiation (Dobbinson and Hill, 2004). A useful composite measure of adolescent sun-related behaviours thus would need to account for the complex range of behaviours adolescents perform in the sun.

Despite their utility, composite measures are also potentially problematic. Glanz and Mayer (2005) highlight that composite scores may mask behaviour-specific changes due to an intervention as well as interactions between demographic variables and specific behaviours (e.g., males are more likely to wear a hat). To fully understand the effectiveness of interventions, a composite measure should therefore be able to allow examination of the individual behaviours included in the measure. This would allow program planners and evaluators to determine which behaviours were most successfully changed by the intervention.

Historically, few authors have reported on the combined protection provided by clothing, sunscreen and hat use (Dobbinson and Hill, 2004). In the published proceedings of the Canadian National Workshop on measurement of sun-related behaviours (Lovato et al., 2000), workshop participants called for further research into the development of scales and indices that provide a composite score representing both exposure and protective behaviours. Yet, despite a large array of work broadly concerned with sun-related behaviours and their measurement, rarely has the use of composite measures of adolescent sun-related behaviours been explored. A well-developed, standardised, composite measure of adolescent sun-related behaviours may provide the best measure of effectiveness of programs. The purpose of this paper is to review composite measures of adolescent sun-related behaviours used in intervention

research, and examine the measurement strategies used to construct composite measures.

2.4 Methods

A review of the peer-reviewed literature was undertaken to identify and compare existing composite measures of adolescent sun-related behaviours used in intervention research. A literature search was conducted for studies published prior to October 2011 in three databases (MEDLINE, PsycINFO, and CINAHL) reporting on intervention studies which included the adolescent population. The search strategy from the US Task Force on Community Preventive Services protocol for the review of interventions to reduce UV exposure (Saraiya et al. 2004) was adapted to identify studies specific to adolescents. The search terms included: skin neoplasm or skin cancer or melanoma, basal cell or carcinoma, squamous cell or nevus or keratosis or actinic keratosis or sun damage or photo damage or skin aging solar keratosis AND primary prevention/ or prevention or knowledge/ or knowledge, attitudes, practice/ or knowledge awareness/ or awareness or attitude or attitudes or public policy/ or policy or health promotion/ or health education or behavio/ or sunburn: or suntan: or tanning ultraviolet rays/ or ultraviolet radiation or sun exposure: or sun protect: or sun safety or solar protect: or solar exposure or sunlight/ or protective clothing/ or protective clothing or sunscreening agents AND adolescen* or youth or teen*. All search results were limited to the English language.

2.4.1 Inclusion/exclusion criteria

Specific inclusion criteria for studies were: 1) intervention programs that included adolescents aged between 12 and 18 years; 2) behaviour change was a target

outcome and reported as a composite measure defined as combining a minimum of two sun-related behaviours; 3) use of direct measures (observation or self-report) for data collection; 4) focus of the intervention was on primary prevention; and 5) published in a peer-reviewed journal. Papers were excluded if they: 1) involved special populations of culturally or medically distinct groups such as individuals with a personal history of skin cancer; 2) focused on indoor tanning behaviours i.e. solarium use rather than outdoor sun exposure; 3) only included one year of the target age group, for example studies that focused on individuals '12 years or younger', or '18 years or older'; and 4) did not describe the individual behaviours included in the composite measure or the method of calculating the composite measure. Reference lists were reviewed to identify additional studies meeting the above criteria.

2.4.2 Assessment of measures

Composite measures of sun-related behaviour were evaluated against a pre-determined list of sun-related behaviours, including both sun-protecting behaviours and sun-exposing behaviours. Sun protection behaviours consisted of: using sunscreen, wearing protective clothing, wearing a hat, seeking shade, and wearing sunglasses. These behaviours are consistent with proposed standardised measures of sun protection behaviours by Glanz et al. (2008), with the addition of avoidance of peak UV hours. Sun-exposing behaviours included: time spent outdoors, reducing sun protection, delaying the use of sun protection, avoiding sun protection and attempting to tan. Time spent outdoors and attempting to tan are included in the recommended standardised measures of sun protection behaviours by Glanz et al. (2008); the additional sun-exposing items have been used previously by our research team and were shown to be useful in understanding UV exposure among adolescents (Williams et al., 2011a).

2.5 Results

Searching produced 2195 potentially relevant papers. An initial screening was completed based on title and abstract and removal of duplicates, with 178 papers deemed as appropriate for full text review. Secondary screening was then completed on the 178 papers, based on inclusion and exclusion criteria. The primary reasons for exclusion included: the outcome measures used were not reported as a composite, the method for calculating the composite measure was not described in sufficient detail, and the target age group for the intervention was not clearly defined as including adolescents aged between 12 and 18 years.

Twelve studies reported the inclusion of a composite measure and met selection criteria. Details of the 12 studies are summarised in Table 2.1. The settings for interventions included secondary schools, recreational settings, community-wide programs and mass media campaigns. Three studies were identified that included the target population of 12 to 18 years in occupational settings (Hall et al., 2009; Glanz et al., 1998; Glanz et al., 2001), however these studies were excluded on the basis that the employment setting presents unique rules and constraints to adolescents thereby representing a different population to the target group for this review. Where a composite measure was used in multiple papers reporting outcomes from the same study sample, only one study was included e.g. Buller et al. (2006) and Reynolds et al. (2006). Buller et al. (2006) reported two composite measures within the same study. Hill et al. (1993) reported using the same Body Cover Index as the baseline study of the same intervention (Hill et al., 1992), however, since the baseline study also reported a second composite measure, a Body Exposure Index, both studies were included. Two studies reported using the same composite measure, the Sun Protection Behaviours

Scale (Weinstock et al., 2002; Norman et al., 2007); as these were in different settings and samples, both studies were included. Five intervention studies focused specifically on the adolescent population and seven studies included a primarily adult population with some overlap to the target population of 12 to 18 years (Lombard et al., 1991; Hill et al., 1992; Hill et al., 1993; Carmel et al., 1994; Weinstock et al., 2002; Dixon et al., 2008; Dobbinson et al., 2008b).

Table 2.1 Summary of studies including a composite measure of adolescent sun-related behaviours

Author and year	Location	Intervention	Setting	Age and Sample size (n)	Name of composite
Buller et al.(2006)	USA	Sunny Days Healthy Ways	Secondary school	11-15 years (n=2,038)	Behaviour Composite Total body coverage score
Carmel et al. (1994)	Israel	3 stage- Pamphlets, screening & lecture	Community wide	15 years + (n=509)	Sun Exposure Protective Behaviour
Hill et al. (1992)	Australia	SunSmart (baseline)	Community wide	14 years + (n=1655)	Body Exposure Index
Hill et al. (1993)	Australia	SunSmart	Community wide	14 years + (n=4428)	Body Cover Index
Lombard et al. (1991)	USA	SafeSun	Recreation	16 years + (2 pools, Membership Pool A n=325, Pool B n=293)	Aggregate measure: two or more behaviours
Lowe et al. (1999)	Australia	Skin Cancer and Teenagers (SCAT) Project	Secondary school	Grade 8,9,10 Age in years not provided (n=3,400)	Sun Protective Behaviour Index
McGee et al. (1992)	New Zealand	Cancer Society's Sun-smart campaign	Mass media	Grade 10. Age in years not provided (n=345)	Sun protection score

Norman et al. (2007)	USA	SunSmart Expert System in Primary Care	Primary care	11-15 years (n=819)	Sun Protection Behaviour Scale
Olson et al. (2007)	USA	SunSafe in the Middle School Years	Community wide	Grades 6-8. Age in years not provided (n=794 at baseline, 492 at follow-up)	Body Surface Area protected
Weinstock et al. (2002)	USA	Rhode Island Sun Smart Project	Recreation	16 years + (n=2,324)	Sun Protection Behaviour Scale
Dobbinson et al. (2008)	Australia	SunSmart	Mass media	16 years + (n=11,589)	Body Exposure Index
Dixon et al. (2008)	Australia	SunSmart	Community wide	14 years + (n=46,810)	Clothes cover index

2.5.1 Behaviours included in composite measures

The behaviours included in the composite measures are summarised in Table 2.2. Wearing protective clothing and sunscreen use were the behaviours most frequently included in composite measures. However, substantial variation exists between measures on how these behaviours were assessed. Hill et al. (1992) provided a detailed assessment of wearing protective clothing where 17 separate body segments were coded to reflect the clothing worn on each segment during a specific interval of sun exposure on the most recent weekend. In contrast, the composite measure by McGee and Williams (1992) included only one item for protective clothing ('protect self with clothing') with recall of this behaviour being over the summer period. Buller et al. (2006) assessed sunscreen use by level of agreement with the statement 'I wore sunscreen with SPF >15', whereas Carmel et al. (1994) did not assess the SPF of the sunscreen used but rather where it was applied ('Do you protect yourself from the sun by using sunscreen on your face' and 'using sunscreen on your body'). Wearing sunglasses and avoidance of peak UV hours were the sun protection behaviours least frequently included in composite measures.

Table 2.2 Behaviours included in composite measures of adolescent sun-related behaviours

		X= behaviours included in the composite measure										
		Sun-protecting behaviours						Sun-exposing behaviours				
Author and year	**Name of composite**	**Use Sun-screen**	**Wear Protec-tive clothing**	**Wear a Hat**	**Seek Shade**	**Wear Sun-glasses**	**Avoid Peak UV hours**	**Time spent out-doors**	**Reduce protection**	**Delay using sun protect ion**	**Time spent tanning**	**Avoiding all sun protection**
Buller et al. (2006)	Behaviour Composite	X	X	X	X	X	X					
	Total body coverage score	X	X	X	X			X				
Carmel et al. (1994)	Sun Exposure Protective Behaviour (SEPB)	X	X	X			X	X				
Hill et al. (1992)	Body Exposure Index	X	X	X				X				
Hill et al. (1993)	Body Cover Index (clothing)		X	X								

Author and year	Name of composite	Use Sun-screen	Wear Protec-tive clothing	Wear a Hat	Seek Shade	Wear Sun-glasses	Avoid Peak UV hours	Time spent out-doors	Reduce protection	Delay using sun protect ion	Time spent tanning	Avoiding all sun protection
Lombard et al. (1991)	Aggregate measure: two or more behaviours	X	X	X	X	X						
Lowe et al. (1999)	Sun Protective Behaviour Index (SPBI)	X	X	X	X			X				
McGee et al. (1992)	Sun protection score	X	X	X								
Norman et al. (2007)	Sun Protection Behaviour Scale (SPBS)	X	X		X		X					
Olson et al. (2007)	Body Surface Area (BSA) protected	X	X	X	X	X						
Weinstock et al. (2002)	Sun Protection Behaviour Scale (SPBS)	X	X		X		X					
Dobbinson et al. (2008)	Body Exposure Index	X	X	X		X						
Dixon et al. (2008)	Clothes cover index		X	X								

In relation to sun-exposing behaviours, three of the composite measures included an assessment of time outdoors (Hill et al., 1992; Lowe et al., 1999; Buller et al., 2006), with one study (Carmel et al., 1994) including a measure of 'Reducing the hours of exposure to the sun'. Dobbinson et al. (2008) assessed time outdoors but reported it as a separate dependent variable to the behaviour composite called a Body Exposure Index. Buller et al. (2006) included three measures of sun exposure (lay out in sun to get a tan, use a self-tanning cream, get sunburned) however reported them as separate indicators. None of the identified studies included specific sun-exposing behaviours within a single composite measure of sun-related behaviour that included both sun-protecting behaviours and sun-exposing behaviours.

2.5.2 Measurement strategies

The measurement strategies and period of recall used for each composite measure are summarised in Table 2.3. Three strategies were identified for collecting data used to generate composite measures; self-report surveys (written, face-to-face or telephone based), self-report diaries and observation data. Survey methods were the most frequently used source of data to create a composite measure of adolescent sun-related behaviours. Periods of recall varied substantially, from recall of behaviours on the previous weekend (Hill et al., 1992; Hill et al., 1993; Dobbinson et al., 2008) to recall of behaviours last summer (McGee and Williams 1992; Buller et al., 2006). Three studies used a written survey (McGee and Williams 1992; Carmel et al. 1994; Buller, Reynolds et al. 2006), one used a computer based survey (Norman et al. 2007), one study surveyed adolescents face-to-face (Weinstock et al., 2002), and three via telephone (Hill et al., 1992; Hill et al., 1993; Dobbinson et al., 2008).

Two studies used a diary format to record data on behaviours over different time intervals. One diary collected data only during school time (Buller et al. 2006), and another collected data on behaviours for one day when at school and one day on the weekend (Lowe et al. 1999). Two studies used data collected during observation at beaches or pools to generate the composite measure (Olson et al., 2007, Lombard et al., 1991), while another study (Dixon et al., 2008) collected observation data at both beaches and pools as well as non-aquatic outdoor leisure environments including parks, gardens and golf courses.

Table 2.3 Method, recall and calculation methods used in composite measures

Author and year	Name of composite	Method	Recall	Calculation method
Buller et al. (2006)	Behaviour Composite	Written survey	"When outside >15mins past month"	Mean rating across 6 items 5-point likert scales
	Total body coverage score	1 day diary	When outdoors while at school yesterday during recess, lunch, PE	A weighted body coverage measure ranging from 0-15. Protection level was calculated by giving each participant an aggregate score for use of solar protection measures on each of eight body regions. The points assigned to each body region were weighted to reflect the comparative risk of that region developing melanoma or skin cancer.
Carmel et al. (1994)	Sun Exposure Protective Behaviour (SEPB)	Written survey	"Do you protect yourself from the sun by…"	Sum of the ratings across 6 items 9-point likert scales
Hill et al. (1992)	Body Exposure Index	Telephone survey	When outside for >15mins on previous weekend, on Sunday	For the body exposure index, use of sunscreen, its sun protection factor, and time spent outside were included with the proportion of the body covered by clothing (including trouser/dress and sleeve length) for 17 separate body segments. The resulting value is an index of the degree to which the whole body was exposed to sunlight in the designated period.

Hill et al. (1993)	Body Cover Index (clothing)	Telephone survey	When outside for >15mins on previous weekend, on Sunday	The body coverage index indicates the percentage of the body covered by clothes. For this 17 separate body segments were identified, and whether each was clothed or not was determined from the self-report of details of clothing worn. Each segment was weighted according to the proportion of the total body surface area it occupies on a person of average proportions. The weighted scores were then summed to give an index of the proportion of the body covered by clothing.
Lombard et al. (1991)	Aggregate measure: two or more behaviours	Observation	Observation at pool between 2pm-2:30pm	Count of two or more behaviours
Lowe et al (1999)	Sun Protective Behaviour Index (SPBI)	2- day diary	Sunday/Monday diary	For each of six time periods during the day, a Sun Protective Behaviour Index score summarised the sun-protective behaviour exhibited in that period. Each of the periods of the diary was then assigned weights based on measured ultraviolet radiation levels. A student's aggregate SPBI was then obtained by summing the products of each SPBI and its corresponding weight.
McGee et al. (1992)	Sun protection score	Written survey	Sun protection over the summer period	Composite across 3 items, of respondents who 'Often' or 'always' performed 3 behaviours
Norman et al. (2007)	Sun Protection Behaviour Scale (SPBS)	Computer survey and telephone survey	"When in the sun for more than about 15 minutes, how often do you…"	Mean rating across 7 items 5-point likert scales

Olson et al. (2007)	Body Surface Area (BSA) protected	Observation (and interview for sunscreen use)	Observation at beach/pool between 11am and 3pm	The total body surface protected by different clothing types and/or sunscreen was calculated using algorithms based on body surface area charts. Six levels of upper body clothing, Four levels of lower body clothing and three levels of hats, sunglasses, and whether in the shade were used to determine the total percent of body surface area protected.
Weinstock et al. (2002)	Sun Protection Behaviour Scale (SPBS)	Face to face survey	"When in the sun for more than about 15 minutes, how often do you…"	Mean rating across 7 items 5-point likert scales
Dobbinson et al. (2008)	Body Exposure Index	Telephone survey	When outside for >15mins on previous weekend, on Sunday (or Saturday)	The body exposure index was based on the Wallace rule of nines, that the body can be divided into approximately nine equal parts, and based on the same method as described for the Body Exposure Index by Hill et al. (1992)
Dixon et al. (2008)	Clothes cover index	Observation	Observation during summer weekends between 11am and 3pm	Summing the proportion of body covered by type of hat, shirt and leg cover.

2.5.3 Calculation methods for composite measures

The methods for calculating the composite measures are summarised in Table 2.3. There were three main methods utilised; body surface area calculations; mean scores; and counting the behaviours performed. The amount of body surface area protected or exposed was used to calculate a composite measure in six studies (Hill et al., 1992; Hill et al., 1993; Buller et al., 2006; Olson et al., 2007; Dixon et al., 2008; Dobbinson et al., 2008). Buller et al. (2006) calculated a total body coverage score adapted from a sun protection diary based on previous research (Girgis et al., 1993). The diary data were used to calculate a weighted body coverage measure for each time period spent outdoors by giving each participant an aggregate score for use of solar protection measures on each of eight body regions. The points assigned to each body region were weighted to reflect the comparative risk of that region developing melanoma or skin cancer. Hill et al. (1993) reported a composite body cover index that reflected the percentage of the body covered by clothes. For this, 17 separate body segments were identified; whether each was clothed or not was determined from the self-report of details such as trouser and sleeve length. Each segment was weighted according to the proportion of the total body surface area it occupies on a person of average proportions and then summed to give an index of the body exposed to sunlight in the designated period. In previous work by Hill et al. (1992), a body exposure index was calculated which, additional to the measures of body coverage by clothing, also included use of sunscreen, SPF and time spent outdoors. Dobbinson et al. (2008) further developed the body exposure index by including the use of sunglasses in the index. Olson et al. (2007) calculated the total percent of body surface protected by different clothing types and/or sunscreen using algorithms based on body surface area charts.

The evaluation end point was the proportion of the adolescent's body surface protected from the sun by clothing, sunscreen, or shade.

Three studies used mean scores across frequency items to create a composite score of sun-related behaviour (Weinstock et al., 2002; Buller et al., 2006; Norman et al., 2007). The Sun Protection Behaviour Scale (Norman et al., 2007, Weinstock et al., 2002) is calculated by determining the mean response across the seven items that reflect compliance with four sun protection behaviours on 5-point likert scales (never-rarely-sometimes-often-always), with higher scores indicating greater use of sun protection. Buller et al. (2006) created a behaviour composite calculating the mean score across six items that reflected compliance with six sun protection behaviours using 5-point likert scales. While not calculating a mean score, Carmel et al. (1994) created a summed score of responses on frequency scales of 1 (not at all) to 9 (always). The sum of the six scores comprised the index of Sun Exposure Protective Behaviour (SEPB) with higher scores indicating more compliance to recommendations. McGee and Williams (1992) also reported a composite measure based on frequency scales reporting the proportion of respondents who 'often' or 'always' used sunscreen, wore a hat and wore protective clothing.

Counting the number of behaviours performed was used as the method for calculating the composite measure in two studies. Lombard et al. (1991) used observation data to create a measure of sun protection behaviours among participants using 'two or more protective behaviours'. A more complex algorithm was developed by Lowe et al. (1991) called the Sun Protection Behaviour Index (SPBI) which summarised the number of sun protection behaviours students performed using a 2-day diary. In the diary students were asked to indicate at which times they were outside on

Sunday and Monday, and which sun protection measures they used at those times. For each of six time periods during the day, a SPBI score summarised the number of sun-protective behaviours exhibited. Each of the periods was then assigned weights based on measured ultraviolet radiation levels. A student's aggregate SPBI was then obtained by summing the products of each SPBI and its corresponding weight.

2.5.4 Psychometric properties of composite measures

Reliability

Three studies reported internal consistency of the composite measure, with Cronbach alpha of 0.43 for the Behaviour Composite (Buller et al., 2006), 0.71 for the Sun Exposure Protective Behaviour (Carmel et al., 1994) and 0.78 for the Sun Protection Behaviour Scale by Norman et al. (2007). Olson et al. (2007) reported a high correlation between application of sunscreen or clothing on the face and neck ($r=0.80$), upper/lower arms, upper/lower legs, and front/neck trunk ($r\geq0.85$) suggesting the categorisation of body surface area groupings was appropriate. In the study by Lombard et al. (1991), interrater reliability was reported for observation data, with ratings of: shirts 97.8%, sunglasses 87.1%, shade 100%, hats 93.1% and zinc 100%. In Norman et al. (2007) 33 adolescents were retested 1 week later on average; reliability was good (intraclass correlation coefficient = 0.70).

Validity

The majority of studies reported adapting or using composite measures from previous studies. Three studies (Hill et al., 1993; Dixon et al., 2008; Dobbinson et al., 2008) reported adapting composite measures originally developed by Hill et al. (1992).

The total body coverage score used by Buller et al. (2006) was based on a previous study by Girgis et al. (1993) which compared self-report data with observation data. In the study by Girgis et al. (1993), kappa (k) indices for the different behaviours included: headwear k=0.70, clothing worn on shoulders k=0.34, clothing on legs k=0.35 and use of shade k=.031. The composite measure developed by Girgis et al. (1993), and also used by Buller et al. (2006), were later validated in another study (Yaroch et al., 2006) where comparisons were made with UV sensitive monitors, reporting Kendall's tau b for hand =0.42, face=0.54, arm=0.40, and leg=0.82. Two studies used the Sun Protection Behaviour Scale (SPBS), Norman et al. (2007) and Weinstock et al. (2002); however, the original study by Weinstock et al. (2000) refers only to an unpublished manuscript reporting validation data. Lowe et al. (1999) based their composite measure on previous work by Gillespie et al. (1993) and cite an examination of the psychosocial correlates of the index by Balanda et al. (1999) providing evidence of criterion validity of the index.

In only two studies were the composite measures examined for validity using primary data (Hill et al. 1992; Buller et al. 2006). The body exposure index- which takes into account time outside, hat use, clothing and sunscreen use- was shown to be a significant independent predictor of sunburn (χ^2 (1)=27.9 p<.001) (Hill et al., 1992). Buller et al. (2006) used a sub-sample to compare self-report data with a colorimeter, finding the greater the reported sun safe behaviour the lower the redness of the skin (r=0.15, p=0.03).

2.6 Discussion

Our review showed that composite measures of sun-related behaviours have been used in the evaluation of skin cancer prevention programs among adolescents. Where used, the scope of sun-protection behaviours included within the composite measure is often limited to an incomplete range of behaviours and rarely, if ever, are specific sun-exposing behaviours included. Furthermore, data on the psychometric properties of existing composite measures are frequently not determined. The most frequently reported method for calculating composite measures is using body surface area (Hill et al., 1992; Hill et al., 1993; Buller et al., 2006; Olson et al., 2007; Dixon et al., 2008; Dobbinson et al., 2008); however, this method is limited as it reflects behaviour during a single point in time, as opposed to over an extended period which would indicate a change in habit (Saraiya et al., 2004). Determining the mean score across likert items was the second most frequent calculation method, however, the public health importance of small average changes across likert items may be difficult to discern (Saraiya et al., 2004).

This review has two important implications for further research. First, the identified variation in behaviours assessed suggests a clear construct definition of adolescent sun-related behaviours that takes into account the range of behaviours adolescents perform in the sun is lacking. Glanz et al. (2008) made substantial progress towards standardisation of measures through recommending a core set of behavioural measures for use in intervention research; what is currently lacking, however, is an agreed method for calculating a composite measure. Second, given the lack of data on the psychometric properties of existing composite measures, the field would be

advanced by further research that builds evidence on the validity and reliability of composite measures of adolescent sun-related behaviours.

Adolescents present unique challenges to program planners. Despite being knowledgeable about the need for sun protection (Livingston et al., 2001) adolescents have consistently been found to exhibit low levels of adherence to sun protection guidelines (Fritschi et al., 1992; Livingston et al., 2007; Dobbinson et al., 2008a). A major barrier to adequate sun protection among adolescents is the desire to be tanned (Fritschi et al., 1992; Lowe et al., 1993). In an analysis of repeated cross sectional studies of Australian adolescents in 1993, 1996, 1999 and 2002, Livingston et al. (2007) noted that as desire for a tan increased, compliance with recommended sun protection behaviours decreased. It is surprising, therefore, that composite measures of adolescent sun-related behaviours have rarely considered the combined impact of sun-protecting and sun-exposing behaviours. There is some evidence of the distinction between sun-protecting and sun-exposing behaviours being explored among university students (Jackson and Aiken, 2000; Mahler et al., 2003; Mahler et al., 2005; Mahler et al., 2007) however, rarely has this distinction been explored among adolescents. Furthermore, previous research has identified significant differences in habitual sun protection behaviours of adolescents across contexts (Williams et al., 2011c); suggesting context plays an important role in adolescent sun-related behaviours. Few composite measures have assessed behaviours across multiple contexts, such as on weekends and at school.

In this review we focused solely on studies evaluating interventions. Composite measures have been used to assess the prevalence of sun protection behaviours in population surveys using nationally representative samples in Australia (Livingston et al., 2003; Livingston et al., 2007), the USA (Hall et al., 1997; Cokkinides et al., 2001;

Santmyire et al., 2001), Canada (Purdue, 2002) and Sweden (Branstrom et al., 2001). As with the studies examined in this paper, the method for calculating composite measures varied between population studies. Branstrom et al. (2001), with a cross sectional national sample of 2,615 adolescents, calculated an index using one item concerning whether the respondent did anything to protect themselves from the sun and six items concerning the specific sun protection behaviours performed. Purdue (2002) calculated a composite measure 'Leisure time sun exposure', combining time in the sun and sun protection behaviours performed. Other population studies have used frequency groupings to report the number of individuals who routinely practice behaviours (Livingston et al., 2003, Livingston et al., 2007, Cokkinides et al., 2001). These population studies further highlight the variation in methods of calculating composite measures within the literature.

A number of limitations of this review warrant discussion. The review was limited to studies reporting composite measures using data collected predominantly from self-report. Creech and Mayer (1997) identified seven types of measurement strategies of UV exposure, which they classified as either direct or indirect. Direct measurement strategies include verbal report and observation because they attempt to assess behaviours directly related to UV exposure or avoidance such as sunscreen use. Despite limitations of direct measurement strategies, including self-report's subjective nature, proneness to memory lapse and response bias, these measures are frequently the most practical for intervention research and the most frequently used in intervention research on sun protection (Glanz and Mayer, 2005). Additionally, adolescents self-report of sun protective behaviours have been found to be generally valid (Lower et al., 1998).

This review was limited to studies published in the peer-reviewed literature and, as a result for example we had no access to a large scale study that used a composite measure. The 'Me No Fry' campaign was a specific adolescent targeted campaign implemented in two states of Australia, New South Wales and Western Australia. Industry evaluation reports from the NSW campaigns from 1992, 1993, 1994 and 1995 were published however we were not able to secure the data. The Western Australian campaign report (Jalleh and Donovan, 2003) did not sufficiently describe the method of calculating the composite score but a summary of the 'Me No Fry' Campaigns by the National Health and Medical Research Council in Australia (National Health and Medical Research Council, 1996) noted sun protection as having been assessed using a diary of behaviours performed on the previous weekend, with the level of sun protection determined using a coding schedule adapted from previous research (Foot et al., 1993; Girgis et al., 1993; Girgis et al., 1994). This method appears similar to the method used by Lowe et al. (1991).

A strength of this review was the detailed focus on composite measures used among a high risk population for excess UV exposure. To date a detailed analysis of composite measures of adolescent sun-related behaviours has been lacking. This review represents a summary of the current state of knowledge regarding composite measures of adolescent sun-related behaviours. While substantial gains towards standardisation of measures of UV exposure have been made through the work by Glanz et al. (2008), further work is needed on the development of valid and reliable composite measures of adolescent sun-related behaviours. To advance the field, a conceptual model of adolescent sun-related behaviour is required; agreement on the range of behaviours to include in a composite measure is essential, as is consideration to the importance of

different contexts specific to adolescents. This review has highlighted the range of quantitative approaches used to calculate composite measures, and development of a composite measure using the most appropriate mathematical methods is warranted. Given the current state of knowledge, a valid and reliable composite measure of adolescent sun-related behaviour remains a challenge in the field of skin cancer prevention.

CHAPTER 3: TOWARDS A CONCEPTUAL MODEL OF ADOLESCENT SUN-RELATED BEHAVIOURS

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (Submitted), Towards a conceptual model of adolescent sun-related behaviours. *Journal of Adolescent Research.*

3.1 Executive Summary

Chapter 3 describes the development of a conceptual model of adolescent sun-related behaviours. The model sought to provide conceptual clarity of sun-related behaviours among adolescents, since a review of the literature (Chapter 2) identified variation in the range of behaviours included in composite measures, suggesting conceptual clarity was required. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi, and Professor Don Iverson. It was submitted to the *Journal of Adolescent Research*, and is currently under review.

3.2 Abstract

Variations and inconsistencies in operationalising key terms central to understanding UV radiation exposure among adolescents are evident in the literature. Given these variations, there is a need to explore adolescent sun-related behaviours at a conceptual level. Conceptual models are useful tools as they necessitate the identification of the outcomes of interest in prevention programs. In this paper we explore existing conceptual models of adolescent sun-related behaviours. A systematic literature search of five databases was completed, identifying seven conceptual models of behaviour; however, none of the identified models specified a complete range of behaviours influencing UV exposure among adolescents. As a result of this gap in the literature an extended conceptual model of adolescent sun-related behaviours was developed. The model categorises sun-related behaviours into three main groups, sun-protecting behaviours, intentional sun-exposing behaviours and incidental sun-exposing behaviours. The model identifies the relationships between behaviours, genetic factors, environmental factors and indicators of UV exposure. The model represents a step towards conceptual clarity of sun-related behaviours among adolescents, and provides a framework for future studies targeting adolescents by bringing together, in one model, the range of sun-related behaviours that determine adolescents' total UV exposure from the sun.

Keywords: Skin cancer prevention; adolescents; conceptual model; sun protection; sun exposure; sun-related behaviours

3.3 Introduction

Skin cancer prevention programs are aimed at reducing exposure to UV radiation among individuals and populations. Like other types of health promotion efforts, these programs are most likely to succeed when they are based on a clear understanding of the targeted health behaviours (Saraiya et al., 2004). It seems necessary, therefore, to provide conceptual clarification of the behaviours that influence UV radiation exposure, particularly among adolescents who are frequently targeted in skin cancer prevention programs. 'Sun-protection' and 'sun exposure' are two terms widely used in the skin cancer prevention literature. They are broadly defined as behaviours that either increase or decrease exposure of the skin or eyes to the sun (Dobbinson and Hill, 2004b). However, without explicit identification of the individual behaviours, there is an inherent assumption of consensus on the targeted behaviours in skin cancer prevention programs. In a review of composite measures of adolescent sun-related behaviours, substantial differences in the range of sun-protecting and sun-exposing behaviours included in existing composite measures was revealed (Williams et al., 2011b) suggesting a range of operational definitions of adolescent sun-related behaviours is being used.

With respect to the concept of sun-protection, earlier studies have tended to emphasise the use of sunscreen as the primary outcome measure of program effectiveness (Saraiya et al., 2004). Current recommendations for sun-protection behaviour across Australia are to protect yourself in five ways: (seek) shade, (slip on) protective clothing, (slap on) a broad brimmed hat, (slide on) sunglasses and (slop on) SPF 30+ sunscreen (Cancer Council NT, 2011; Cancer Council NSW, 2010; Cancer Council SA, 2011; Cancer Council ACT, 2011; Cancer Council WA, 2011; Cancer

Council QLD, 2011; Cancer Counsil Tas, 2011). In some instances (Cancer Council Australia, 2011), recommendations also include specific reference to avoiding the sun during peak UV hours, and recommendations to practice sun protection during specific months of the year (Cancer Council Vic, 2011). Given that individuals can reduce their UV exposure by selecting and substituting from a range of sun-protection behaviours to suit individual preferences and the context they are in, it is surprising that composite measures of adolescent sun-related behaviours rarely include the complete range of sun-protection behaviours (Williams et al., 2011b).

While sun-protection behaviours are an important component of skin cancer prevention programs, the concept of 'sun exposure' is also important. Despite programs having successfully increased knowledge and enhanced positive attitudes to the health hazards of sun exposure, few programs have demonstrated positive change in sun-exposing behaviours (Cokkinides et al., 2002; Saraiya et al., 2004; Kristjansson et al., 2003b). Williams et al (2011a) defined specific adolescent sun-exposing behaviours and then combined these behaviours with sun-protecting behaviours. Their study found that simultaneous assessment of sun-protecting behaviours and sun-exposing behaviours provided the greatest explanatory power of indicators of UV exposure among adolescents (sunburn, current tan, desired depth of tan) compared with either dimension being assessed alone. These data suggest sun-exposing behaviours and sun-protecting behaviours are both important components of overall UV exposure among adolescents.

Varied interpretations of the concept of 'sun exposure' are evident in the literature. Dobbinson and Hill (2004, p.214), in a review of the literature, defined sun exposure as 'being outdoors in the sun, regardless of deliberate protection used at that time'. Alternatively, previous work has conceptualised sun exposure among young

adults as including two dimensions, one being intentional sun exposure (e.g. sunbathing) and the other incidental sun exposure, defined as sun exposure obtained while doing other (non-sunbathing) activities (Mahler et al., 2003; Mahler et al., 2005; Mahler et al., 2007). Similarly, Shoveller et al. (2003), in a qualitative exploration of Canadian adolescent sun-exposing behaviours, reported adolescents actively attempt to tan using two distinct methods; intentional tanning and incidental tanning. The first method, intentional sun-tanning, includes deliberate attempts to obtain a tan such as lying in the sun and using solaria, whereas incidental sun-tanning involves getting a tan while engaging in an outdoor activity other than lying in the sun. While these two methods for tanning are different, Shoveller et al. (2003) note they are not mutually exclusive. Despite 'sun-exposure' being a core concept in influencing overall UV exposure, the distinction between intentional and incidental sun exposure has not been adequately examined (Saraiya et al., 2004).

In light of the variation and inconsistencies in operationalising key terms which are central to understanding UV exposure among adolescents, a review of conceptual models of adolescent sun-related behaviours is warranted. Conceptual models are useful as they necessitate the identification of the outcomes of interest in programs and thus can be useful for program planning (Saraiya et al., 2004). There are numerous theoretical models of health behaviours such as the Health Belief Model (Rosenstock, 1974) and the Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980), which define constructs that are useful in predicting and changing behaviours. These models of psychological variables are essential and important; however, to add to our understanding of behaviours, the focus of this review was on identifying conceptual models of specific 'sun-related behaviours' rather than the

psychological constructs that influence them. This paper makes a contribution to the literature by extending the existing conceptual models of sun-related behaviours. This elaboration should be useful in guiding the development and evaluation of skin cancer prevention programs targeting adolescents.

3.4 Methods

A review of the peer-reviewed and grey literature was undertaken to identify existing conceptual models of adolescent sun-related behaviours. A literature search was conducted for articles published prior to November 2011 in five databases (Web of Science, Scopus, MEDLINE, CINAHL and PsycINFO). The search terms included: skin neoplasms OR skin cancer OR melanoma OR squamous cell OR basal cell OR photo damage OR sun damage OR skin cancer prevention OR skin cancer intervention OR sun exposure OR sun related OR sun prot* OR tanning OR suntan OR sun safety AND behaviour OR behaviour AND conceptual OR framework OR conceptual model OR conceptual framework OR planning framework.

3.4.1 Inclusion/exclusion criteria

The inclusion criteria were: 1) articles that reported using or developing a conceptual model, conceptual framework or planning/analytic framework of UV exposure, sun-related behaviours or skin cancer prevention; and 2) articles where the types of sun-related behaviours that were included in the conceptual model were described in the manuscript. Articles were excluded if they focused on the psychological antecedents of behaviours or did not specify that 'behaviour' was included in the model.

3.5 Results

The search strategy produced 218 potentially relevant articles. Initial screening was completed on the 218 articles using titles and abstracts which resulted in 35 papers being reviewed in full. Reference lists were reviewed to identify other potentially relevant articles in both peer-reviewed and grey literature. The primary reason for exclusion was that the model did not include any reference to behaviours (e.g. Ferguson and Vita (2005).

Seven articles were identified that described a conceptual model or framework which included sun-related behaviours (Peterson et al. 2010; Lucas et al., 2006; Hillhouse and Turrisi, 2005; Saraiya et al., 2004; Shoveller et al., 2003; Montague et al., 2001; Hill and Boulter, 1996), the behaviours included in each model are described in Table 3.1.

Table 3.1 Conceptual models

Author (Date)	Conceptual Model	Purpose of the model	Behaviours included	Target population	Description of behaviours in the model
Petersen et al. (2010)	The Skin Cancer Prevention Framework	Guide efforts in population-level skin cancer prevention and evaluation	"Personal UV protection behaviour"	Whole of population	Personal UV protection behaviour is identified as a determinant of skin cancer (based on WHO/Lucas 2006).
Lucas et al. (2006)	Causal web for health impacts due to ultraviolet radiation	To outline the determinants of the health impacts of ultraviolet radiation	"Behaviour -sun-seeking -sun-protective"	Whole of population	Behaviour, both sun-seeking and sun-protective, are identified (along with genetic, cultural, and immune factors) as proximal factors to diseases associated with ambient UV radiation.
Hillhouse and Turrisi (2005)	Behavioural alternative model	A theorectical model to guide intervention efforts	Behaviour in question and the viable alternative behaviour	Young people	Based on decision theoretic framework. This model posits that health-related behaviours are best predicted by examining both the behaviour in question (e.g. sunbathing) and the viable alternative behaviours available to the individual that compete for attention and time (e.g. going to a movie, to a friend's house, to the mall)

Saraiya et al. (2004)	Analytic framework for media interventions to reduce ultraviolet exposure and increase sun-protective behaviors	A model/analytic framework to depict the conceptual approach to preventing skin cancer by reducing UV exposure for mass media interventions. Used to compare the effectiveness of mass media interventions in a systematic review.	"Change behaviour: Increase UV protection (use of appropriate clothing, shade and sunscreen). Limit UV exposure (avoiding exposure during peak hours)"	Whole of population	"Changing behaviours" is identified in the model as related to decreasing the incidence of sunburn and changing attitudes about UV exposure (exposure during peak hours) and sun tanning. Behaviours are also identified as related to possible harms, including vitamin d deficiency and less physical activity, as well as decreased incidence of skin cancer.
Shoveller et al. (2003)	The process of becoming a tanner	To explain the processes by which adolescents make decisions about getting a suntan and guide future quantitative analysis	"Intentional tanning" and "Incidental tanning"	Adolescents	The model identifies two types of tanning behaviours, intentional and incidental, on a pathway from becoming motivated to tan, experimenting and establishing self leading to two types of tanning behaviours, intentional and incidental tanning.

Montague et al. (2001)	SunSmart Program- a schematic diagram of main routes of influence of the SunSmart program directed at reduced exposure to ultraviolet radiation	Articulate how the SunSmart program could reduce skin cancer. This model incorporates both individual and social change.	"Sun protection behaviour"	Whole of population	Sun protection behaviour is identified in the model as influenced by environment, social and cultural norms as well as knowledge attitudes and intentions.
Hill and Boulter (1996)	Behavioural factors in causation of skin cancer	Provide a framework for interventions aimed at the prevention of skin cancer.	"Behavioural causes"	Whole of population	Behavioural causes are identified in the model as influenced by predispositions, social norms, physical environment, resources, activity demands, weather and genetics.

The purpose of the models or frameworks varied between studies, for example four conceptual models were described as being used to guide program design (Peterson et al. 2010; Hillhouse and Turrisi, 2005; Montague et al., 2001; Hill and Boulter, 1996), while in another the conceptual model was used to describe a causal pathway for the disease burden associated with UV exposure (Lucas et al., 2006). Other purposes included guiding future quantitative research design (Shoveller et al., 2003), and comparing the effectiveness of mass media interventions in a systematic review (Saraiya et al., 2004). Models were applicable to the whole of population in all but one instance where the model was based on the adolescent population (Shoveller et al., (2003).

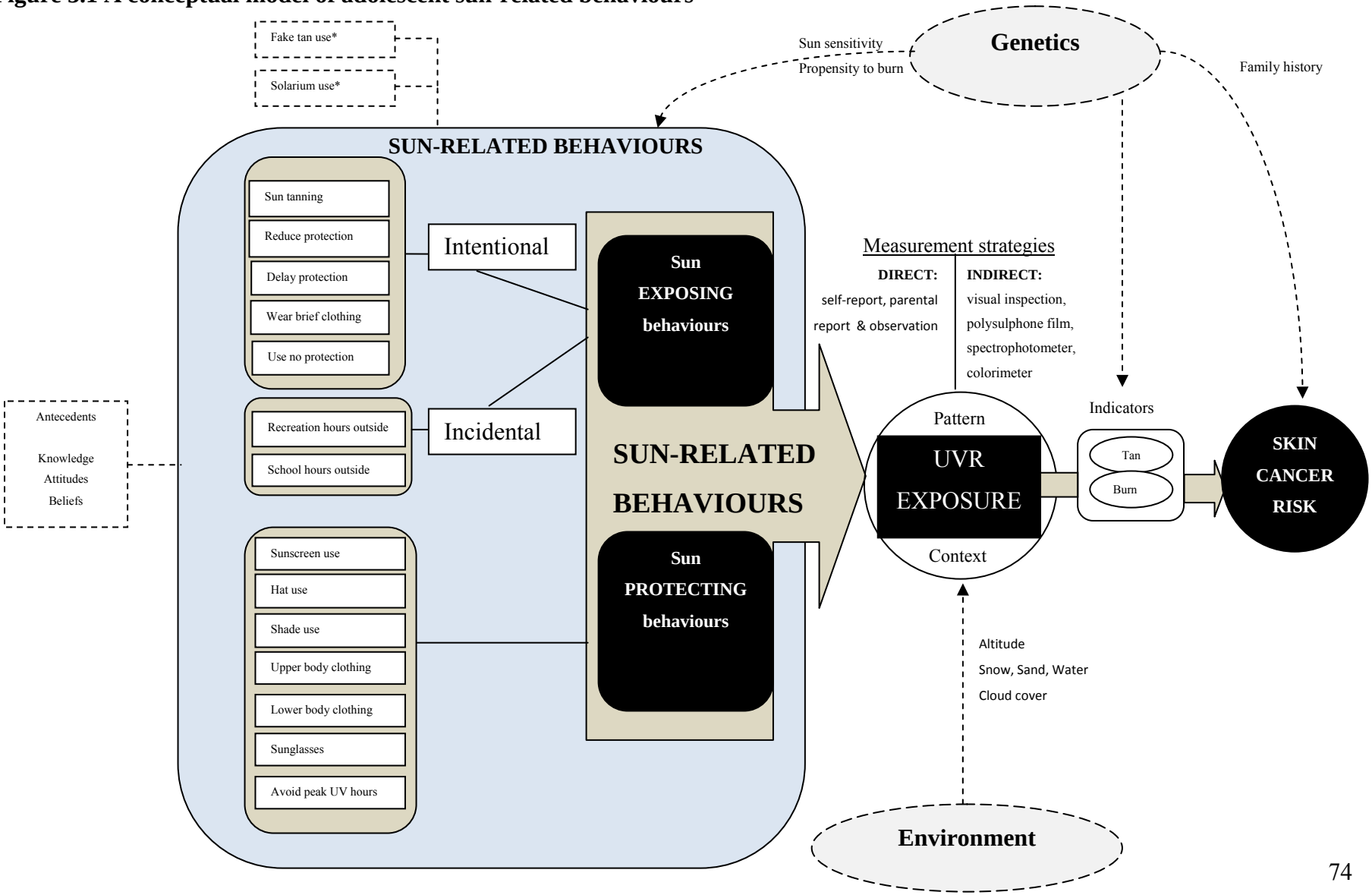
The specific sun-related behaviours included in existing models or frameworks vary, with few models identifying specific individual sun-related behaviours or the measurement approaches for behaviours. For example, Montague et al. (2001) identify 'sun-protection behaviour' as a component of their model to reduce UV exposure with no reference to sun-exposing behaviours, while Lucas et al. (2006) identify both sun-protecting behaviours and sun-seeking behaviours in their causal pathway of skin cancer, but do not define the specific behaviours within these two constructs. Hill and Boulter (1996) conceptualise the role of behavioural factors in the development of skin cancer, and how these behaviours are in turn influenced by other factors including a person's skin type, attitudes and beliefs, social norms and the physical environment. This model identifies 'behavioural causes' as central to the model, within the manuscript they are described as including sun exposure, protective behaviour and deliberate sunbathing. The Skin Cancer Prevention Framework (Peterson et al., 2010) takes into account individual behavioural outcomes, as well as outcomes at a setting or

environment level, however, the individual behaviours were not explicitly defined in the model, only stating "Personal UV protection behaviour". None of the identified models included a range of specific sun-related behaviours that included both sun-protection and sun exposure and which defined the measurement approaches as well as relationship of behaviours with UV exposure. Thus, a new conceptual model of adolescent sun-related behaviours was developed.

3.5.1 Proposed Model

In order to provide conceptual clarity of the 'behavioural causes' of skin cancer specific to the adolescent population we expanded on existing conceptual models of sun-related behaviours (see Figure 3.1). Our model includes three categories of sun-related behaviours: sun-protecting behaviours, intentional sun-exposing behaviours and incidental sun-exposing behaviours. These behaviours are represented as pathways to UV exposure and ultimately skin cancer risk. Consistent with the Hill and Boulter (1996) model, non-behavioural factors, including both genetics and environmental UV radiation, are included in the model. Furthermore, the model defines indicators of UV exposure, including sunburns and tanning, which can be used as indicators of UV exposure and later linked with skin cancer risk. The antecedents to sun-related behaviours, including knowledge, attitudes and beliefs are important influencers of sun-related behaviours. Despite not being the focus of the model, a substantial body of evidence exists on the importance of these factors in influencing sun-related behaviours, these antecedents are therefore identified in the model as influencing sun-related behaviours.

Figure 3.1 A conceptual model of adolescent sun-related behaviours



***Solarium use and fake tan use are both identified as a form of intentional tanning however are external to the model of sun-related behaviours**

3.5.2 Behavioural causes: sun-related behaviours

At the centre of our model are sun-related behaviours. We make the distinction between sun-protecting behaviours and sun-exposing behaviours as both contribute to UV exposure.

Sun-exposing behaviours are either intentional or incidental. Intentional sun exposure is exposure to the sun with the primary purpose of achieving a tan, while incidental sun exposure occurs as a result of being outdoors without adequate protection whilst pursuing other activities (Dobbinson and Hill, 2004a). Specific behaviours defined as intentional sun-exposing are: actively seeking a tan, reducing sun-protection by using a lower SPF sunscreen, delaying the use of sun-protection, not using any sun-protection at all so as to tan and wearing brief clothing. Two other intentional tanning behaviours (solarium use and fake tan use) are identified in the model; however, they are represented separately to 'sun-related behaviours' since they are not performed in the sun. Specific incidental sun exposure items included in the model are exposure to UV through: time spent outdoors at school, and time spent outdoors in sport or recreation not associated with tanning.

The category of sun-protecting behaviours refers to those behaviours directed at reducing UV exposure. Consistent with recommendations for sun-protection behaviours in Australia, behaviours included in the model are: wearing a hat, using sunscreen of SPF >15, wearing sunglasses, seeking shade, wearing protective clothing on both the upper and lower body, and avoiding peak UV hours in the middle of the day. Inherent in our model is the assumption that individuals can and usually do perform both sun-protecting behaviours and sun-exposing behaviours (i.e. both elements contribute to

overall UV exposure) and that they are not opposite ends of the one continuum from protection to exposure.

3.5.3 UV exposure pattern and context

Exposure to UV radiation has been established as the major environmental risk factor for melanoma and non-melanoma skin cancers, being linked to 80 to 95% of all skin cancers (Baum and Cohen, 1998; Marks, 2000; Diepgen and Mahler, 2002). The pattern of exposure, intermittent or continuous, is important in the aetiology of different types of skin cancer, with melanoma and basal cell carcinomas thought to be associated with incidents of sunburn, particularly in childhood, and squamous cell carcinomas with continuous sun exposure (Elwood and Jopson, 1997; Elwood and Gallagher, 1998; Marks, 2000). In a meta analysis of published studies exploring sun exposure and melanoma risk, an approximate 60% increased likelihood was associated with recreational sun exposure compared to a 5% reduction for occupational (continuous) sun exposure (Gandini et al., 2005a).

UV exposure also occurs within a situational context and therefore the context of UV exposure is identified in the model. Context includes both social and environmental factors and, despite these factors not being the focus of the model, they are identified as an important component to UV exposure. Previous research has identified the importance of context. For example, an exploratory study of adolescents and adults in the UK highlighted the importance of the holiday context as an important factor in the preparedness for sun protection (Eadie and MacAskill, 2007). Williams et al (2011c) also identified differences in sun protection behaviours among adolescents across contexts of school, weekends and holidays during summer. Consideration of the

context in which UV exposure occurs within is therefore an important element of the model.

3.5.4 Non-behavioural causes: environmental UV and genetics

Non-behavioural factors, including both environmental and genetic factors, are identified in the model. Environmental factors that influence the amount of UV radiation exposure for individuals include being at higher altitude (Diffey, 1992), ground surface reflection (Kylling et al., 2000; McKenzie and Paulin, 1998) and cloud cover (Josefsson and Landelius, 2000). Each of these factors is therefore identified in the model.

Genetics are an important non-behavioural factor risk factor for skin cancer. Family history is considered a risk factor for malignant melanoma with approximately 5% to 12% of malignant melanomas developing in individuals who have one or more first-degree relatives with cutaneous malignant melanoma (Goldstein and Tucker, 2001). Furthermore, epidemiologic studies have identified that certain phenotypic factors are consistently associated with increased risk for the development of malignant melanoma. These factors include: photo-type (sun sensitivity- the tendency to burn rather than tan); freckles; blue, green or grey eyes; blonde or red hair; and fair complexion (Gandini et al., 2005b). Studies of the relationship between melanoma and pigmentary phenotype factors report an increased likelihood ranging from 60% to 260% (Gandini et al., 2005b). Previous research has noted genetic factors also relate to sun-protection behaviours. For example in a study among young adults in Australia, individuals with sun-sensitive skin were shown to be more likely to practice sun

protection behaviours than individuals with skin that tans (Schofield et al., 2007). Thus genetic factors, UV exposure and sun-related behaviours are identified in the model.

3.5.5 Outcomes of UV exposure: sunburns and tanning

While the primary aim of programs targeting sun-related behaviours is to reduce the incidence of skin cancer, more proximal measures of UV exposure are needed to identify effective interventions. Thus, we included two indicators of UV exposure that can be measured for individual exposure - sunburns and tanning. Sunburn is a measure of the biologically active sunlight reaching the skin (Hill et al., 1992). Sunburns also correlate with the risk of developing skin cancer. Sunburn is generally thought to be an indicator of high levels of intermittent sun exposure (Armstrong and Kricker, 2001), often associated with recreational activities.

Tanning can also be considered an indicator of UV exposure (Glanz and Mayer, 2005) and defined as skin colour changes that are indicative of the cumulative exposure to UV radiation (Creech and Mayer, 1997). While less frequently used as an indicator of UV exposure in intervention studies, tanning has been used to evaluate interventions on sun exposure among children (Buller et al., 1996; Milne et al., 2001; Mayer et al., 1997).

3.5.6 Measurement strategies

Consistent with Creech and Mayer (1997) seven strategies for UV measurements are included in the model, these are: self-report, parental report, observation, visual inspection, polysulphone film, spectrophotometer and colorimeter. Direct measurement strategies, which include observation, self-report and parental report are identified in the

model closest to sun-related behaviours because they attempt to assess behaviours directly related to UV exposure or protection. The remaining strategies, which focus on changes in the skin or in film assumed to be the consequences of UVR exposure, termed "indirect" strategies by Creech and Mayer (1997), are presented in the model closest to the indicators of UV exposure.

3.6 Discussion

Variations and inconsistencies in operationalising two key terms central to understanding UV exposure among adolescents exist in the literature. The lack of conceptual models of adolescent sun-related behaviours identified through a systematic literature search of five databases warranted the development of a conceptual model of adolescent sun-related behaviours.

Our conceptual model includes specific sun-related behaviours in three main categories, sun-protecting behaviours, intentional sun-exposing behaviours and incidental sun-exposing behaviours. The model identifies the relationship between genetic and environmental factors, as well as defining indicators of UV exposure. In Australia, adolescent sun-related behaviours are worsening despite an extensive history of community-wide skin cancer prevention programs aimed at improving sun-related behaviours (Livingston et al., 2007). There is a need to identify the most effective programs targeting adolescents so that successful programs can be expanded. However, different measures of behaviour between studies make comparison of results and determination of the most effective programs difficult. In consideration of deteriorating compliance with recommended sun protection behaviours among adolescents the effectiveness of programs should be enhanced by targeting the expanded model of sun-related behaviours presented in this paper. As suggested by Perry and Jessor (1985)

"efforts to promote health can be divided into two main strategies, those that are oriented toward weakening, reducing and eliminating behaviours that compromise health; and those that are oriented toward introducing, strengthening, and reinforcing behaviours that enhance health" (pg 174). They suggest a comprehensive approach to health promotion involves an optimal balance of attention to both strategies: strengthening health enhancing behaviours and simultaneously reducing health compromising behaviours. In applying the model presented here, program planners would be able to balance strategies to maximise sun-protecting behaviours, while also actively targeting strategies to reduce sun-exposing behaviours.

This model provides clarity regarding the specific individual sun-related behaviours that adolescents perform and which influence their overall UV exposure. It provides a framework to guide the design and evaluation of skin cancer prevention programs targeting adolescent sun-related behaviours. Furthermore, it provides the basis for the development of measures that assess the combined effect of sun-related behaviours on UV exposure. Such measures are needed to determine the overall effectiveness of skin cancer prevention programs targeting adolescents.

CHAPTER 4: UNDERSTANDING THE BEHAVIOUR OF THE TARGET MARKET: WHAT DO ADOLESCENTS THINK ABOUT WHEN ASKED QUESTIONS ABOUT THEIR BEHAVIOUR IN THE SUN?

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (2011) Understanding the behaviour of the target market: What do adolescents think about when asked questions about their behaviour in the sun? In Proceedings of the *Australian and New Zealand Marketing Academy (ANZMAC) Conference 2011*; Perth, Australia

4.1 Executive Summary:

Chapter 4 describes the results of a 'think-aloud' study that was conducted to elicit adolescents' interpretation of key terms and phrases used in measures of adolescent sun-related behaviours. This chapter builds on previous chapters by exploring the range of adolescent sun-related behaviours identified in the conceptual model (Chapter 3). The article explores adolescents' interpretation of terms such as 'tanning' and 'sun protection'. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi and Professor Don Iverson. This article was published in proceedings of the Australian New Zealand Marketing Academy Conference, Perth 2011 and awarded 'Best Paper' in the combined tracks for Research Methods, and Marketing Metric and Modelling.

4.2 Abstract

We undertook a project to develop a psychometrically sound instrument measuring adolescent sun-related behaviour for use in the evaluation of a social marketing program. During the preliminary stages, we conducted a pilot study to test the face validity of the instrument with adolescents. Think-aloud sessions were completed with 24 adolescents. Results identified gaps in our understanding of adolescent sun-related behaviour. Adolescents interpreted 'tanning' as specifically lying at the beach in the sun, however, also reported behaviours to 'get a bit of sun'; suggesting adolescents and researchers have different interpretations of key terms. The study highlights that use of the think-aloud technique can improve understanding behaviours of the target market and improve the validity of measures of adolescent sun-related behaviour.

4.3 Introduction

Skin cancer is a major public health concern. Australia and New Zealand combined has the world's highest rates of melanoma, 36.6 per 100,000 (Ferlay et al., 2008). In Australia, social marketers have recently focused on improving the sun protection behaviours of the notoriously hard-to-change group, adolescents. Sun exposure during the adolescent years is an important determinant of future melanoma risk (Weinstock et al., 1989; Cust et al., 2011; Kricker et al., 2007; Whiteman et al., 2001). Unfortunately however, adolescents are a group who spend more time in the sun and engage in fewer sun protection behaviours than adults (Dobbinson et al., 2008a). Furthermore, available evidence suggests sun protection practices among Australian adolescents have declined significantly over time. Livingston et al. (2007) reported a significant increase in the percentage of students who did not routinely practice any of three protective behaviours (wearing a hat, using sunscreen, wearing clothes covering the body) from 18% to 23% in the period 1993-1999.

Interestingly, excessive sun exposure among adolescents continues to occur despite high levels of knowledge about the hazards of sun exposure. Numerous studies have noted a poor correlation between increased knowledge on the dangers of sun exposure and intentions to sun protect (Lazovich and Foster, 2005; Payne, 2004; Adams and White, 2005; Adams, 1996; Lower et al., 1998b; Arthey and Clarke, 1995). This gap between knowledge and behaviours highlights the challenge for social marketers in changing the behaviours of adolescents. Adolescents are identified as a priority group for social marketing campaigns to improve sun protection (Cancer Council NSW and NSW Health Department, 2007). As new campaigns are developed there is a need to ensure measures used to evaluate such programs are valid and reliable.

Self-report measures of behaviour are the most widely used measures of sun protection behaviour (Saraiya et al., 2004; Glanz and Mayer, 2005). However, the ability of surveys to obtain accurate information depends in part on their understandability and appropriateness for the target audience (Carbone et al., 2002). Measures of adolescent sun exposure need to be appropriate to the specific needs of the adolescent group. Cognitive interviewing methods offer one approach to understanding how a survey item is understood and how answers are generated. Cognitive interviewing methods are traditionally used to assist in improving the reliability and validity of questionnaires through reducing systematic error in recall (Nielson et al., 2002; Beatty and Willis, 2007; Ward and Traweek, 1993; Ouimet et al., 2004). One such cognitive interviewing technique is called the 'concurrent think-aloud interview' whereby respondents think aloud when answering survey questions and responses are probed extensively for details about how they arrived at their answers (Jobe and Mingay, 1989).

We undertook a project to develop a psychometrically sound instrument measuring adolescent sun-related behaviour to be used in the evaluation of social marketing program targeting adolescents. During the preliminary stages of development, the research team pilot tested the instrument with the adolescent target market to test the face validity of the instrument.

4.4 Method

4.4.1 Participants

A convenience sample of 24 adolescents was identified through academic staff and students from a local university in Wollongong on the south coast of New South Wales, Australia. Participants had to be aged between 12 and 18 years and agreed to participate in a 1 hour, audio-taped session called a 'think aloud session'. The sample size was considered sufficient based on comparison with similar studies using cognitive interviewing methods (Glanz et al., 2008; Carbone et al., 2002, Hartman et al., 2009). The sessions were held on the university premises during school holiday time. Participants were made aware prior to providing their written consent that the session would be audio taped and that the survey related to sun protection. Parental consent was also obtained from each participant. Participation was voluntary, with each participant made aware prior to the commencement of the session of their option to withdraw at any time. Ethics approval for the study was obtained from the University's Human Research Ethics Committee. All participants were provided with a $10 gift voucher for their time. There were 11 females and 13 males who participated in think aloud sessions. Their ages ranged between 13 and 18 years, and all participants were currently enrolled in secondary school.

4.4.2 Survey instrument

The survey instrument contained 38 questions about sun related behaviours including specific sun-exposing and sun-protecting behaviours that were considered relevant to ultraviolet (UV) exposure among adolescents. Different prompts were used to recall behaviours, this included recall of behaviours when outside last weekend;

behaviours during summer in general; behaviours when at school; and behaviours during the summer holidays. Specific sun protection behaviours assessed included: wearing a broad brimmed hat, wearing a shirt with sleeves, wearing SPF 30+ sunscreen, wearing sunglasses, and staying in the shade. The sun protection behaviour items included in the survey were based on the recently recommended standardised US measures of adolescents' habitual sun protection during summer (Glanz et al., 2008). Sun-exposing behaviours included in the survey were conceptualised as those behaviours that maximise exposure of the skin to the sun with the primary purpose of achieving a biological response such as a tan (Dobbinson and Hill, 2004). Five new items were developed to explore sun-exposing behaviours of adolescents; these related to time spent tanning (two items), as well as delaying, reducing or avoiding sun protection.

4.4.3 Cognitive interviews

The purpose of the cognitive interviews was to determine the validity of the survey by probing respondents to see if they interpreted the questions in the intended manner, to observe how that worked through the items; to assess if response categories and wording were appropriate; and see if there were items missing relating to behaviours they performed in the sun that were not captured by the survey instrument. During the session, the session facilitator followed a pre-determined written protocol which included key points for discussion. Notes were kept by the facilitator for each session as well as an audio recording of the session.

4.4.4 Data analysis

Audio recordings from interviews were transcribed and notes were reviewed by the interviewer for accuracy and completeness. Interviewer notes were also examined to add detail to the transcripts. Next, the interviewer conducted a content analysis and responses were examined for emerging themes across interviews. Content analysis is a scientific, objective, systematic, quantitative, and generalisable description of communications content (Kassarjian, 1977). Transcripts were reviewed and coded by hand.

4.5 Results

Three key themes emerged in the analysis of data. These related to: issues with recall of behaviours; differences in the interpretation of key terms to what was intended; and, gaps in survey regarding the behaviours assessed.

4.5.1 Issues with recall

In response to questions relating to summer sun exposure, 15 participants commented that the term ‘summer’ was too difficult to respond to given that it referred to such a broad range of times i.e. weekend, school time and holiday time.

> *“It’s kind of hard with the first question if you don’t really know if you are talking about holidays or if it’s the weekend or school” (Male 15 yrs)*

Issues were also encountered with recall of sunburns last summer. Participants reported difficulty recalling exactly how many sunburns they had experienced last summer as well as being unsure as to the severity of redness that counted as ‘sunburn’.

"Sunburns last summer, I think I had two really bad ones other than just being a bit red, a little bit red doesn't really count does it?" (Female 16 yrs)

4.5.2 Interpretation of key terms

When considering the term 'sun protection' 13 participants clearly interpreted the term as referring to the use of sunscreen. More specifically, sun protection was not interpreted as including hat use, wearing sunglasses or wearing protective clothing.

"I interpreted sun protection as just sunscreen" (Male, 14 yrs)

Participants suggested that questions about sun protection behaviours could be changed so as to provide more detail after the term 'sun protection' to remind respondents of what was included.

"You could have in brackets after protection (hat, clothing, sunscreen) just so people know it includes those things." (Male, 16 yrs)

When thinking about the behaviour of 'tanning' participants were very context specific with the interpretation that tanning only occurs at the beach, when lying on a towel and exposed to full sun.

"You're on a towel and not moving from the towel for that amount of time." (Female, 15 yrs)

Additional to being context specific, tanning was also viewed as a deliberate activity that was time specific.

"So like, you might be at the beach for 3 hours but you're not going to put down 3 hours because you didn't spend 3 hours actually tanning, you might put down one or something like that." (Male 16 yrs)

4.5.3 Gaps in the survey regarding the behaviours assessed

Through probing responses by the facilitator it was identified that most participants did not identify themselves as 'tanners' with the majority of participants reporting negative beliefs about 'tanning'.

"You don't want to be seen to be doing it with the purpose of tanning" (Male, 17 yrs)

"I hate sunbaking but I would like to get more sun and be browner" (Female, 15 yrs)

"I don't like to say that I am tanning" (Female, 16 yrs)

"Tanning is ridiculously brown girls lying at the beach" (Female, 17 yrs)

Participants did however, consider that at the end of summer they would expect their skin to look browner than their current winter skin tone, also identifying they would 'wear brief clothing' or 'delay using sun protection' to get a bit of sun however did not consider this 'tanning' behaviour.

"I just want to get a bit of sun. Skin looks a bit healthier rather than be indoors and looking all ghostly"

(Female, 14 yrs)

Some participants also suggested the term 'incidental sun exposure' described their behaviour when outside doing activities

"Incidental exposure is when you're just doing activities, like swimming, and as a bonus you get a bit of sun" (Male, 18 yrs)

4.6 Discussion

Data obtained using the think-aloud technique was extremely useful in assessing the face validity of the instrument of adolescent sun-related behaviours and ultimately improving the validity of the developed measure. The think-aloud technique identified gaps in our understanding of adolescent sun-related behaviour. Adolescents interpreted the term 'sun protection' to mean sunscreen, and felt that other forms of sun protection needed to be listed in the question if they were to be considered. This is important because the agreed definition of, and included components of, sun protection are the combination of avoiding peak UV hours, staying in the shade, wearing a hat, wearing protective clothing, wearing sunglasses and applying sunscreen (TCCNSW and NSW Health, 2001). There is substantial variation in the assessment of individual behaviours used in previous studies (Saraiya *et al* 2004). Given the use of sunscreen is considered a secondary level of protection (TCCNSW and NSW Health, 2001); our data supports that survey instruments should include the assessment of each sun protection behaviour individually. Collection of self-report data on the incidence of summer sunburn should be done during the summer season or shortly thereafter to reduce potential recall biases. This is consistent with issues of recall bias of summer sun protection behaviours observed among adult populations (Adams et al., 2009).

The difference between researchers' and respondents' interpretations of the term 'tanning' is also a significant finding. The majority of intervention studies use some form of verbal report to measure outcomes (Glanz and Mayer, 2005) as well as population surveillance frequently assessing sun-exposing behaviours specifically in the context of 'tanning'. For example the Australian National Sun Survey includes the item "Have you made any attempt to get a suntan this season?" The recently proposed standard measures of sun exposure for behavioural and epidemiologic research by Glanz et al. (2008) included an item 'spending time in the sun in order to get a tan". Given the different interpretation of the term 'tanning' identified in this study, further exploration of the accuracy of responses to questions about 'tanning' is warranted. The influence of social desirability bias should be considered. Most teenagers participating in the think-aloud sessions were aware tanning was not good for you, however, gave conflicting responses in terms of not seeking a tan while still obtaining a tan. Recent mass media campaigns focused on tanning as a negative behaviour, for example the Cancer Institute NSW Dark Side of Tanning Campaign (www.darksideoftanning.com.au) may have contributed to this trend. The difference between incidental tanning and intentional tanning warrants further exploration among the adolescent group. A limitation of the study was that it was completed during the winter. As many of the participants were inside during peak UV hours, they responded in the hypothetical regarding their most recent weekend sun related behaviour.

Limitations of this study include the use of a convenience sample, the sample size and the potential for limited themes emerging. The use of a convenience sample in this study limits the generalisability of the results as sampling bias cannot be excluded. The sample size of 24 was small however, is comparable to other studies using the 'think-

aloud' technique. For example, Carbone et al. (2002) used a sample of 23 students to assess understanding of dietary surveys. Glanz et al. (2008) also used cognitive interviewing methods with a sample of nine adolescents for survey items related specifically to sun exposure among adolescents.

In conclusion, this study highlights that use of cognitive methods, such as the think-aloud technique, can improve the face validity of measures of adolescent sun related behaviours. Data from cognitive interviews improved understanding behaviours of the target market. Given the focus on behaviour change in social marketing initiatives, confirming the face validity of measures of other health behaviours may be beneficial.

CHAPTER 5: SUN-PROTECTING AND SUN-EXPOSING BEHAVIOURS: TESTING THEIR RELATIONSHIP SIMULTANEOUSLY WITH INDICATORS OF ULTRAVIOLET EXPOSURE AMONG ADOLESCENTS

Williams, M., Caputi, P., Jones, S.C. & Iverson, D. (2011), Sun-protecting and Sun-exposing Behaviours: Testing Their Relationship Simultaneously with Indicators of Ultraviolet Exposure among Adolescents. *Photochemistry and Photobiology*, 87(5), 1179-1183. Reproduced with permission of John Wiley and Sons.

5.1 Executive Summary

Chapter 5 seeks to build on existing understanding of adolescent sun-related behaviours by combining sun-protecting and sun-exposing behaviours and testing their relationship simultaneously with indicators of UV exposure. This chapter uses the self-report survey developed as a result of the think-aloud study presented in Chapter 4, and tests relationships identified in the conceptual model presented in Chapter 3. This article was written by the candidate with co-authors Associate Professor Peter Caputi, Professor Sandra Jones, and Professor Don Iverson, and was published in Photochemistry and Photobiology, 2011.

5.2 Abstract

The aim of this study was to build on existing understanding of adolescent sun-related behaviour by combining sun-protecting and sun-exposing behaviours and testing their relationship simultaneously with indicators of ultraviolet (UV) exposure. Data were collected for 692 adolescents aged between 12 and 18 years. General linear modelling was undertaken to test the relationship of sun-related behaviours with indicators of UV exposure. Overall, the combined sun protection and sun-exposing behaviours accounted for 13.8% of the variance in the number of sunburns, 28.1% of the variance in current tan and 57.5% of the variance in desired tan respectively. Results indicated that having a strong desire for a tan was significantly associated with spending time tanning, delaying the use of sun protection, wearing brief clothing and using no sun protection; whereas the number of sunburns was significantly associated with sunscreen use, avoiding peak hours and delaying sun protection. Current tan was significantly associated with wearing sunglasses, shade use and time spent tanning. In examining sun-related behaviours among adolescents, consideration needs to be given to both sun-exposing and sun-protecting behaviours. This research has important implications for conceptualizing outcomes in programs designed to reduce UV exposure.

5.3 Introduction

Adolescents may choose to both protect their skin and expose their skin to the sun. For example, a young person who wears a hat may also deliberately wear brief clothing to get a tan. Existing literature on ultraviolet (UV) exposure among adolescents has seldom focused on the interaction between sun-protecting and sun-exposing behaviours. Understanding the relationship between sun-exposing and sun-protecting behaviours can inform the development of effective interventions targeting reduced UV exposure among adolescents and facilitate the evaluation of programs through a more detailed understanding of adolescent UV exposure. In this paper we combine specific sun-exposing behaviours with sun-protecting behaviours and determine their relationship simultaneously with indicators of UV exposure.

'Sun-exposing' and 'sun-protecting' are related but conceptually different behaviours, not simply opposite ends of a continuum from protection to exposure. An increasing body of evidence has identified different psychosocial pathways for sun-exposing behaviours and sun-protecting behaviours (Jackson and Aiken, 2000; Buller et al., 1996; Arthey and Clarke, 1995; Keesling and Friedman, 1987), suggesting that adolescents make separate choices to protect their skin from the sun and to expose their skin to the sun. Both sun-protecting and sun-exposing behaviours have been related to perceived susceptibility to skin cancer and premature aged skin. However, sun-protecting behaviours are also related to peer sun-protection behaviours, perceived barriers to use sunscreen, and self-efficacy of sunscreen use (Cockburn et al., 1989; Cody and Lee, 1990; Jones and Leary, 1994; Keesling and Friedman, 1987; Mahler et al., 1997). Sun-exposing behaviours have been associated with peer sunbathing norms,

relaxation, and appearance concerns (Jackson and Aiken, 2000; Keesling and Friedman, 1987; Leary and Jones, 1993; Wichstrom, 1994).

Surveys of sun protection behaviours among adolescents have shown generally low compliance with recommended guidelines for sun protection (Livingston et al., 2003; Cokkinides et al., 2006). Despite extensive investigation into sun protection behaviours, there has been limited analysis of the elements of sun-exposing behaviours and, specifically, the differentiation between intentional and incidental sun exposure (Saraiya et al., 2004). Intentional sun exposure is defined as "exposure to the sun with the primary purpose of achieving a biological response such as a tan, usually with limited attention to sun protection and maximal concern for extended exposure", (Dobbinson 2004, p211) and incidental sun exposure as "a result of being outdoors without adequate protection whilst pursuing activities not directed exclusively at obtaining a suntan" (Dobbinson 2004, p211).

The aim of this study was to assess specific sun-protecting and sun-exposing behaviours, and test their relationship simultaneously with indicators of ultraviolet (UV) exposure.

5.4 Materials and Methods

5.4.1 Participants

The study adopted a convenience sampling strategy to recruit adolescents aged 12-18 years. A third of the participants were aged 14 years (31%) (M= 15.0, SD = 1.65), and the majority were female (64%).

5.4.2 Sample Selection

Three methods of recruitment were used: schools, online and via a regional Australian university's promotional events. Schools were selected based on their geographic location. All schools were located within a single local government area of a coastal community in eastern Australia. Ethics approval was sought from the representing education office for each school. All schools meeting the eligibility criteria were invited to participate in the study (a total of six independent and Catholic secondary schools); two schools agreed to participate, one independent school and one Catholic school. An advertisement for the survey was placed on the social networking site, Facebook. The advertisement was promoted to individuals with a Facebook account who were aged between 12 and 18 years of age. To avoid individuals from the school sample completing the survey online, the online promotion was limited to individuals whose location, as defined by Facebook, was within a 25 kilometer radius of the city of Sydney in eastern Australia, approximately 80 kilometers north of the regional city. Participants were also recruited at information evenings held by the regional university for Year 12 students; none of these students were from the participating schools. Significant differences existed in age (χ^2 (14) = 574.18 p= .000) and gender (χ^2 (2) = 10.12 p=.006) profile by sample selection method.

All participants, irrespective of the method of recruitment, were made aware prior to providing their consent that the survey related to sun protection. Participation was voluntary, with participants advised prior to the commencement of the survey of their option to withdraw at any time. The study protocol was approved by the University's Human Research Ethics Committee.

5.4.3 Measures

A preliminary version of the survey instrument was developed for pre-testing with adolescents to guide the final selection of measures. The preliminary survey included specific sun-exposing and sun-protecting behaviours that were considered relevant to UV exposure among adolescents. Specific sun protection behaviour items were based on the recently recommended standardised US measures of adolescents' habitual sun protection during summer (Glanz et al., 2008). Additional items were included to increase the specificity of the assessment of sun protection behaviours, including measures of lower body protective clothing and avoidance of peak UV. Five new items were developed for sun-exposing behaviours; these related to time spent tanning, as well as delaying, reducing or avoiding sun protection. The preliminary survey was pre-tested with 24 adolescents and seven skin cancer prevention experts from three Australian State Cancer Councils (West Australia, Victoria and New South Wales) to ensure the survey captured the range of sun-exposing and sun-protecting behaviours performed by adolescents and recommended by the Cancer Councils. Adjustments were made to question wording and response options based on the results of pre-testing the survey.

The final sun-related behaviour items included in the survey are shown in Table 5.1. Both sun-exposing and sun-protecting behaviours were assessed across four contexts: at school, on the weekend, during the holidays and during summer in general. These contexts were identified as relevant to adolescent UV exposure during the qualitative pre-testing of the survey and subsequent work by the research team which confirmed that adolescents exhibit different behaviours across these contexts (Williams et al., 2011c).

Table 5.1 Sun related behaviour items

Sun protection behaviour items*
1. When you are outside on a warm sunny day how often do you USUALLY ….Wear sunscreen?
2. Wear a hat?
3. Stay in the shade?
4. Wear a shirt with sleeves that covers your shoulders
5. Wear long pants/skirt that cover your legs at least to your knees?
6. Wear sunglasses?
7. Spend most of the time inside during peak UV hours in the middle of the day?
Sun-exposing behaviour items*
1. Spend time in the sun in order to get a tan?
2. Wear a reduced SPF sunscreen, oil or lotion in order to get a tan?
3. Delay applying sun protection in order to get some sun on your skin?
4. Wear brief clothing so as to get some sun on your skin?
5. Wear no sun protection at all in order to get a tan?

*Response options: Never (1), Rarely, Sometimes, Often, Always (5).

Two key indicators of UV exposure (number of sunburns and current level of tan) were included in the survey. These were assessed by "In the past 12 months, how many times did you have a red or painful sunburn that lasted a day or more?" with response options ranging from '0' through to '8 or more', and "What is your current level of tan?" with response options ranging from 'no tan' through to 'a very dark tan'. As the survey was administered in spring time and current level of tan would be expected to be low, an additional UV indicator measure was included, referred to as 'desired tan'; this item was: "Do you like to get a suntan?" with response options ranging from 'no tan' through to a 'very dark tan'.

5.4.4 Statistical analysis

Three general linear models were tested in this study. The first model examined the extent to which sun-protecting behaviours predicted the outcome measures or indicators of UV exposure (number of sunburns, perceived degree of current tan, and perceived desired depth of tan). The second model examined the extent to which sun-exposing behaviours predicted the outcome measures. In the third model, sun-exposing and sun-protecting behaviours were included in the same model. We tested a general linear model that assessed the extent to which the six protecting and five exposing behaviours predicted the outcome measures (number of sunburns, current tan, and desired tan). The general linear model approach allows a linear combination of the multiple outcome measures to be tested and was more appropriate over a multiple regression. A factor analysis of the survey items revealed factors that corresponded to the six protecting and five exposing behaviours. Factor scores were derived and used as indicators of these behaviours in the models described. The impact of skin tone and gender were also controlled for as fixed factors in modelling the indicators of UV exposure.

5.5 Results

The results of the three general linear models tested are reported separately. The first model examined the extent to which protecting behaviours predicted the indicators of UV exposure, the second model explored sun-exposing behaviours and the third model combined both sun-protecting and sun-exposing behaviours. The univariate results for each of the general linear models are shown in Table 5.2.

Table 5.2 Univariate results for the general linear modelling

UV Indicator	Behaviour, skin tone and gender	*Model 1* *B* (SE)	*Model 2* *B (SE)*	*Model 3* *B (SE)*
Number of Sunburns	Wearing protective clothing	-.197(.102)		-.136(.114)
	Wearing sunglasses	-.081(.094)		-.165(.099)
	Wearing a hat	-.088(.095)		-.088(.100)
	Using sunscreen	**-.245(.102)**		**-.409(.114)**
	Avoiding peak UV hours	**-.302(.098)**		**-.262(.105)**
	Using shade	.039(.102)		-.029(.110)
	Spending time in sun to tan			-.065(.110)
	Using a low SPF sunscreen			-.027(.100)
	Delaying use of sun protection		**.421(.124)**	**.467 (.124)**
	Using no sun protection		.082(.131)	.077(.135)
	Wearing brief clothing		.134(.119)	.077(.124)
	Skin tone	**1.808(.557)**	**1.845(.589)**	**1.805(.573)**
	Gender	.492(.659)	.362(.684)	-.994(.769)
Current Tan	Wearing protective clothing	**-.117(.040)**		-.061(.045)
	Wearing sunglasses	**.079(.037)**		**.077(.039)**
	Wearing a hat	.033(.037)		.050(.040)
	Using sunscreen	.014(.040)		.002(.045)
	Avoiding peak UV hours	-.043(.038)		-.046(.041)
	Using shade	**.157(.040)**		**.110(.043)**
	Spending time in sun to tan		**.215(.040)**	**.173(.043)**
	Using a low SPF sunscreen		.037(.038)	.011(.040)
	Delaying use of sun protection		.015(.048)	.009(.046)
	Using no sun protection		.010(.051)	.023(.054)
	Wearing brief clothing		.053(.046)	.011(.049)
	Skin tone		**-.891(.228)**	**-.870(.227)**
	Gender	**-.964(.218)**	-.281(.265)	-.172(.272)
Desired tan	Wearing protective clothing	**-.248(.045)**		-.046(.040)
	Wearing sunglasses	.025(.041)		-.006(.035)
	Wearing a hat	**-.106(.041)**		-.056(.035)
	Using sunscreen	.062(.044)		.030(.040)
	Avoiding peak UV hours	**-.094(.043)**		-.021(.037)
	Using shade	**.248(.045)**		**.134(.039)**
	Spending time in sun to tan		**.457(.036)**	**.404(.039)**
	Using a low SPF sunscreen		-.003(.035)	-.012(.036)
	Delaying use of sun protection		**.132(.044)**	**.119(.044)**
	Using no sun protection		**.149(.046)**	**.125(.048)**
	Wearing brief clothing		**.199(.042)**	**.175(.044)**
	Skin tone	-.342(.243)	-.151(.207)	-.165(.203)
	Gender	-.469(.288)	-.137(.240)	-.175(.245)

Items in bold p=<0.05

5.5.1 Model 1

At the multivariate level in Model 1, wearing protective clothing (Wilks' Lambda = .942, p= .000), wearing a hat (Wilks' Lambda = .979, p= .011), using sunscreen (Wilks' Lambda = .984, p= .033), avoiding peak UV hours (Wilks' Lambda = .977, p= .006) and using shade (Wilks' Lambda = .940, p= .000) were significantly associated with a linear combination of the indicators of UV exposure. Skin tone was also significantly associated (Wilks' Lambda = .791, p= .000).

At the univariate level, results indicated the number of sunburns had the strongest relationship with skin tone (Partial Eta^2 = .019), avoiding peak UV hours (Partial Eta^2 = .017) and using sunscreen (Partial Eta^2 = .011). Current level of tan was most strongly associated with skin tone (Partial Eta^2 = .035), using shade (Partial Eta^2=.028), wearing protective clothing (Partial Eta^2 = .016) and wearing sunglasses (Partial Eta^2 = .009). Desired tan was most strongly associated with wearing protective clothing (Partial Eta^2 = .055), using shade (Partial Eta^2 = .054), wearing a hat (Partial Eta^2 = .012) and avoiding peak UV hours (Partial Eta^2 = .009)

5.5.2 Model 2

At the multivariate level in Model 2, spending time tanning (Wilks' Lambda = .762, p= .000), delaying the use of sun protection (Wilks' Lambda = .962, p= .000), wearing no sun protection in order to tan (Wilks' Lambda = .977, p= .008) and wearing brief clothing (Wilks' Lambda = .956, p= .000) were all significantly associated with a linear combination of the indicators of UV exposure. Skin tone was also significantly associated (Wilks' Lambda = .830, p= .000).

At the univariate level, delaying use of sun protection (Partial Eta^2 =.022) and skin tone (Partial Eta^2 =.019) had the strongest associated with sunburns. Desire for a tan was associated with spending time in the sun to tan (Partial Eta^2= .237), delaying the use of sun protection (Partial Eta^2=0.17), using no sun protection at all (Partial Eta^2= .020) and wearing brief clothing (Partial Eta^2=.042). Current level of tan was associated with the factor spending time in the sun to tan (Partial Eta^2=.053) and skin tone (Partial Eta^2=.029)

5.5.3 Model 3

At the multivariate level in Model 3, spending time tanning (Wilks' Lambda = .815, p= .000), delaying the use of sun protection (Wilks' Lambda = .958, p= .000), and wearing brief clothing (Wilks' Lambda = .964, p= .001) were significantly associated with a linear combination of the indicators of UV exposure. Of the sun protection behaviours, wearing sunscreen (Wilks' Lambda = .972, p= .003) and seeking shade (Wilks' Lambda = .972, p= .003) were significantly associated with UV exposure indicators. Both skin tone (Wilks' Lambda = .837, p= .000) and gender (Wilks' Lambda = .983, p= .040) were also significant at the multivariate level.

At the univariate level, results indicated the number of sunburns had the strongest relationship with delaying the use of sun protection (Partial Eta^2 = .028), using sunscreen (Partial Eta^2 = .026), avoiding peak UV hours (Partial Eta^2 = .013) and skin tone (Partial Eta^2= .020). Current level of tan was most strongly associated with spending time in the sun (Partial Eta^2 = .032), skin tone (Partial Eta^2=.030), using shade (Partial Eta^2 = .013) and wearing sunglasses (Partial Eta^2 = .008). Desired tan was most strongly associated with spending time in the sun to tan (Partial Eta^2 = .183), wearing

brief clothing (Partial $Eta^2 = .032$), using shade (Partial $Eta^2 = .024$), delaying sun protection (Partial $Eta^2 = .015$) and wearing no sun protection in order to tan (Partial $Eta^2 = .014$).

The extent to which the behaviours included in each of the three models predicted the outcome measures (number of sunburns, current tan, and desired tan) is presented in Table 5.3. Overall, the combined sun protection and sun-exposing behaviours, controlling for skin tone and gender, accounted for the largest amount of variance (i.e. 13.8%) in the number of sunburns, 28.1% of the variance in current tan and 57.5% of the variance in desired tan respectively (See Table 5.3).

Table 5.3 Adjusted R Squared for three separate general linear models testing the extent behaviours predict indicators of UV exposure, each model controls for skin tone and gender.

	Model 1. Sun-protecting behaviours	Model 2. Sun exposing behaviours	Model 3. Combined sun-protecting and sun-exposing behaviours
	Adj R^2	Adj R^2	Adj R^2
Number of sunburns	.090	.116	.138
Current tan	.262	.257	.281
Desired tan	.329	.549	.575

When assessed independently from sun-exposing behaviours, sun-protecting behaviours accounted for 9.0% of the variance in number of 'sunburns', 26.2% of the variance in 'current tan' and 32.9% of the variance in 'desired tan'. That is, simultaneously considering both protecting behaviours and exposing behaviours marginally improved the explanatory power of the model rather than assessing sun protection behaviours alone.

5.6 Discussion

While sun protection behaviours among adolescents are frequently explored in the literature, less frequently explored is the extent to which sun protection and sun-exposing behaviours, in combination, relate to UV exposure. The expanded assessment of sun-related behaviours marginally improved the explanatory power for the three indicators of UV exposure among adolescents (Sunburn: adjusted R^2= .138, Current tan: adjusted R^2= .281, Desired tan: adjusted R^2 = .575), and offers a more detailed understanding of the influence of specific types of sun-related behaviours on indicators of UV exposure, particularly sun-exposing behaviours. Intervention programs are frequently evaluated in the context of their impact on sun-protecting behaviours. The results highlight that both sun-exposing and protecting behaviours uniquely contribute to indicators of UV exposure, and when compared to the assessment of sun-protecting behaviours alone modestly improve the explanation of indicators of UV exposure; 'sunburn' Adjusted R^2 increased by .048, 'current tan' Adjusted R^2 increased by .019, and 'desired tan' Adjusted R^2 increased by .246. This research has implications for both conceptualizing and operationalising the behavioural outcomes of interest in programs designed to reduce UV exposure among adolescents, suggesting that measures of adolescent sun-related behaviour could benefit from considering both exposing and protecting behaviours. The opportunity to further explore the ability to influence the identified sun-exposing behaviours through targeted interventions among adolescents is a direction for future research.

Important limitations of our study warrant discussion. Due to the study occurring in spring, it was decided to include 'desired tan' as an indicator of UV exposure. While it is established that UV radiation stimulates pigmentation in human

skin, commonly known as tanning, the lack of data available on the natural history of tanning makes it difficult to determine the best times for measurement of tanning (Creech and Mayer, 1997). Zonios and Dimou (Zonios et al., 2008; Zonios and Dimou, 2009) recently developed a method for the estimation of skin concentrations of melanin of human skin in vivo. This non invasive technique using light scattering spectroscopy, provides a promising robust method for better estimation of tanning in vivo, less is known regarding the reliability of self-report of indicators of tanning. A recent study exploring alternate methods for measuring skin colour and sun damage (Daniel et al., 2009) reported moderate to high correlation ($r = .70$ $p<.01$- $r = .71$ $p<.01$) between self-report of current skin colour and skin reflectance spectrophotometry indicating that these measures have convergent validity. All information in this study is self-reported, and no independent validation of self-reported current tan or sunburn can be made. There is however, no reason to believe that these variables are measured with less accuracy than in other studies. Cumulative, self-report summer sunburn has been the most common measure of sunburn used in population studies (Dobbinson and Hill, 2004a). Using level of tan as an indicator of UV exposure is complex due to individual differences in skin type and the skin's propensity to burn; however, the general linear modelling controlled for skin type, as measured by Fitzpatrick (Fitzpatrick, 1998). Given expected differences in sun-related behaviours of male and female respondents, the general linear modelling also controlled for gender, however a more detailed exploration of the impact of gender is beyond the scope of this study. The influence of gender on sun-protecting and sun-exposing behaviours provides an interesting topic for future studies to explore. A further limitation of the study is the non-random nature of the sample, which limits the ability to generalise these results to the total adolescent

population. Nonetheless, these results are important as they highlight new opportunities for interventions among a high risk population.

Our findings support other data that adolescents make separate choices both to protect their skin from the sun and to expose their skin to the sun (Arthey and Clarke, 1995). The potential for adolescents to concurrently both expose and protect their skin highlights the complexity of sun-related behaviours among adolescents. A relatively new line of research in skin cancer prevention has explored the use of sunscreens to aid sun exposure, with some data indicating sunscreens are used as tanning aids to avoid sunburn and extend UV exposure (Autier, 2009; Thieden et al., 2005; Autier et al., 2000). While our data shows an association between sunscreen use and 'sunburns' it does not show an association between sunscreen use and 'current tan' or 'tan desire'; furthermore no association was found between using a 'reduced SPF sunscreen' and indicators of UV exposure. The lack of association in this study may reflect cultural differences in the nature of tanning behaviours between Australian adolescents and those in European countries.

Additional to knowing that adolescents attempt to tan, our data provides further understanding of the behaviours adolescents perform to obtain a tan, defining the specific behaviours within the construct of intentional sun exposure. The more detailed exploration of tanning behaviours has recently emerged in the literature with the categorisation of tanning sub-types (O'Riordan et al., 2008b; Hillhouse et al., 2007; Pagoto et al., 2004); these subtypes have been developed based on skin cancer risk, sun protection practices and tanning motivations, and highlight specific sub-groups or segments who would benefit from targeted interventions, our data facilitates the identification of tanning sub-types among adolescents to which programs can be

targeted. Furthermore, an increased understanding of the specific sun-exposing behaviours adolescents perform to obtain a tan, as identified here, highlights the complexity of sun-related behaviours.

The current findings add to this growing body of evidence on adolescent sun-related behaviours. Overall, the data provides a more detailed understanding of the relationship between specific types of sun-related behaviours and indicators of UV exposure among adolescents. The results highlight that an expanded view of sun-related behaviour; one which includes sun-exposing behaviours as well as sun protection behaviours, provides a modest increase in explanatory power of UV exposure among adolescents. Thus, program development as well as measurement instruments could benefit from considering both behavioural elements.

CHAPTER 6: DO AUSTRALIAN ADOLESCENT FEMALE FAKE TAN USERS PRACTICE BETTER SUN PROTECTION BEHAVIOURS THAN NON-USERS?

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (2011-epub ahead of print), Do Australian adolescent female fake tan users practice better sun protection behaviours than non-users? *Health Education Journal*. Reproduced with permission from SAGE Publications.

6.1 Executive Summary

Chapter 6 describes an analysis that sought to determine the prevalence of fake tanning product use among adolescents and identify differences in sun-protection behaviours between fake tanning product users and non-users. The relationship between fake tan use and UV exposure is identified in the conceptual model presented in Chapter 3; this relationship has not been previously explored among the adolescent population. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi, and Professor Don Iverson, and published in Health Education Journal 2011.

6.2 Abstract

Objective: To determine differences in sun protection behaviours, and incidence of sunburn, between Australian adolescent female fake tan users and non-users.

Design: Cross sectional survey.

Method: 398 adolescent females aged 12 to 18 years participated in a survey at public venues, schools, and online. The main outcome measures were self-reported fake tan usage in the past 12 months, frequency of sunburns and habitual sun protection behaviours.

Setting: Surveys were completed in New South Wales, Australia.

Results: The prevalence of self-reported use of fake tanning products in the past 12 months among Australian adolescent females was 34.5 per cent. Female fake tan users were significantly less likely to report wearing a hat, wearing a shirt with sleeves or wearing pants covering to the knees. There was no difference between fake tan users and non-users in use of sunscreen, seeking shade, wearing sunglasses or avoidance of peak UV hours. Logistic regression modelling, when accounting for age, desire for a tan and skin type, revealed fake tan users were more likely to experience frequent sunburns and less likely to wear protective clothing.

Conclusions: Our findings show that fake tan use among Australian female adolescents is associated with decreased sun protection, specifically reduced use of both upper and lower body protective clothing. Fake tan users were significantly more likely to experience repeated sunburns, after controlling for skin type. These findings provide impetus for the development of health education programs targeting a new sub group of adolescents with distinct tanning behaviours.

6.3 Introduction

Despite over 20 years of population wide interventions to improve sun protection in Australia, the major barrier to sun protection among adolescents continues to be the desirability of a tan, with available data showing that as desire for a tan increases, sun protection behaviour decreases (Livingston et al., 2007). Fake tan products are lotions and sprays which temporarily pigment the skin without requiring exposure to ultraviolet (UV) radiation. Fake tanning has presented a significant challenge for cancer control agencies since its emergence due to the perception that promoting such products sends the "wrong message" to the community regarding the desirability of a tan (Chapman, 1999). While there is a substantial body of literature on adolescent sun protection behaviours there has been limited research on the effect fake tan products have on adolescent UV exposure and associated sun protection behaviours. Given the lack of evidence to date, cancer control agencies have not promoted the use of fake tanning products as a safe alternative for obtaining a tan.

The fake tanning industry is booming, with an estimated growth rate of 429 per cent from 2001 to 2006, and projections to become a half a billion dollar industry by 2011(Research & Markets, 2007). Findings on the prevalence of fake tanning product use among adults differ between studies, ranging from 9 per cent in an Australian population aged 15 years and older (Girgis et al., 2003) to 22 per cent among US adults aged between 18 and 30 years (Brooks et al., 2006). Among US adolescents, approximately 11 per cent report using fake tan products in the previous 12 months (Cokkinides et al., 2010). However, few studies have focused on the prevalence of fake tanning use specifically among Australian adolescents, or on the differences in sun protection behaviours between users and non-users.

Existing literature on fake tan use and associated sun protection behaviours is sparse, with conflicting results. Among adolescents in the US, fake tan use was associated with indoor tanning and higher frequency of sunburns however not use of sunscreen (Cokkinides et al., 2010). Studies among primarily adult populations have shown that individuals who have used fake tan products in the past year are more likely to report regularly using sunscreen with SPF 15+ when in the sun than non-users (Girgis et al., 2003; Brooks et al., 2006; Stryker et al., 2007; Beckmann et al., 2001). On the other hand, all but one study (Dixon, 1997) show that fake tan users are more likely to report being sunburned (Brooks et al., 2006; Beckmann et al., 2001; Purchase, 1994), including both Australian and US adults. Studies comparing the use of protective clothing between users and non-users have also been inconsistent. Beckmann et al. (2001) noted that users were less likely to report regularly wearing protective clothing than non-users, while Girgis et al. (2003) and Stryker et al. (2007) found no significant differences in use of protective clothing between the two groups. Similarly, findings on shade use have been inconsistent; Stryker et al. (2007) found users were significantly less likely to seek shade, whereas Beckmann et al. (2001) found no significant difference between groups.

The aim of this study, therefore, was to assess the use of fake tanning products among adolescents in New South Wales Australia, and to examine similarities and differences in users' versus non-users' reported sun protection behaviours and incidence of sunburns.

6.4 Methods

In spring 2009, adolescents from New South Wales (NSW) were invited to participate in a survey at public venues, schools, and online. Respondents who completed the paper based survey were identified within high schools and at public events around a regional NSW coastal community. On-line respondents were identified via a promotion on the social networking site Facebook with promotion restricted to NSW residents aged 12-18 years.

6.4.1 Description of participants

This analysis has been limited to female respondents because the overwhelming majority of fake tan users were female (95.8 per cent) with only six male respondents reporting fake tan use in the previous 12 months.

6.4.2 Measures

The self-report survey was part of a larger Summer Lifestyle Survey on adolescent sun protection attitudes and behaviours. Prevalence of fake tan use was assessed with an item similar to that used by Beckmann et al. (8) "Over the past 12 months have you used a fake tanning lotion or cream to make you look more tanned?" Pre-testing of the instrument with adolescents resulted in the inclusion of the term "spray tan". The final wording of the item was "Have you made any attempt to get a tan in the last 12 months by using a sunless tanning cream (fake tan) or spray tan?" Number of sunburns in the previous 12 months was assessed with response options ranging from '0' to '8 or more'. This item is consistent with recently recommended standardised US

measures of adolescent sun exposure and protection (Glanz, et al., 2008). The survey questions and response options are included in 6.1.

Table 6.1 Summary of Summer Lifestyle Survey questions and response categories, surveyed in spring, NSW, Australia, 2009.

Questions	Response options
When you are outside on a warm sunny day, how often do you usually ….. • Wear sunscreen • Wear a hat • Stay in the shade • Wear a shirt with sleeves that covers your shoulders Wear long pants/skirt that covers your legs at least to your knees • Wear sunglasses • Spend most of the time inside during peak UV hours in the middle of the day	Never (1), Rarely, Sometimes, Often, Always (5)
In the past 12 months, how many times did you have a red or painful sunburn that lasted a day or more?	0, 1, 2, 3, 4, 5, 6, 7, "8 or more"
Have you made any attempt to get a tan in the last 12 months by using a sunless tanning cream (fake tan) or spray tan?	Yes No
Suppose your skin was exposed to strong sunshine at the beginning of summer with no protection (e.g. sunscreen, hat) at all. If you stayed in the sun for 30 minutes would your skin:	Just burn and not tan afterwards Burn first then tan afterwards Not burn at all just tan Nothing would happen
Do you like to get a suntan?	No Yes, a light tan Yes, a moderate tan Yes, a dark tan Yes, a very dark tan

To examine the sun protection behaviours of users' and non-users' of fake tanning products, respondents indicated how often they applied sunscreen, wore a hat, wore a shirt with sleeves, wore sunglasses and sought shade when in the sun between 11am and 3pm. These five items were selected as they represent the current guidelines for sun protection behaviours as recommended by Cancer Council NSW (12) and are consistent with recently recommended standardised US measures of adolescent sun protection (11). Additional measures of lower body protective clothing and avoidance of peak UV hours were included to increase the specificity of the assessment.

6.4.3 Statistics

Descriptive statistics were generated for fake tan use and demographic variables. Differences between fake tan users and non-users on sun protection behaviours were assessed using cross-tabulation and multivariate analysis of variance. Logistic regression modelling was used to assess the relationship between fake tan use, sunburns and sun protection behaviours controlling for age, desire for a tan and skin type. For the model, the number of sunburns was grouped into low sunburns (0-1 sunburns in the previous 12 months), moderate sunburns (2-4 sunburns in the previous 12 months) and frequent sunburns (5 or more sunburns in the previous 12 months). Fake tan use was the dependent variable. For each sun protection behaviour, response options were coded from 1 (never) to 5 (always).

6.5 Results

Overall, 398 females aged 12 to 18 years (M = 15.08 SD = 1.68) participated in the survey. Demographic data on the fake tan users and non users are shown in Table 6.2. The prevalence of fake tan product use during the past 12 months among adolescent

females aged between 12 to 18 years was 34.5 per cent. The frequency of fake tan use increased significantly with age, with the highest proportion of fake tan users (42.4 per cent) being among the 17-18 year old category (χ^2 (2) = 9.66 p=.008).

Table 6.2 Fake tan use among adolescent females surveyed in spring 2009 from NSW, Australia, by demographic variables.

Fake tan use	**Yes** % (n)	**No** % (n)
Females	34.5% (137)	65.5% (260)
Age		
12-14 years	27.2 (55)	72.8 (147)
15-16 years	41.6 (32)	58.4 (45)
17-18 years	42.4 (50)	57.6 (68)

Descriptive statistics for sun protection behaviours among females using and not using fake tan products are shown in Table 6.3. Multivariate analysis of variance was used to assess differences in sun protection behaviours between users and non-users, and indicated significant differences (Wilks' Lambda = .864, F (7,358) = 8.03, p = .000). At the univariate level the results indicate that females who reported using fake tan in the previous 12 months were significantly less likely to report regularly wearing a hat, wearing a shirt with sleeves and wearing pants that cover at least to the knees. There was no significant difference in mean values for self-reported sunscreen use, shade use, wearing sunglasses and avoidance of peak UV hours between fake tan users and non-users.

Table 6.3 Descriptive statistics for sun protection behaviours among adolescent females in NSW Australia using and not using fake tan products, surveyed in spring 2009.

During summer in general	Users n=137		Non-users (n=261)		
	M	SE	M	SE	*P*
Use sunscreen	3.31	.090	3.31	.064	.997
Wear a hat	2.03	.096	2.40	.068	**.002**
Seek shade	2.90	.079	3.09	.057	.061
Wear a shirt with sleeves	2.49	.088	3.18	.063	**.000**
Wear pants to at least the knees	1.85	.091	2.43	.065	**.000**
Wear sunglasses	3.61	.111	3.39	.080	.102
Avoid peak UV hours	2.73	.091	2.82	.065	.450

M = Mean, SE= Standard Error.

To examine the association between fake tan use and sunburns, logistic regression modelling was used. The model included factors likely to confound the association between fake tan use and sunburns including gender, age, skin type, sun protection behaviours and preference for a tan. The results for the regression model are shown in Table 6.4. The findings show there was a significant association between fake tan use and sunburns with fake tan users more likely to experience 2-4 sunburns (OR = 2.13, 95% CI, 1.17-3.86) and 5 or more sunburns (OR = 4.39, 95% CI, 1.78-10.83). Fake tan use and skin type were also significantly associated, with fake tan users less likely to report having a skin tone that 'burns then tans' (OR = 0.23, 95% CI, .11-.49) or skin that 'just tans' (OR = 0.23, 95% CI, .10-.54).

Fake tan use in the previous 12 months was significantly associated with reduced likelihood of wearing upper body protective clothing (B = -.72, SE = .78, *p* =.000) or lower body protective clothing (B = -.40, SE = .17, *p* = .023). Fake tan use and desire for a suntan were also significantly associated. Fake tan users were significantly more likely to desire a light (OR = 4.60, 95% CI, 1.56-13.60), moderate (OR = 7.82, 95% CI, 2.63-23.313), or dark tan (OR = 4.42, 95% CI, 1.33-14.76).

Table 6.4 Correlates of fake tan use among adolescent females in NSW Australia, surveyed in spring 2009.

	Odds Ratio	95% CI	p value
Age			**.026**
12-14 years	1.0		
15-16 years	1.65	(.812 - 3.333)	.167
17-18 years	2.37	(1.253-4.484)	**.008**
Skin type			**.001**
Just burn	1.0		
Burn then tan	.234	(.111-.490)	**.000**
Tan only	.231	(.098-.542)	**.001**
Nothing would happen	.289	(.065-.279)	.102
Sun protection behaviours			
Sunscreen use	1.214	(.905-1.628)	.195
Hat use	.818	(.611-1.095)	.177
Shade use	1.151	(.788-1.683)	.467
Upper body protective clothing use	.488	(.346-.689)	**.000**
Lower body protective clothing use	.673	(.478-.947)	**.023**
Wear Sunglasses	1.007	(.799-1.270)	.952
Avoid peak UV hours	1.294	(.961-1.741)	.089
Sunburns			
Low (0-1 burns)	1.0		
Moderate (2-4 burns)	2.126	(1.171-3.859)	**.013**
Frequent (5 + burns)	4.387	(1.778-10.825)	**.001**
Desire for a tan			**.006**
No	1.0		
Yes, a light tan	4.600	(1.555-13.604)	**.006**
Yes, a moderate tan	7.823	(2.625-23.311)	**.000**
Yes, a dark tan	4.424	(1.326-14.763)	**.016**
Yes a very dark tan	4.789	(.956-23.975)	.057

6.6 Discussion

The prevalence of fake tan use among this sample of female adolescents (34.5 per cent) is higher than previously reported prevalence among primarily adult populations which ranged from 9 per cent (Girgis et al., 2003) to 22 per cent (Brooks et al., 2006), and higher than the prevalence of 19.1 per cent among US female adolescents aged 11-18 years reported by Cokkinides et al. (2010). Our findings show that fake tan use among Australian female adolescents is associated with decreased sun protection, specifically reduced use of both upper and lower body protective clothing. Unlike earlier studies (Brooks et al., 2006; Girgis et al., 2003; Stryker et al., 2007; Beckmann et al., 2001) we did not find that females who used fake tan products in the past year were more likely than non-users to report regularly using sunscreen when in the sun. In contrast, we found no difference between the self-reported sunscreen use of the two groups.

Notably, we found that fake tan users were significantly more likely to experience repeated sunburns, after controlling for skin type. The association between fake tan use and increased sunburns is consistent with previous studies among adolescents in the US (Cokkinides et al., 2010) and adults in both US and Australian populations (Brooks et al., 2006; Beckmann et al., 2001; Purchase, 1994). However, given minimal studies specific to the adolescent population, this study provides disconcerting data on the association between fake tan use and frequent sunburns among Australian adolescents. As adolescence and early adulthood are among the most sensitive age periods for the effects of sunburn and future incidence of skin cancers (Veierod et al., 2003), these findings should provide an impetus for further investigation into the nature of the relationship between fake tan use and sunburns specifically among the adolescent

population. As a harm minimisation strategy our results provide no evidence for cancer control agencies to promote fake tan products as a safe alternative to tanning in the sun. However the association between increased desire for a tan and fake tan use suggests fake tan users represent a distinct tan seeking segment of adolescents and an appropriate target group for interventions.

A possible limitation of this study is the use of both written and online survey approaches for data collection. There is a lack of data available on if completing surveys in an online format versus on paper influences how individuals respond to questions about their sun protection behaviours. The potential that respondents were influenced by the survey approach method cannot be excluded. As this study used a non-random sample and was cross-sectional in nature it was not possible to confirm that the use of fake tan directly increases the risk of sunburn; however there is a significant association between the two factors. Brooks et al. (2006) postulate the association between fake tan use and sunburns is a result of individuals using fake tan products being unaware they provide negligible sun protection; they also suggest that fake tan users may be more likely than others to seek tans or accentuate the tans they receive from the sun or tanning beds. Given the significant association between fake tan use and increased desire for a tan, it is more plausible that fake tan users represent a distinct tan seeking segment of adolescents rather than just being unaware a fake tan provides no protection from the sun. These associations are yet to be investigated in the literature. The potential that fake tan use is associated with an increased likelihood of frequent sunburns among Australian adolescents is worrisome. Given the increasing popularity of fake tan products in our society, coupled with the significant risk associated with sunburn

obtained during adolescence and future risk of skin cancer, further research is needed in this area.

6.7 Conclusion

Our findings show that fake tan use among Australian female adolescents is associated with decreased sun protection, specifically reduced use of both upper and lower body protective clothing. Fake tan users were significantly more likely to experience repeated sunburns, after controlling for skin type. Further research is needed to determine the direction and strength of the association between use of fake tan products, decreased sun protection behaviours and sunburns.

CHAPTER 7: AUSTRALIAN ADOLESCENTS' COMPLIANCE WITH SUN PROTECTION BEHAVIOURS DURING SUMMER: THE IMPORTANCE OF THE SCHOOL CONTEXT

Williams, M., Jones, S.C., Caputi, P., Iverson, D. (2011-epub ahead of print), Australian adolescents' compliance with sun protection behaviours during summer: the importance of the school context. *Health Promotion International*. Reproduced with permission of Oxford University Press.
http://heapro.oxfordjournals.org/content/early/2011/04/20/heapro.dar028.full.pdf+html

7.1 Executive Summary

Chapter 7 explores the differences in sun-protection behaviours across key contexts relevant to adolescents during summer. The analysis compares sun protection behaviours between school, weekends, holidays and summer in general. The relationship between sun-related behaviours and the influence of context was initially identified in the conceptual model presented in Chapter 3. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi and Professor Don Iverson, and was published in Health Promotion International, Advance Access April 21, 2011.

7.2 Abstract

Objective: Adolescents exhibit significantly lower sun protection behaviours than adults in Australia. While many studies have assessed the sun protection behaviours of adolescents during summer, few studies have explored the differences in sun protection behaviours of adolescents across key contexts relevant to adolescents during summer- notably school time, weekends and school holidays. Greater understanding of differences in behaviours across these contexts provides more detailed explanations of the nature of adolescent ultraviolet exposure, and thereby facilitates improved targeting of interventions for this hard to reach segment. In this study we explore the differences in self-reported, habitual, sun protection behaviours of adolescents across key contexts during summer.

Method: A sample of 692 adolescents aged between 12 and 18 years completed a self-report survey concerning habitual sun-related behaviours across four key contexts. Comparisons were made between contexts in seven key sun protection behaviours.

Results: The results show there are significant differences in habitual sun protection behaviours of adolescents between contexts.

Conclusions: These findings suggest that some sun protection behaviours are not transferred between key contexts relevant to adolescents and highlight an opportunity for public health programs to focus more specifically on facilitating the transfer of positive sun protection behaviours between contexts.

7.3 Introduction

Australia continues to have one of the highest incidences of skin cancer in the world, with new cases estimated to outnumber other forms of cancer by a ratio of four to one (AIHW, 2008). Exposure to ultraviolet (UV) radiation from the sun is the primary preventable risk factor for developing both melanoma and non melanoma skin cancers, with adolescence a period of significant risk (Weinstock et al., 1989; Whiteman et al., 2001). The adolescent group demonstrates the highest level of risk behaviours in terms of low compliance with recommended sun protection behaviours (Dobbinson et al., 2008b), long periods of exposure to UV radiation and has a high incidence of sunburns (NSW Skin Cancer Prevention Working Group, 2007)

Australia has a long history of population-wide programs promoting sun protection (Montague et al., 2001), and recently, increased adolescent targeted programs such as the NSW Cancer Institute's 'Darker Side of Tanning'. Despite these efforts, national surveys of adolescent sun protection behaviours, conducted every three years since 1984, have shown consistently low compliance of adolescents with recommended guidelines for sun protection (Livingston et al., 2003). Among adolescent males, routine compliance with three sun protection behaviours; wearing a hat, wearing protective clothing and using sunscreen, has ranged between 9% and 13% in the period between 1993 and 2002, and 6-10% compliance among adolescent females in that same period (Livingston et al., 2003).

Measurement of sun-protection behaviours most often involves self-report of habitual sun-protection practices (Creech and Mayer, 1997; Glanz and Mayer, 2005). The Australian School Students' Alcohol and Drug Survey has provided repeated

population-based data on the sun protection behaviours of Australian adolescents (Livingston et al., 2003), with data collected in the context of habitual behaviours 'during summer'. The recently proposed standardised measures of adolescent behaviours (Glanz et al., 2008) are also assessed in the context of 'during summer'. Measures of habitual behaviours are useful to allow generalizations across a population and to monitor change over time. The inherent generalization in measures of habitual behaviour during summer, however, ignores potential differences in sun protection behaviours between key contexts, such as at school, on weekends and during holidays.

Knowledge of how behaviours vary between contexts can provide health promotion planners with greater opportunities to influence behaviour change through improved targeting of programs to specific contexts. The influence of the school context in sun protection has been highlighted in previous research findings; for example, that a sun protection school policy, such as compulsory hat use when outside, was related to increased sun protection among adolescents (Lower et al., 1998a). Overall however, the limited success of programs to date in improving the sun protection behaviours of adolescents (Saraiya et al., 2004), highlights the need to better understand the nature of adolescent sun protection behaviours. Identifying and understanding differences in sun protection behaviours between contexts may provide the information needed to better target programs to this challenging group in terms of stimulating behaviour change. Despite high levels of knowledge about the need for sun protection (Arthey and Clarke, 1995), adolescents have not translated this awareness into positive sun protection behaviours (Livingston et al., 2003).

The present study is the first attempt at quantifying the differences in self-reported habitual sun-related behaviours between key contexts relevant to adolescents. The

purpose of this study was to determine whether, and to what extent, self-reported habitual sun protection behaviours among adolescents varied between specific contexts during summer.

7.4 Methods

7.4.1 Participants

A sample of 692 adolescents aged between 12 and 18 years participated in this study. The sex distribution of the sample was 36 per cent male and 64 per cent female, which under-represents the male population with the actual distribution of secondary school students in New South Wales (NSW) in 2009 of 52 per cent male and 49 per cent female (Australian Bureau of Statistics, 2008). Age characteristics were generally consistent with those from the state dataset with 66 per cent aged 12-15 years and 34 per cent aged 16 plus compared to an actual distribution of secondary school students in NSW in 2009 of 68 per cent aged 12-15 years and 32 per cent aged more than 16 years (Australian Bureau of Statistics, 2008).

7.4.2 Sample selection

The study adopted a convenience sampling strategy of adolescents aged 12-18 years. Three methods of recruitment were used: schools, online and via a regional Australian university's promotional events. Schools were selected based on their geographic location. All schools were located within a single local government area of a coastal community in Eastern Australia. Eligible schools were required to be located within 10 kilometres of the beach reflecting a similar coastal lifestyle and be either non-government or independent secondary schools. Ethics approval was sought from the

representing education office for each school. Following ethics approval, school Principals were approached to seek participation. All schools meeting the eligibility criteria were invited to participate in the study (a total of six independent and Catholic secondary schools). Each school was offered a $200 incentive for its participation; no individual student incentives were offered. Two schools agreed to participate in the study, one independent school and one Catholic school.

An advertisement for the survey was placed on the social networking site, Facebook. A chance to win a $50 incentive was available to participants who completed the survey online. The advertisement was promoted to individuals with a Facebook account who were aged between 12 and 18 years of age. To avoid individuals from the school sample completing the survey online, the online promotion was limited to individuals whose location, as defined by Facebook, was within a 25 kilometre radius of the city of Sydney in eastern Australia, approximately 80 kilometres north of the regional city. Participants were also recruited at information evenings held by the regional university for Year 12 students. Attendees were offered a $5 voucher for completing the survey and screened to ensure they had not already completed the survey at school or online.

All participants, irrespective of the method of recruitment, were made aware prior to providing their consent that the survey related to sun protection. Participation was voluntary, with participants advised prior to the commencement of the survey of their option to withdraw at any time. The study protocol was approved by the University's Human Research Ethics Committee.

7.4.3 Measures

Habitual sun protection behaviours were based on the recently recommended standardised US measures of adolescents' habitual sun exposure and protection during summer (Glanz et al., 2008) but adapted to include specific contexts relevant to adolescents during summer. The three specific contexts of 'when at school during summer', 'on the weekend during summer', 'during the summer holidays' were used as well as the more general context of 'during summer in general'. The specific contexts were conceptualised as key opportunities relevant to adolescent UVR exposure during the summer months. In Australia, school holidays comprise approximately half of the summer months (December- January). Participants were asked to report their usual sun-protecting behaviour in each of the contexts with these items all prefaced with "When you are outside on a warm sunny day, how often do you usually do the following (in context)…"

Seven sun protection behaviours were assessed for each context: wearing sunscreen, wearing a hat, staying in the shade, wearing a shirt with sleeves that covers your shoulders, wearing pants/skirt to at least your knees, wearing sunglasses and spending most of the time inside during peak UV hours in the middle of the day. Five of these items are consistent with current guidelines for sun protection in eastern Australia and are also similar to the recently standardised US measures of sun protection behaviours (Glanz et al., 2008). The additional items, a measure of lower body protective clothing and avoidance of peak UV hours were included to increase the specificity of the assessment. Participants rated each question on a 5- point likert-type scale ranging from "never" (1) to "always" (5).

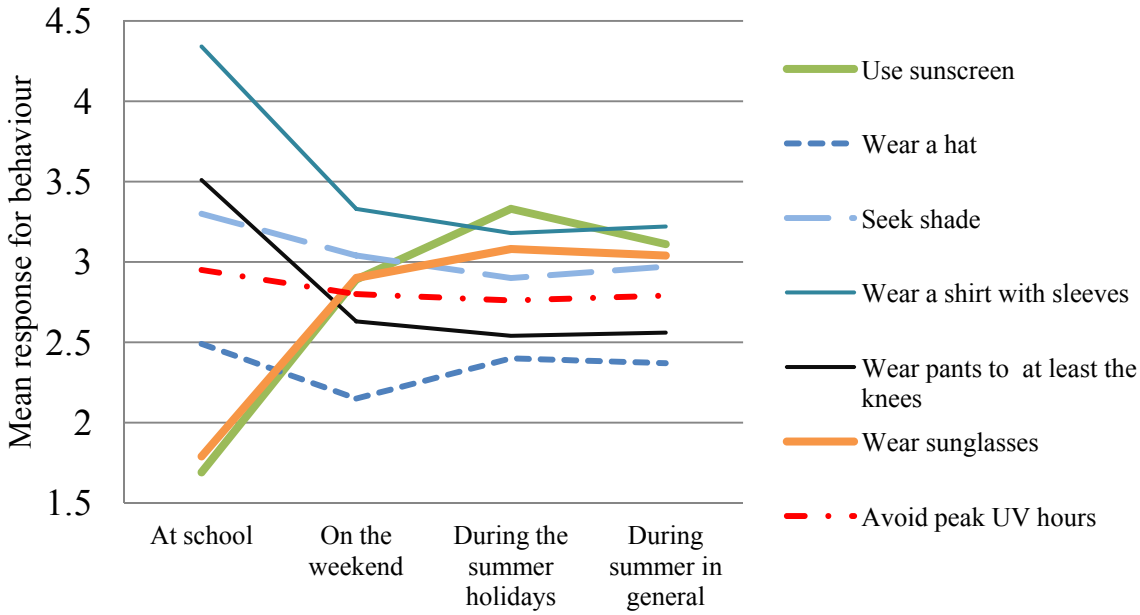
7.4.5 Statistical analysis

Data were analysed using SPSS version 17.0. Differences in sun protection behaviours across the key contexts were analysed using a multivariate repeated measures analysis of variance. Follow-up post-hoc comparisons were then carried out on significant findings.

7.5 Results

The mean response for compliance with sun protection behaviours in each context is shown in Figure 7.2. Sun protection behaviours among adolescents were poor in each of the contexts assessed. The mean compliance with sun protection behaviours reported in any context ranged from 1.69 - 4.34 (possible range 1 'never'- 5 'always'). Only one of the reported behaviours achieved a mean compliance greater than 4.0: wearing a shirt with sleeves that covers your shoulders at school. Using sunscreen at school had the lowest mean compliance (M=1.69, SD=1.06) for any behaviour in any context assessed. When combined, the average compliance of the seven sun protection behaviours in each context was similar; at school (M=2.87, SD=1.13), on weekends (M=2.82, SD=1.15), summer holidays (M=2.88, SD=1.26), and summer in general (M=2.87, SD=1.14).

Figure 7.2 Mean response for each sun protection behaviour within each context



In relation to compliance with individual sun protection behaviours in each context, the highest mean compliance with the sun protection behaviours performed at school were for wearing a shirt with sleeves that cover your shoulders (M=4.34, SD=1.14), wearing pants that cover at least to the knees (M=3.51, SD=1.12) and seeking shade (M=3.30,SD=1.14). The lowest mean compliances with sun protection behaviours performed at school were: using sunscreen (M=1.69, SD=1.06), wearing sunglasses (M=1.79, SD=1.12), wearing a hat (M=2.49, SD=1.40) and avoiding peak UV hours (M=2.95, SD=1.14).

With regard to sun protection behaviours performed on weekends, compliance with seeking shade (M=3.04, SD=0.91) and wearing a shirt with sleeves that cover your shoulders (M=3.33, SD=1.21) had the highest mean compliance compared to other sun protection behaviours on weekends. The mean compliance for the five remaining

behaviours performed on weekends ranged from 2.15 – 2.90. During the summer holidays, the highest mean compliance for sun protection behaviours were: using sunscreen (M=3.33, SD=1.03) and wearing a shirt with sleeves (M=3.18, SD=0.88). The lowest compliance were for wearing a hat (M=2.40, SD=1.14) and wearing pants to cover at least to the knees (M=2.54, SD=1.20). During summer in general, the sun protection behaviours most frequently complied with were wearing a shirt with sleeves (M=3.22, SD=1.19) and use of sunscreen (M=3.11, SD=1.03). The lowest compliance were for were wearing a hat (M=2.37, SD=1.15) and wearing pants to cover at least to the knees (M=2.56, SD=1.26).

7.5.1 Multivariate analysis

To determine if there were differences in compliance with behaviours between contexts a multivariate repeated measure analysis of variance was performed. Significant multivariate effects were detected for behaviours (Wilks' Lambda=.503, F(6,575)=94.51, p=.000), contexts (Wilks' Lambda=.934, F(3,578)=13.71, p=.000), and the interaction between behaviours and contexts (Wilks' Lambda=.246, F(18,563)=95.78, p=.000). Post-hoc analyses were conducted to further examine the interaction effect. The mean difference and standard errors of self-reported compliance with behaviours performed in each context are reported in Table 7.1. The mean differences in compliance between contexts are first referenced to the context of 'during summer in general'; then 'during holidays' and finally 'on weekends' until the mean differences in compliance for each behaviour are compared between each context. The findings from the post-hoc analyses are presented under sub headings for each context.

Table 7.1 Mean difference in sun protection behaviours among adolescents across key contexts

	Summer in general	**Holidays** Mean Difference (SE)	**Weekends** Mean Difference (SE)	**School** Mean Difference (SE)
Sunscreen	Ref	-.22 (.03)*	.23 (.04)*	1.42 (.04)*
		Ref	.45 (.03)*	1.64 (.05)*
			Ref	1.19 (.05)*
Hat	Ref	-.02 (.02)	.23 (.03)*	-.12 (.06)
		Ref	.25 (.03)*	-.09 (.06)
			Ref	-.34 (.06)*
Shade	Ref	.08 (.02)*	-.07 (002)*	-.32 (.04)*
		Ref	-.14 (.03)*	-.40 (04)*
			Ref	-.26 (.04)*
Shirt	Ref	.04 (.02)	-.11 (.03)*	-1.11 (.05)*
		Ref	-.15 (.02)*	-1.15 (.05)*
			Ref	-1.00 (.05)*
Pants	Ref	.02 (.02)	-.07 (.03)*	-.95 (.06)*
		Ref	-.09 (.02)*	-.97 (.06)*
			Ref	-.88 (06)*
Sunglasses	Ref	-.05 (.02)	.13 (.02)*	1.25 (.05)*
		Ref	.18 (.02)*	1.30 (.05)*
			Ref	1.12 (.05)*
Peak Hours	Ref	.04 (.02)	-.00 (.03)*	-.16 (.05)*
		Ref	-.04 (.02)	-.19 (.05)*
			Ref	-1.5 (.05)*

Ref= Reference Category *p <.005

7.5.2 Context of school

Significant differences were seen in the mean compliance with sun protection behaviours performed at school compared to each alternate context for six of the seven behaviours (excluding wearing a hat, where there was no difference in compliance at school with compliance during the holidays or during summer in general). Adolescents' compliance with wearing sunscreen and wearing sunglasses was significantly less frequent at school than in any other context. The use of protective clothing (wearing a

shirt with sleeves and pants to at least the knees) and avoidance of peak UV hours were reported significantly more often at school than in any other context. Shade was also more often utilised in the school context than in any other context assessed. Compliance with wearing a hat at school was significantly higher than on weekends.

7.5.3 Context of weekends

The mean compliance with sun protection behaviours on weekends was significantly different to other contexts for six of the seven behaviours assessed (excluding avoidance of peak UV hours where there was no difference in avoidance of peak UV hours between weekends and holidays). Participants reported more often using sunscreen and wearing sunglasses on the weekend than at school; however, these two behaviours were less significantly likely to be engaged in on weekends than during the summer holidays or summer in general. Adolescents reported using shade as well as protective clothing (both upper and lower body clothing) more often on weekends than during summer holidays or summer in general but significantly less often on weekends than when at school. Hats were significantly less often used on weekends than any other context.

7.5.4 Context of holidays

Summer holiday behaviours were most similar to summer in general sun protection behaviours with no significant differences between contexts for five of the seven behaviours assessed (excluding sunscreen, where compliance during the holidays was significantly higher than during the summer in general; and use of shade, where shade was significantly less likely to be sought during the holidays than during summer). Adolescents reported the highest compliance with using sunscreen and

wearing sunglasses during the summer holidays compared to any other context, but the lowest use of protective clothing use (both upper and lower body clothing).

7.5.5 Context of summer

Summer sun protection behaviours and summer school holiday behaviours were not significantly different for wearing a hat, wearing a shirt with sleeves that covered shoulders, wearing pants to knees, wearing sunglasses and avoiding peak UV hours.

7.6 Discussion

To our knowledge, this study is the first to assess and compare sun protection behaviours across key contexts relevant to adolescents during summer. In the contexts assessed, compliance with recommended sun protection behaviours overall was generally low. However, there were significant differences between the contexts in relation to the specific sun protection behaviours performed, and notably increased compliance with sun protection behaviours in the school context. The behaviours with highest compliance reported in the schools are conceivably a function of the rules enforced in that context (e.g., wearing protective clothing is a function of the school uniform policy) or the structural environment (e.g., provision of shaded areas in playgrounds), thus making sun protection easier for adolescents. At the same time those behaviours where compliance was lowest in schools is likely a function of not being required or enforced in that context (e.g. using sunscreen) or even in all likelihood opposed (e.g., sunglasses are generally not included in the school uniform policy given the potential for students to lose them or have them stolen), highlighting opportunities for new policy development. In this study, discriminating between contexts provided a

detailed understanding of sun protection behaviours during summer, and thus identified opportunities for new program interventions.

A substantial improvement in sun protection and reduction in skin damage would likely result if adolescent targeted programs were able to increase the transfer of positive behaviours across contexts. When mean scores for each sun protection behaviour is combined within a context, the overall compliance with recommended sun protection behaviours in each context was very similar, demonstrating how a composite score can mask the interaction between contexts and individual behaviours. Five of the seven behaviours assessed were complied with more often at school than in any other context. The major obstacle to maximal adolescent sun protection being achieved at school is the significantly lower use of sunscreen and wearing of sunglasses at school. It follows that these behaviours should be a target of school-based interventions. The SunSmart campaign is one of the longest standing community-wide sun protection programs, launched in 1988 in the Australian state of Victoria and run by the Cancer Council Victoria with funding by the Victorian Health Promotion Foundation. The program identifies 'environments' as a main route of influence, with structural change in schools and knowledge dissemination to teachers a major component of the program design (Montague et al., 2001).

The SunSmart program is consistent with the 'Health Promoting Schools' approach. The health promoting schools approach identifies teaching and learning curriculum, the school environment and partnerships and community links as interrelated areas of focus in school health promotion. Sun protection has been previously identified as an essential element of health promoting schools (World Health Organization, 2002). Specific initiatives worthy of further consideration in the health

promoting schools framework include increased focus on teachers incorporating the development of sun protection self efficacy in their lessons in a creative way. Creation of a pro-sun protection environment can be enhanced by modifying school policies to provide sunscreen or requesting students to bring sunscreen to school for use when outdoors in the school environment, as well as incorporating sunglasses within the uniform policy. Providing parents with information regarding their role in supporting their teenage son or daughter through role modelling can facilitate the transfer of sun protection behaviours to alternate contexts. Schools partnering with local councils and sporting groups in making sun protection products more readily available in the community venues, such as swimming pools for carnivals, can facilitate making sun protection easier for adolescents. In combination these activities provide a significant opportunity to transfer positive sun protection behaviours to alternate contexts and warrant further exploration. While the strategies themselves may not be new to sun protection policy in schools, the ability to focus on transferring positive behaviours between contexts provides a new opportunity for improving adolescent sun protection.

The contexts assessed (at school, weekends, holidays, summer in general) provide a different picture of adolescents' sun exposure and sun protection behaviours. It appears that "summer in general" is most similar to self-reported behaviour "during summer holidays", with no significant differences seen between summer holidays and summer in general for five of the seven behaviours assessed. This suggests that when adolescents recall their usual behaviours 'during summer' they reference their behaviours performed during the school holidays. Adolescents are a group whose behaviour is considered hard to change, and greater understanding of the nature of their

UVR exposure may allow interventions to take account of the specific behaviours in specific contexts and thereby potentially result in better outcomes.

A limitation of this study is the reliance on self-report data. In the area of sun protection it is difficult to identify a gold standard against which measurements from the tool under investigation can be compared (Lower et al., 1998a). Various attempts have been made to establish the validity of adolescent self-report measures, including parental report and direct observation, but as Lower et al., (1998) noted, adolescent self-report of solar protection is valid and has the potential to be utilised with a degree of confidence to assess behaviour. A further limitation of this study is the inability to stratify the study sample based on specific school policies and curriculum within each school. Stratification would enable determination of the differential impact of specific policies within the school context on sun protection behaviours. A systematic review by Saraiya et. al., (2004) reported insufficient evidence to determine the effectiveness of educational and policy interventions on sun protection behaviours in secondary schools. Given the increased compliance with sun protection behaviours among adolescents in the school context identified in the study, our results highlight the continuing need for research in this area.

7.7 Conclusion

The study provides in-depth information about adolescent sun protection behaviours. Identifying that differences exist between habitual behaviours in key contexts provides an opportunity for health promotion programs to focus on enabling the transfer of positive behaviours to alternate contexts. Targeted activities based on specific behaviours could facilitate halting and potentially reversing the current negative

trend in adolescent sun protection. The findings from this study deepen our understanding of adolescent sun exposure. In summary, sun protection behaviours are not transferred between key contexts relevant to adolescents and the results of this study highlight potential areas for more effective interventions in adolescent sun protection.

CHAPTER 8: VALIDITY OF ADOLESCENT SELF-REPORTED SUN PROTECTION BEHAVIOURS IN A SCHOOL CONTEXT: ASSOCIATION OF DIRECT OBSERVATIONS WITH A SELF-REPORTED DIARY AND A SURVEY

Williams, M., Caputi, P., Jones, S.C. & Iverson, D. (Submitted), Validity of adolescent self-reported sun protection behaviours in a school setting: Association of direct observations with a self- reported diary and a survey, *Photochemistry and Photobiology.*

Executive Summary

Chapter 8 describes the results of a validation study of adolescent self-report using data obtained in the school context. In this article self-report survey data and a 1-day diary of sun protection behaviours is compared with independent observation of behaviours performed at school. This chapter builds on the previous chapters that explore adolescent sun-related behaviours, and in this chapter a major measurement issue is explored, the validity of adolescent self-report. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi, and Professor Don Iverson, and has been submitted to Photochemistry and Photobiology.

8.2 Abstract

The objective of this study was to validate self-report of sun-related behaviours among adolescents in a school setting by utilising direct observation of sun-protection behaviours to corroborate self-report survey and sun behaviour diary. Two schools and a total of 376 students from Years 8 and 9 were invited to participate. A final sample of 244 students (64.9% of those invited) completed a survey, a diary, and had at least one direct observation taken during an outdoor interval at school. We found poor to fair agreement between direct observations and self-report of 'usual behaviours' from the survey of hat use, shade use and upper body clothing and lower body clothing. However, we found moderate to substantial agreement between the diary measure and direct observation for each of the sun protection behaviours. Overall, this study indicates that adolescent self-report of sun-related behaviours in the school context is valid for behaviours reported via a diary. The survey however, did not show validity of self-report, suggesting that validation of measures of 'usual' behaviours at school necessitates a data collection period longer than one day.

8.3 Introduction

Effectiveness of interventions targeting a reduction in UV radiation exposure has predominately been through the use of self-report data (Saraiya et al., 2004). The accuracy and validity of self-report data are, however, limited by concerns regarding recall, difficulty in estimating the frequency of routine behaviours, and social desirability biases. Given these potential limitations, evidence of the validity of self-report measures of sun-related behaviours is essential. A growing number of studies have reported how validly their self-report measures can assess sun-related behaviours among the general population, particularly in aquatic settings such as the beach or pool (Maddock et al., 2007; Glanz et al., 2010; O'Riordan et al., 2009; O'Riordan et al., 2008a; O'Riordan et al., 2006; Foot et al., 1993; Bennetts et al., 1991).

Various methods have been used to establish the validity of self-reports of sun-related behaviour in specific settings (Girgis et al., 1994; Oh et al., 2004, Glanz et al., 2010; O'Riordan et al., 2008a, Glanz et al., 2010; O'Riordan et al., 2009; O'Riordan et al., 2006). However, few studies have explored the validity of self-report measures of adolescent sun-related behaviours performed in the school setting. Secondary schools are an important setting for program planners to implement interventions targeting adolescents. Adolescents spend a large proportion of their time at school, with the percentage of daily UV radiation exposure received on routine breaks at school estimated to be approximately 47% (Moise et al., 1999), and contributing significantly to cumulated exposure up to age 20 (Parisi et al., 2000). Therefore, it is important to accurately assess UV exposure in this setting. Several studies have used the school setting as a sampling frame, but have not evaluated sun behaviour at school (Lower et al.,1998, Dusza et at., 2005). In one study (Yaroch et al., 2006) self-report data of

behaviours performed at school were compared with an objective measure (UV monitor stickers) among adolescents, however objective observation data were not available. None of the identified studies have compared two measures (written survey and diary) of adolescent self-reported sun-related behaviours with direct observation of behaviours in the school context. The objective of this study was to validate self-report of sun-related behaviours among adolescents in a school setting by utilising direct observation of sun-protection behaviours to corroborate self-report survey data and a self-report behaviour diary.

8.4 Methods

8.4.1 Setting and recruitment

The study was conducted in Wollongong, a regional coastal city in New South Wales (NSW) Australia. Wollongong is the third largest city in New South Wales, with a population of just under 300,000 people. The study was completed in spring time prior to the implementation of a school-based intervention scheduled to commence the following summer targeting students from Years 8 and 9. The Australian Cancer Council recommends Australians take steps to protect against sun damage when the SunSmart UV Alert indicates the UV Index is at three or above (www.cancer.org.au). In NSW during September the UV Index generally reaches three or above on a daily basis (www.bom.gov.au/nsw/uv/index). A convenience sample of six independent and Catholic secondary schools was invited to participate in the study. Each school was offered a $200 incentive for participation; no individual student incentives were offered. Two schools agreed to participate in the study (participation rate 33%), one independent school and one Catholic school. The school sample (n=376) was part of a larger

convenience sample of adolescents that participated in a concurrent study of adolescent sun-related behaviours (Williams et al., 2011c), the larger study sample included an additional 316 adolescents who were recruited from community events and online and completed the same self-report survey. Parents were provided with a study information sheet approximately four weeks before the study commenced and had the opportunity to withdraw their child from the study. Informed student consent was also obtained. The study protocol was reviewed and approved by the University's Human Research Ethics Committee.

8.4.2 Procedure

The study period for each participant was one school day; however to complete the study across the whole sample four separate study days were required. Study days were scheduled so that participants had a physical education (PE) lesson scheduled during the study day and the forecast was for a generally fine day. At the beginning of the school day participants were asked to complete a written Summer Lifestyle Survey that collected information about their sun-related behaviours, including their usual sun-related behaviours at school. After returning the survey, participants were given a sticker with a unique number to attach to their right shoulder and wear throughout the day. They were also given a diary record which they were instructed to complete after each outdoor interval; recess, lunch and PE. Participants were reminded by teaching staff at the conclusion of each outdoor interval that they were to fill in their diary. Participants were asked to return their completed diary at the end of the study day. Recess was held each day from 10:50-11.10am, lunch from 12:50-1:30pm, and PE time varied depending on individual student timetables. During each outdoor interval, trained observers walked around the school grounds in pairs observing participants' behaviours

in the sun. The trained observers recorded the observed behaviours on a standardised form which included the participant's unique number from the sticker.

8.4.3 Measures

Self-report survey

The Summer Lifestyle Survey included items assessing sun-related behaviours, knowledge, attitudes and beliefs. The face and content validity of the self-report survey were established with experts in the cancer control industry and a convenience sample of adolescents prior to the study commencing. Industry experts from three cancer councils in Australia (Cancer Council New South Wales, Victorian Cancer Council and Cancer Council Western Australia) were invited to assess the content validity of the instrument using a standardised pro-forma for feedback. Cognitive interviewing was undertaken with 24 adolescents to determine the clarity and relevance of questions (Williams et al., 2011d). Adjustments were made to the survey based on the findings. The current analysis is restricted to those items about sun-related behaviours performed at school as well as demographic characteristics and skin tone. Seven sun-related behaviours were assessed for the school setting. These were how often students usually: wore sunscreen, wore a hat, stayed in the shade, wore a shirt with sleeves that covered their shoulders, wore pants/skirt to at least their knees, wore sunglasses and spent most of the time inside during peak UV hours in the middle of the day. Five of these items are similar to the proposed standardised US measures of sun protection behaviours for use in behavioural and epidemiological research (Glanz et al., 2008), and are consistent with current guidelines for sun protection in eastern Australia (Cancer Council NSW, 2010). The additional items, a measure of lower body protective clothing and avoidance

of peak UV hours, were included to increase the comprehensiveness of the assessment. The stem for each question was adapted to include the frame of the school context, for example "When you are outside on a warm sunny day how often do you usually do the following:...when at school... wear sunscreen?" Participants responded to each question on a 5-point likert-type scale ranging from "never" (1) to "always" (5). Skin tone was assessed with one item, "How would you describe your skin colour when you don't have any tan?" with response options ranging from very fair to black. All surveys were coded to match an individual diary record and observation sticker which was given to each participant. The survey was pre-coded with a unique number to enable matching with diary and observation data.

Self-report diary

A Sun Protection Behaviour Diary (Girgis et al., 1993; Yaroch et al., 2006) was used to record sun protection behaviours during each time interval outdoors during the day at school. The diary was completed over one day. For each time interval participants were asked to record: whether they were outdoors mostly in the sun or shade; what type of hat they wore (nothing, visor/cap, broad brimmed/bucket hat); and what protective clothing they were wearing on both their upper (nothing, sleeveless, short sleeved, three quarter sleeved, long sleeves) and lower body (short shorts/skirt, knee length pants/skirt, three quarter pants/skirt, long pants/skirt). Participants were also asked to indicate whether they had applied sunscreen at any time throughout the day. The diary was pre-coded with a unique number to enable matching with survey and observation data for each participant.

Observation measures

Direct observation was undertaken by three pairs of researchers (six observers) who observed and recorded the behaviours of participants when outdoors in the school environment at each time interval. Each observer was trained in the observation protocol prior to the study. Observers were required to achieve three consecutive observations of 100% agreement with the trainer prior to commencing data collection. Within each school, each pair of observers was designated the outdoor areas in which to undertake their observations. The observers stood in the area and scanned for any individual with an observable sticker. Observers stood next to each other and moved together through the area assessing the same individual at the same point in time; however, they were instructed not to confer on their observation records. A pre-coded form was developed with the data elements and method for observation based on a method developed by Maddock et al. (2007).

For each observation, both observers independently assessed the participant's use of shade (mostly in the sun-shade available, mostly in the sun-shade not available, mostly in the shade, moving between), whether they wore sunglasses, the type of hat worn (nothing, visor/cap, broad brimmed/bucket), and what protective clothing was being worn on both the upper (nothing, sleeveless, short sleeved, three quarter sleeved, long sleeves) and lower body (short shorts/skirt, knee length pants/skirt, three quarter pants/skirt, long pants/skirt) during a snapshot in time. The trained observers wore University branded name badges to make them easily identifiable.

8.4.4 Data Analysis

Data were analyzed using SPSS version 17.0. To assess the level of agreement between observers, kappa indices were calculated using a macro for a non-symmetric kappa statistic (NSKAPPA.SPS). Descriptive statistics were then examined for the participants' surveys and diary records. Data on wearing sunglasses were collected but subsequently excluded from analysis because of the low number of participants observed wearing sunglasses (n=4). To enable comparison of survey data with observation records, sun protection practices recorded in the survey via 5-point likert items were dichotomised into "always-often" versus "never-rarely-sometimes". Data for the observed sun protection behaviours were then dichotomised for consistency with the survey categories. For example, observation records for upper body clothing were re-coded to 'nothing-sleeveless' versus 'short sleeves-three quarter-long sleeves' to enable comparison with responses to the survey question "how often do you usually wear a shirt with sleeves covering your shoulders?". Observation data for hat use were re-coded to classify 'any hat' (including cap/visor/broad brimmed/bucket) versus 'no hat'. Lower body clothing was re-coded to 'short shorts/skirt' versus 'knee length- three quarter length-long pants/skirt'. Shade use was re-coded to classify 'mostly shade' (including mostly in the sun-shade available, mostly in the sun-shade not available) versus 'mostly sun'. Observation data from individuals observed moving between sun and shade areas were excluded from analysis.

Comparison was then made between observation data and self-report data from the survey, and between observation data and self-report data from the diary. Separate diary records and observation records for each interval were matched so that the only records reflecting the same time period were compared. Kappa indices were calculated

using the cross-tab procedure of SPSS, with confidence intervals calculated using a macro for non-symmetric kappa statistic (NSKAPPA.SPS). Consistent with O'Riordan et al. (2006), kappa coefficients were categorised as poor (k< 0.0); slight (k=0.0-0.2); fair (k= 0.2-0.4); moderate (k=0.4-0.6); substantial (k=0.6-0.8); and almost perfect (k= 0.8-1.0). To further examine the relationship between survey data and observed behaviours, the distributions of survey responses were examined using the Mann-Whitney test between participants who were observed wearing sun-protective items versus those who were observed not wearing the items.

8.5 Results

8.5.1 Participant characteristics

Overall 376 students were invited to participate in the study with 358 students completing a survey (response rate= 95.2%), 293 completing a diary (response rate= 77.9%), and 292 having at least one observation taken during an outdoor interval, recess, lunch, or PE (response rate= 77.7%). Kappa indices reflected a high level of inter-rater agreement for all behaviours, with substantial or almost perfect agreement for wearing a hat (k =0.97), upper body clothing (k =0.95), lower body clothing (k=0.94) and using shade (k=0.95).

A comparison of those participants with a record for each of the three measures (survey, diary and observation during at least one interval) versus those without a record for any of the three measures revealed no significant differences between groups in year at school or age, however, males were significantly less likely to provide data from the three measures χ^2 (1, N=361) = 69.25, p<.001. Only participants with a matching survey, diary and an observation record during at least one interval were included in the

analysis (n=244, response rate= 64.9%). Participants included in the analysis ranged in age from 12 to 16 (Mean= 13.89, SD= .699). The majority of participants were female 74.2% (n= 181), and over half 61.5% (n=150) were in Year 8. Approximately one third of participants reported their skin tone as 'fair 'or 'very fair' (33.1%), with 33.5% reporting their skin tone as 'medium' and the remaining respondents reporting darker skin tones.

8.5.2 Sun protection practices

Compliance with each of the recommended sun-related behaviours across the three measures is summarised in Table 8.1. Overall, the reported use of protective clothing was high across all measures, with reported prevalence of 'wearing a shirt with sleeves covering shoulders' ranging from 88.9% in the survey to 98.9% in the observation data, and 'wearing pants/skirt to at least the knees' ranging from 67% in the survey of usual behaviours at school to 100% of observations during the lunch interval. The least frequently recorded sun-related behaviour was for wearing sunscreen with only 7.4% of participants reporting 'often-always' wearing sunscreen at school and 6.1% reporting via the diary record that they had applied sunscreen at any time throughout the day.

Table 8.1 Reported compliance with recommended sun protection practices across measures.

	Survey [a] n (%)	Diary [b] n (%)	Observation [b] n (%)
Hat use [c]	107 (43.9)	103 (44.0)	68 (36.4)
Wearing a shirt with sleeves covering shoulders [d]	217 (88.9)	233 (97.9)	187 (98.9)
Wearing pants/skirt to at least the knees [e]	161 (67.1)	225 (93.4)	189 (100.0)
Using Shade [f]	103 (42.6)	130 (55.6)	100 (52.9)
Wearing sunscreen [g]	18 (7.4)	15 (6.1)	Not observed

[a] percentage responding "Often/Always"

[b] record for lunch period only. Grouping of diary and observation data as follows:

[c] "cap/visor, broad brimmed" v "no hat"

[d] "short sleeves, 3/4length, long sleeves" v "sleeveless"

[e] "knee length, ¾ length and long pants/skirt" v "short shorts/skirt"

[f] "mainly shade" v "mostly in the sun- shade available, mostly in the sun-shade not available" (observation data for moving between sun and shade excluded)

[g] any sunscreen applied throughout the day.

8.5.3 Agreement between measures

Agreement between self-report survey and observation data

Percent agreement between the self-report survey of usual behaviours at school and the direct observation method for each time interval ranged from 50.6% for use of shade during Physical Education (PE) to 89.7% for wearing a shirt with sleeves during recess (Table 8.2). Kappa indices for hat use ranged from slight to fair agreement (k=0.19 to k= 0.27). Indices for shade use varied with kappa for shade use during PE (k =0.04) to a fair kappa for shade use during lunch (k= 0.29). Due to the large number of

observations falling in one category for wearing a shirt with sleeves and wearing pants/skirt to at least the knees, kappa indices were not calculated; however, the percentage agreement for each of these behaviours across the three intervals was generally high (69.0% to 89.7%).

Table 8.2 Agreement between self-report survey responses by whether the item was observed during each interval outside

	Observation and survey agreement n (%)	Observation and survey discrepancy		kappa	CI
		Positive observation & negative survey entry n (%)	Negative observation & positive survey entry n (%)		
Hat use[a]					
Recess	82 (65.1)	11 (8.7)	33 (26.2)	.26	.10-.41
Lunch	119 (63.6)	25 (13.4)	43 (23.0)	.27	.14-.40
PE	71 (61.2)	17 (14.7)	28 (24.1)	.19	.02-.36
Shirt with sleeves[b]					
Recess	114 (89.7)	13 (10.3)	0	N/C	N/C
Lunch	167 (88.3)	22 (11.6)	0	N/C	N/C
PE	101 (85.6)	17 (14.4)	0	N/C	N/C
Pants/Skirt to at least the knees[c]					
Recess	88 (69.8)	38 (30.2)	0	N/C	N/C
Lunch	129 (69.0)	57 (30.5)	1 (.01)	N/C	N/C
PE	83 (70.9)	32 (27.4)	2 (.02)	N/C	N/C
Shade use[d]					
Recess	71 (55.9)	44 (34.6)	12 (9.4)	.18	.04-.32
Lunch	118 (64.5)	45 (25.0)	20 (10.9)	.29	.16-.42
PE	42 (50.6)	19 (22.9)	22 (26.5)	.04	-.17-.24

[a] "cap/visor, broad brimmed" v "no hat"

[b] "short sleeves, 3/4length, long sleeves" v "sleeveless"

[c] "knee length, ¾ length and long pants/skirt" v "short shorts/skirt"

[d] "mainly shade" v "mostly in the sun- shade available, mostly in the sun-shade not available" (observation data for moving between sun and shade excluded)

N/C = Not calculated

To further examine the relationship between self-reported usual behaviours at school and observed behaviours, the distributions of self-reported responses were examined using the Mann-Whitney test between participants who were observed wearing sun-protective items versus those who were observed not wearing the items. As shown in Table 8.3, a significant difference was found for wearing a hat and using shade. This was not calculated for wearing a shirt with sleeves or wearing pants/skirt to at least the knees due to the low number of participants observed not wearing these items. The data suggests participants observed wearing sun protective items were significantly more likely to report wearing these items 'usually' at school in the self-report survey than were participants observed not wearing them.

Table 8.3 Distribution of self-report survey responses by whether the item was observed during lunch break

	Observed with item n (%)	**Observed without item n (%)**	***P* value** [a]
Wear a hat			<.001
Never (%)	2 (2.9)	17 (14.3)	
Rarely (%)	14 (20.6)	30 (25.2)	
Sometimes (%)	9 (13.2)	29 (24.4)	
Often (%)	28 (41.2)	32 (26.9)	
Always (%)	15 (22.1)	11 (9.2)	
Wear a shirt with sleeves			
Never (%)	7 (3.7)	0	
Rarely (%)	7 (3.7)	0	
Sometimes (%)	8 (4.2)	0	
Often (%)	32 (16.9)	0	
Always (%)	135 (71.4)	0	
Wear pants/skirt covering to at least the knees	19 (10.3)	1 (50.0)	
Never (%)	21 (11.4)	0	
Rarely (%)	17 (9.2)	0	
Sometimes (%)	55 (29.7)	0	
Often (%)	73 (39.5)	1 (50.0)	
Always (%)			
Use shade			<.001
Never (%)	2 (2.0)	6 (6.1)	
Rarely (%)	7 (7.1)	23 (27.4)	
Sometimes (%)	36 (36.4)	35 (20.2)	
Often (%)	45 (45.5)	17 (20.2)	
Always (%)	9 (9.1)	3 (3.6)	

[a] Mann Whitney Test

Agreement between self-report diary and observation data

Agreement between the self-report diary of behaviours performed during specific intervals outdoors at school and the direct observation method for each time interval ranged from 80.9% for lower body clothing during PE to 98.9.7% for upper body clothing during recess (Table 8. 4). Kappa indices were moderate to substantial for hat use (k= 0.61 to k=0.75), wearing a shirt with sleeves (k=0.60 to k=0.72) and using shade (k=0.60- k=0.73). The lowest agreement between observation and diary measures was for lower body clothing during PE (k= 0.36).

Table 8.4 Agreement between self-report diary responses by whether the item was observed during each interval outside

	Observation and diary agreement n (%)	Observation and diary discrepancy		kappa	CI
		Positive observation & negative diary entry n (%)	Negative observation & positive diary entry n (%)		
Hat use [a]					
Recess	105 (84.0)	4 (3.2)	16 (26.2)	.61	.46-.76
Lunch	158 (87.3)	2 (1.1)	21 (23.0)	.75	.65-.84
PE	94 (87.0)	3 (2.8)	11 (24.1)	.71	.57-.85
Upper body clothing [b]					
Recess	125 (98.4)	2 (1.6)	0	.71	.58-.85
Lunch	183 (98.9)	2 (1.1)	0	.72	.63-.83
PE	106(95.5)	5 (4.5)	0	.60	.42-.78
Lower body clothing [c]					
Recess	121 (95.3)	5 (3.9)	1 (<1)	.71	.61-.81
Lunch	178 (94.2)	9 (4.8)	1 (<1)	.68	.59-.76
PE	89 (80.9)	19 (17.3)	2 (1.8)	.36	.20-.53
Shade use [d]					
Recess	111 (88.1)	8 (6.3)	7 (5.6)	.71	.58-.85
Lunch	154(86.0)	16 (8.9)	9 (5.0)	.73	.63-.83
PE	63 (82.9)	10 (13.2)	3 (3.9)	.60	.42-.78

[a] "cap/visor, broad brimmed/bucket" v "no hat"

[b] "short sleeves, 3/4length, long sleeves" v "sleeveless"

[c] "knee length, ¾ length and long pants/skirt" v "short shorts/skirt"

[d] "mainly shade" v "mostly in the sun- shade available, mostly in the sun-shade not available" (observation data for moving between sun and shade excluded)

8.6 Discussion

To our knowledge this is the first study to validate self-reported sun-related behaviours among adolescents in a secondary school setting by comparing two measures of self-report with direct observation of behaviours at school. Overall, we found slight to fair agreement between direct observation and self-report survey responses and moderate to substantial agreement between observations and the diary measure of behaviours. These results suggest the diary measure more accurately reflects actual behaviours than the survey. This finding is consistent with previous studies where diary measures have shown a higher correlation with observations than surveys (O'Riordan et al., 2008a; Glanz et al., 1996), and is expected given participants' tendency to generalise behaviours when recalling 'usual' behaviours at school in the survey compared with the specific point in time captured in the diary record, i.e. since we could not observe 'usual' behaviours at school, behaviours were observed 'today' consistent with the specific period captured in the diary. There was a trend that participants observed wearing sun protective items were more likely to report a higher frequently wearing these items 'usually' at school than participants observed not wearing them, however, future studies would benefit from collecting observation data over longer periods to validate self-report of 'usual' behaviours at school.

A limitation of this study was the potential influence of social desirability bias (Nederhof, 1985). Socially desirable responding is most likely to occur in response to socially sensitive questions (King and Bruner, 2000). It was possible that participants reported their behaviours more accurately in the diary because they were aware they were being observed. However, since the behaviours under study were not deemed socially sensitive compared to, for example, drug use or sexual behaviour, the effect of

social desirability was likely to be minimal. A further limitation was that since data collection was completed during the spring time rather than during summer, respondents' behaviours observed in the school context may not have accurately reflected their behaviours during the summer when temperatures are higher. Temperature is a significant predictor of sun-protective behaviours among adolescents (Dobbinson et al., 2008a); the reported compliance with recommended sun protection behaviours noted in this study should therefore be interpreted cautiously. The percentage agreement seen in this study for survey data and observation data for both upper and lower body protective clothing limited our ability to calculate kappa indices; the high levels of agreement, however, could have been expected given both participating schools had a uniform policy limiting the variation in clothing options for participants. The majority of schools in the Australian context have uniform policies, limiting the choice of clothing options students have. The generalisability of these results to schools without a uniform policy is limited.

Overall the completion rate of the two self-report measures was high, 95.2% for the survey and 77.9% for the diary; 64.9% of the total sample had matching observation data for at least one outdoor interval. However, a further limitation is that while individuals excluded due to incomplete data did not differ in age or year group to the final sample, male students were significantly less likely to have data from the three measures. It is therefore possible that the levels of agreement between self-report measures and observations found in this study may not reflect the true agreement of male adolescent self-report. Strengths of the study include the large sample size and the schools' support for the observation protocol.

Given our inability to confirm the validity of self-reported sunscreen use, further research is needed using other research methods to confirm the validity of self-reported sunscreen use in the school context. While available evidence suggests adolescent use of sunscreen in the school context is low (Williams et al., 2011c), it remains an important component of recommended behaviours to reduce UV exposure. Previous studies among pool-and beach-goers have reported sunscreen swabbing as an effective procedure for detecting sunscreen use (O'Riordan et al., 2006; O'Riordan et al., 2008a). Such methods should be considered to assess the validity of adolescent self-reported sunscreen use in future studies.

Overall, this study indicates that adolescent self-report of sun-related behaviours in the school context is valid using a diary measure. In this particular instance, the survey did not show validity of self-report, suggesting that validation of measures of 'usual' behaviours at school necessitates a data collection period longer than one day. This study contributes to the development of self-report measures of adolescent sun-related behaviour for use in future studies. However, given the acknowledged limitations of this study, further investigation of the validity of measures of adolescent sun-related behaviours in the school context is warranted.

8.7 Acknowledgements

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CHAPTER 9: EVALUATION OF A SKIN CANCER PREVENTION PROGRAM IN SECONDARY SCHOOLS

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (Submitted) Evaluation of a skin cancer prevention program in secondary schools. *Health Education Journal.*

9.1 Executive Summary

Chapter 9 describes results of a school based intervention targeting adolescent sun-related behaviours in a pre-post matched, convenience sample of secondary school students across 3 communities in New South Wales. The utility of a newly developed composite measure in detecting behaviour change is also determined. This chapter is based on the combined findings of each of the previous chapters in this thesis. A comprehensive self-report survey, based on the range of behaviours adolescents' exhibit in the sun, is used to calculate a composite measure of adolescent sun-related behaviour. This measure is used to determine the overall effectiveness of a skin cancer prevention program in changing adolescent sun-related behaviours. This article was written by the candidate with co-authors Professor Sandra Jones, Associate Professor Peter Caputi, and Professor Don Iverson. It was submitted to Health Education, and is currently under review.

9.2 Abstract

The aim of this study was to change adolescent attitudes and intentions for sun-protection through a short-term, appearance-based intervention delivered in secondary schools. A secondary aim was to test the utility of a composite measure of adolescent sun-related behaviours to detect behaviour change. This study was conducted in secondary schools in two intervention regions and one comparison region of New South Wales, Australia, during the summer 2009-2010 using a matched pre and post test design with a comparison group. There was a significant main effect of the intervention over time when all of the assessed attitudes and intention variables were included in the analysis, including susceptibility to photo-aging, severity of photo-aging, intentions to sun protect using methods other than sunscreen and self-efficacy for sun protection using methods other than sunscreen. In addition, the composite sun-related behaviour measure detected small changes in behaviours over time. The results suggest the appearance based message was successful and appropriate to the target market and the message successfully translated to an intervention in secondary schools. Furthermore, the composite measure of adolescent sun-related behaviours showed promise in detecting behaviour change. Future larger scale research that builds on these findings is warranted.

Keywords: Skin cancer prevention; adolescents; secondary schools; intervention; evaluation.

9.3 Introduction

Skin cancer is the most prevalent form of cancer in the world, with the primary preventable risk factor being excess exposure to ultraviolet (UV) radiation from the sun (Hill, 2004b). The incidence of melanoma, a type of skin cancer with the highest associated mortality, is 13 times higher in Australia than the world average (AIHW, 2008). Childhood and adolescence have been shown to be especially vulnerable periods for increasing skin cancer risk (Elwood and Jopson, 1997; Weinstock et al., 1989; Whiteman et al., 2001; Westerdahl et al., 1994; Kricker et al., 1994; Kricker et al., 1995). Despite over 25 years of mass media and other programs aimed at encouraging sun protective behaviours in Australia, sun protection practices among adolescents continue to decline (Livingston et al., 2007; Beckmann and Conor, 2004). Therefore, adolescents represent an important target group for intervention programs to reduce skin cancer incidence. However, a systematic review of sun protection interventions concluded that there was insufficient evidence to determine the effectiveness of sun protection interventions in secondary schools, attributed in part to the small number of studies that examined behaviour change outcomes (Saraiya et al., 2004). This gap in evidence highlights the need for further research in secondary schools targeting adolescent sun protection. The objective of this study was to change adolescent attitudes and intentions for sun-protection through a short-term appearance-based intervention delivered in secondary schools. A secondary aim was to test the utility of a composite measure of adolescent sun-related behaviours in detecting behaviour change that includes both sun-protecting and sun-exposing behaviours.

Previous research provided best practice guidelines for the development of social marketing interventions to address adolescent sun protection (Johnson et al.,

2009); these guidelines informed the design of this study. A key recommendation within the guidelines was to focus the intervention message on appearance concerns. The guidelines authors (Johnson et al. 2009) proposed that appearance based issues, such as wrinkling and sunburn, were more salient to adolescents as the benefits of behaviour change could be realised in the short term. Strategies focused on appearance concerns have shown promise in previous sun protection interventions targeting young adults (Mahler et al., 2003; Mahler et al., 2005; Mahler et al., 2007; Jones and Leary, 1994) and adolescents (Olson et al., 2008).

Self-efficacy is an important construct in behaviour change theories including, for example, Social Cognitive Theory (SCT: Bandura, 1989), the Theory of Planned Behaviour (TPB: (Ajzen, 1991), the Health Belief Model (HBM: Rosenstock, 1974), and Protection Motivation Theory (PMT: Rogers, 1983). Among young adults, self-efficacy has been shown to be a predictor of both intention to sun protect and actual sun protection behaviour (Myers and Horswill, 2006). Another Johnson et al. (2009, pg e 8) guideline recommends: "Sun protection programmes for this target group need to promote their perceived self-efficacy for sun protection by showing how sun protection can fit into current lifestyle and fashion choices" pg e 8.

Since health behaviours are complex, social marketers may need to "draw on a number of theories to help understand a specific problem in a particular setting or context" (Glanz et al., 2002, p.27). While the intervention focused specifically on appearance concerns and self-efficacy, additional constructs from two health behaviour theories, the Health Belief Model (Rosenstock, 1974) and the Theory of Reasoned Action (Fishbein and Ajzen, 1975; Ajzen and Fishbein, 1980) were included to better understand the effectiveness of the intervention. We hypothesised that a short-term

appearance-based intervention in secondary schools would change key cognitive variables including: susceptibility to photo-aging, perceived severity of photo-aging, self-efficacy for sun protection and intentions to sun protect.

9.4 Methods

9.4.1 Study design overview

Two geographically distinct intervention regions in New South Wales, Australia were selected on the basis that both (i) had a higher than average skin cancer incidence (Bois, 2010), (ii) were located on the coast, with similar socioeconomic profiles, and (iii) had similar proportions of adolescents (Australian Bureau of Statistics, 2008). A third region was selected as the comparison group as it was a comparable distance from the coast, had higher than average skin cancer incidence and a similar proportion of adolescents to the intervention regions.

Secondary schools were identified within each of the three regions. Schools within each region were eligible to participate if they were located within 15 kilometres of a beach, and were willing to provide the intervention to one Year 8 and one Year 9 class. Ethics approval was sought from the representing education office for each school as well as the University's Human Research Ethics Committee. Following ethics approval, school principals were approached to seek participation. All government, non-government and independent secondary schools meeting the eligibility criteria were invited to participate in the study with a goal to recruit six schools in each of the three regions. Each school was offered a gift pack as incentive for its participation which included additional sun protection resources to be provided at the end of the intervention; no additional individual student incentives were offered. Students from

schools in the comparison region were provided with the educational resources used in the intervention schools at conclusion of the research.

The school-based campaign was evaluated using a matched pre and post test design with a comparison group. Baseline surveys of self-reported sun-related behaviours and cognitions were completed by adolescents in Year 8 and 9 at the beginning of summer during Term 4, December 2009 (Time 1). Intervention activities were conducted within each school in the intervention regions at the beginning of Term 1, February 2010. Follow-up self-report surveys were completed by students across the three regions at the end of Term 1 in March 2010 (Time 2), four weeks after the intervention. Each student was allocated a unique number to enable the matching of survey records from Time 1 to Time 2.

9.4.2 Intervention

The aims of the school-based intervention were to: (i) communicate the key campaign messages in a fun and interactive format by highlighting the immediate impact of sun exposure on appearance; (ii) make sun protection feel easier by increasing self-efficacy for sun protection; and (iii) promote awareness of the need for sun protection at the 'point of decision' when high risk exposure can occur.

The core messages of the campaign were developed with a commercial advertising agency and extensively pre-tested with adolescents (Jones et al., 2010). During this testing phase a series of focus groups were held and different campaign messages presented to adolescents to identify the most appropriate messages for the target audience. The selected pre-tested messages were then used to develop a suite of resources (e.g. posters, stickers, book marks, wristbands). The focus of the intervention

– reflected in the tagline "Don't let the sun get under your skin" – was on the invisible skin damage caused by sun exposure. The newly developed resources were used for the school-based intervention and a concurrent community-based intervention. Results of the community-based intervention are presented elsewhere (Jones et al., 2011). This paper reports on the school-based intervention.

The school-based intervention consisted of three core components: individual student ultraviolet (UV) camera photos, a sunscreen application education session (using a product called Glitterbug), and UV detection wristbands used during the school swimming carnival. These activities were supported with poster placement, stickers and bookmarks to reinforce the message. Each intervention component was completed during school time and designed to fit within the Personal Development, Health and Physical Education (PDHPE) class curriculum. The PDHPE curriculum aims to involve students in learning and practising ways of maintaining active, healthy lifestyles and improving their overall health (NSW Public Schools, 2011). A qualified secondary school teacher was recruited to liaise with schools to schedule the intervention activities and to deliver the intervention which required approximately three hours of face-to-face time with students.

9.4.3 Structure of the intervention

The intervention was completed over three sessions. In the first session, a portable UV camera was taken into PDHPE class and photographs taken of students' faces. The photograph, which was personal to each student and not shared, revealed acquired sun damage beneath the skin's surface that was invisible to the naked eye. The second session, called Glitterbug, was a group exercise in improving self-efficacy for

sun protection by focusing on the correct application of sunscreen. The Glitterbug solution has the consistency of moisturiser and fluoresces under UV illumination. During the session students were invited to demonstrate how they usually apply sunscreen on their arms and face. A UV lamp was then used to reveal the (lack of) effectiveness of the application, and formed part of a broader discussion regarding correct sunscreen application and the importance of using multiple sun protection strategies rather than relying solely on sunscreen for sun protection.

The third intervention session involved distributing UV detection wristbands during the school swimming carnival. The UV detection wristbands work by changing colour after a period of time in the sun and thus act as a reminder to reapply sunscreen or seek shade. Students were instructed to activate the wristband by covering the band with sunscreen at the commencement of the swimming carnival, they were then instructed to monitor the colour of the wristband throughout the day and, when it changed colour in response to exposure to UV radiation, to reapply sunscreen and/or get out of the sun.

The three components of the intervention were reinforced with campaign materials including posters, stickers and book marks, which emphasised the core campaign message "Don't let the sun get under your skin" and recommended sun protection using five methods: slip on a shirt, slop on sunscreen, slap on a hat, seek shade and slide on sunglasses. The additional campaign materials provided a passive reinforcement of the sun damage message within each school. Intervention exposure was monitored so that students who did not participate in an intervention activity, due to absence from school on that day for example, could be followed up with the

intervention delivered on another day where possible (this was not possible for the UV detection wristband activity).

9.4.4 Participants

There were 23 secondary schools eligible to participate in the study across the three regions; a total of 16 schools agreed to participate. At time 1, there were six schools from each of the intervention regions and four from the comparison region. At time 2 there were 13 participating schools, as three schools (one from each region) were unable to complete the follow-up survey. Within each participating school, one Year 8 class and one Year 9 class were selected by the school for the study. These classes were selected on the basis of the fit of the existing class timetable with the requirements of the intervention schedule. All participating students were made aware prior to providing their consent that the study related to sun protection. Written parental consent was obtained for each intervention component. Participation was voluntary, with participants advised prior to the commencement of the study that they could withdraw at any time.

9.4.5 Measures

The primary outcome measures were cognitive variables including: susceptibility to photo-aging (7 items), severity of photo-aging (1 item), outcome expectations of photo-aging (1 item), intentions to use sun protection (18 items), norms for sun protection (4 items), self-efficacy for sun protection (10 items), tan attractiveness (6 items) and barriers to sun protection (11 items). These items were adapted from previous studies (Mahler et al., 2005; Mahler et al., 2007; Jackson and Aiken, 2006; Reynolds et al., 2006).

A composite sun-related behaviour score was also derived to determine the overall effectiveness of the program in changing behaviours. The composite measure included two behavioural dimensions, sun-protecting behaviours and sun-exposing behaviours (which included both intentional and incidental sun exposure). Items that comprise each of the sun-related behaviours were collected via a self-report survey across four contexts including: at school, on the weekends, during the holidays and during summer in general. The sun-protecting behaviours included: wearing a hat, wearing sunscreen, wearing a shirt with sleeves, wearing pants/skirt to at least the knees, wearing sunglasses, using shade and avoiding peak UV hours; response options ranged from 'never' (1) to 'always' (5). The intentional sun-exposing behaviours included: spending time in the sun to tan, wearing a reduced SPF sunscreen, delaying applying sun protection, wearing brief clothing and wearing no sun protection at all in order to tan. The incidental sun-exposing behaviour items included time spent outside per day between 10am and 4pm at school, on weekends, and during the holidays; response options ranging from '30minutes or less' (7) up to '6 hours' (1) across each context. Response options for sun-exposing behaviours were reverse scored such that higher scores reflect less frequent sun-exposing behaviour.

The mean responses to each of the sun protection behaviours and the sun-exposing behaviours across the contexts were derived and the mean scores were combined to calculate an overall mean sun-related behaviour composite such that higher scores reflected better sun protection and reduced sun exposure. Sun-related behaviours on the most recent weekend were assessed separately using questions adapted from the National Sun Survey (Dobbinson et al, 2007).

9.4.6 Data Analysis

All data were analysed with SPSS version 17.0. Analysis of variance was used to detect differences in demographic variables between intervention and comparison regions at baseline. Multivariate mixed design analysis of variance was completed to detect the interaction effect of intervention (between subjects) and time (within subjects) for key variables. Simple main effects were used to further explore significant interaction effects, with Bonferroni adjustment for multiple comparisons.

9.5 Results

9.5.1 Profile of the sample

Initially, 597 students completed the survey at Time 1, and 413 at Time 2. Of these, 352 had matched records across testing occasions and were retained for analysis. The demographics of the final sample are outlined in Table 9.1. At baseline, there were no significant differences between the intervention and comparison regions for age, sex or skin tone.

Table 9.1 Demographic profile of sample (n=352) and comparisons between intervention and control groups

Variable	Combined matched Time1-Time2 sample % (n)	Intervention Regions % (n)	Comparison Region % (n)	p value
Sex				
Male	46 (162)	44.4 (112)	50 (50)	.346
Female	54 (190)	55.6 (140)	50 (50)	
Age (at pre-test)				
13	10.6 (37)	10.4 (26)	11.1 (11)	.605
14	56.3 (197)	58.2 (146)	51.5 (51)	
15	32.9 (115)	31.1 (78)	37.4 (37)	
16	.3 (1)	.4 (1)	0	
Skin Tone				
Very Fair-Fair	39.0 (137)	36.7 (92)	45.0 (45)	.169
Medium	29.9 (105)	32.7 (82)	23.0 (23)	
Olive-Very dark	31.1 (109)	30.7 (77)	32.0 (32)	

9.5.2 Impact on cognitive variables

We hypothesised that adolescents receiving the 'Don't let the sun get under your skin' intervention would report, at Time 2, improved attitudes and intentions for sun-protection than adolescents not receiving the intervention. Scales were created for the cognitive items, Cronbach's alpha for these scales ranged from a low of .58 for susceptibility to photo-aging to a high of 0.93 for self-efficacy for using sunscreen. The scales were: susceptibility to photo-aging, perceived severity of photo-aging, norms for sun protection and tan attractiveness, intention to use sunscreen, intention to use other methods of sun protection, self-efficacy for sunscreen use, self-efficacy for using other methods of sun protection, barriers to using sunscreen, and barriers to using other methods of sun protection. A multivariate mixed design analysis of variance was performed to determine if there were differences in cognitive variables across time between regions. Table 9.2 presents the mean scores and simple main effects for the cognitive variables.

Table 9.2 Mean scores for cognitive variable scales at Time 1 & Time 2 for both regions.

Construct	Cronbach's alpha	Time 1 Mean (SE)	Time 2 Mean (SE)	p value
Susceptibility to photo-aging	.58			
Intervention Region		3.09 (.04)	3.23 (.04)	**.001**
Comparison Region		3.03 (.07)	3.09 (.07)	.318
Perceived severity of photo-aging	-			
Intervention Region		3.82 (.09)	4.01 (.09)	**.027**
Comparison Region		3.55 (.14)	3.54 (.14)	1.000
Intentions to use sunscreen	.92			
Intervention Region		3.40 (0.6)	3.27 (.07)	**.018**
Comparison Region		3.23 (.10)	3.03 (.12)	**.038**
Intentions to use other methods of sun protection	.87			
Intervention Region		2.34 (.06)	2.45 (.06)	**.029**
Comparison Region		2.56 (.10)	2.16 (.10)	.288
Norms for sun protection	.68			
Intervention Region		2.72 (.06)	2.87 (.06)	**.017**
Comparison Region		2.69 (.10)	2.88 (.06)	.058
Self-efficacy for sunscreen	.93			
Intervention Region		6.88 (.17)	6.65 (.18)	.134
Comparison Region		6.58 (.28)	5.96 (.31)	**.014**
Self-efficacy for other sun protection behaviours	.81			
Intervention Region		4.27 (.16)	4.65 (.16)	**.032**
Comparison Region		4.66 (.27)	4.54 (.26)	.689
Tan attractiveness	.88			
Intervention Region		3.07 (.07)	3.23 (.04)	.064
Comparison Region		3.07 (.12)	3.07 (.01)	1.000
Barriers to sunscreen	.84			
Intervention Region		2.61 (.06)	2.91 (.07)	**.000**
Comparison Region		2.85 (.10)	2.80 (.11)	.641
Barriers to other forms of sun protection	.70			
Intervention Region		3.65 (.06)	3.61 (.06)	.402
Comparison Region		3.46 (.09)	3.34 (.09)	.181
Outcome avoidance	-			
Intervention Region		3.84 (.13)	3.80 (.07)	.639
Comparison Region		3.50 (.13)	3.43 (.12)	.607

Significant multivariate effects were detected for Intervention (Wilks' Lambda=.899, F(11,196)=2.006, p=.030, Partial Eta^2= .101), Time (Wilks' Lambda=.800, F(11,196)=4.458, p=.000, Partial Eta^2= .200), and the interaction between Intervention and Time (Wilks' Lambda=.246, F(18,563)=95.78, p=.000, Partial Eta^2= .102) At the univariate level for the interaction between Time and Intervention, significant effects were detected for barriers to using sunscreen (F(1,206)=9.595, p=.002) and intentions to use other methods of sun protection (F(1,206)=4.211, p=.041) . The mean difference in susceptibility to photo-aging as well as perceived severity of photo-aging significantly increased in the intervention region from Time 1 to Time 2. While there was a significant decrease from Time 1 to Time 2 in intentions to use sunscreen in both intervention and comparison regions, there was an increase in intentions to use other methods of sun protection in the intervention region and a significant decrease in self-efficacy for sunscreen use in the comparison region. The perceived barriers to sunscreen use increased in the intervention region from Time 1 to Time 2 as well as a significant increase in norms for sun protection.

9.5.3 Impact on sun-related behaviours

Three separate multivariate mixed design analysis of variance were performed to determine if there were differences across time between regions for the composite sun related-behaviour score, sun-protection behaviours and sun-exposing behaviours. Table 9.3 presents the mean scores and simple main effects for behaviours. For the composite sun-related behaviour score, significant effects were detected for Time (Wilks' Lambda=.973, F(1,289)=8.035, p=.005, Partial Eta^2= .027), with no significant effects for the interaction between Intervention and Time. For sun-protection behaviours, significant effects were also detected for Time (Wilks' Lambda=.914, F(7,314)=4.217,

p=.000, Partial Eta^2= .086), with no significant effects for the Intervention or the interaction between Intervention and Time. At the univariate level for Time, significant effects were detected for sunscreen use (F(1,320)=22.144, p=.000), and avoidance of peak UV hours (F(1,320)=4.318, p=.038) . For sun-exposing behaviours, significant effects were detected for Time (Wilks' Lambda=.530, F(7,304)=38.519, p=.000, Partial Eta^2= .470), with no significant effects for the Intervention or the interaction between Intervention and Time. At the univariate level for Time, significant effects were detected for spending time in the sun in order to tan (F(1,316)=230.937, p=.000), and incidental recreational exposure (F(1,316)=16.961, p=.000). Simple main effects revealed a trend for sun protection behaviours to worsen from Time 1 to Time 2 across both intervention and comparison regions for all sun protection behaviours excluding spending most of the time inside during peak UV hours which increased from Time 1 to Time 2 across regions. While both intervention and comparison groups reduced sunscreen use over the period of the intervention, the reduction in sunscreen use in the control community was greater than the intervention group. For sun-exposing behaviours, a significant mean difference from Time 1 to Time 2 was detected in both intervention and comparison regions for time spent tanning and time spent outdoors at recreation; a significant difference for wearing brief clothing from Time 1 to Time 2 was detected only in the intervention regions. There were no significant differences in sun-related behaviours between regions including the sun-related behaviours performed on the most recent weekend.

Table 9.3 Mean score for sun-related behaviours across contexts at Time 1 and Time 2 for both the intervention and comparison regions

	Time 1 Mean (SE)	Time 2 Mean (SE)	p value
Composite sun-related behaviour score			
Intervention Region	3.34 (.04)	3.40 (.04)	**.01**
Comparison Region	3.40 (.06)	3.47 (.07)	.17
Sun-protecting Behaviours			
Wear sunscreen			
Intervention Region	2.74 (.06)	2.62 (.06)	**.01**
Comparison Region	2.70 (.09)	2.39 (.10)	**.00**
Wear a hat			
Intervention Region	2.43 (.07)	2.37 (.07)	.30
Comparison Region	2.71 (.11)	2.58 (.11)	.14
Stay in the shade			
Intervention Region	3.15 (.05)	3.11 (.05)	.92
Comparison Region	3.12 (.07)	3.12 (.08)	.88
Wear a shirt with sleeves that covers your shoulders			
Intervention Region	3.76 (.06)	3.68 (.06)	.19
Comparison Region	3.89 (.10)	3.86 (.10)	.75
Wear pants/skirt to at least the knees			
Intervention Region	2.81 (.08)	2.74 (.08)	.40
Comparison Region	3.04 (.13)	3.03 (.13)	.93
Wear sunglasses			
Intervention Region	2.39 (.07)	2.32 (.07)	.30
Comparison Region	2.34 (.11)	2.31 (.11)	.18
Spend most of the time inside during peak UV hours in the middle of the day			
Intervention Region	2.91 (.05)	3.06 (.06)	**.04**
Comparison Region	2.86 (.08)	2.99 (.09)	.25
Sun-exposing behaviours*			
Spend time in the sun in order to tan			
Intervention Region	2.91 (.05)	3.90 (.07)	**.00**
Comparison Region	2.89 (.08)	4.05 (.11)	**.00**

Wear a reduced SPF sunscreen oil or lotion			
Intervention Region	4.75 (.04)	4.69 (.05)	.23
Comparison Region	4.79 (.06)	4.67 (.08)	.13
Delay applying sun protection			
Intervention Region	4.03 (.07)	4.02 (.08)	.89
Comparison Region	4.28 (.07)	4.02 (.08)	.63
Wear brief clothing			
Intervention Region	3.69 (.07)	3.84 (.07)	**.03**
Comparison Region	4.07 (.12)	4.09 (.12)	.86
Wear not sun protection at all			
Intervention Region	4.18 (.07)	4.16 (.07)	.75
Comparison Region	4.34 (.12)	4.22 (.12)	.28
Recreation exposure hours			
Intervention Region	5.00 (.10)	4.76 (.11)	**.01**
Comparison Region	4.99 (.16)	4.45 (.17)	**.00**
School exposure hours			
Intervention Region	3.26 (.08)	3.23 (.09)	.72
Comparison Region	3.26 (.13)	3.20 (.14)	.70

*Higher mean score represents less frequent sun-exposing behaviour

9.6 Discussion

This study contributes to the knowledge on the effectiveness of skin cancer prevention programs that are targeted at adolescents in secondary schools. The intervention was based on best practice guidelines and found to be effective in changing attitudes and intentions directly related to the focus of the intervention. Consistent with previous research using UV photography among young adults (Mahler et al., 2005) the intervention increased perceived susceptibility to photo-aging. Interestingly, intentions to use sunscreen decreased in both intervention and comparison regions. This finding is in contrast to previous studies where UV photography increased intentions to use sunscreen (Mahler et al., 2003; Olson et al., 2008). Despite the reduction in intentions to use sunscreen in the intervention regions, self-efficacy for using sun protection methods

other than sunscreen increased, as did intentions to use sun protection methods other than sunscreen. Self-efficacy has been shown in previous studies to mediate program effects on intention to sun-protect e.g. Mahler et al. (1997), Mahler et al. (2003), Jackson and Aiken, (2006). In this study it is possible that the Glitterbug activity increased the perception that sunscreen is difficult to adequately apply, resulting in an increase in participants' intentions to use alternate methods of sun protection. This is supported by the finding of a significant increase in perceived barriers to sunscreen use in the intervention regions.

The composite behavioural measure proved to be a useful tool to assess adolescent sun-related behaviours since it was able to detect small changes in behaviours over time. Studies targeting adolescents rarely measure sun-related behaviours, and adolescent targeted studies that do assess behaviours rarely consider both sun-protecting and sun-exposing behaviours in a composite measure.

Among young adults, the use of appearance-based interventions have successfully reduced tanning bed usage (Gibbons et al., 2005; Hillhouse et al., 2008) and sunbathing (Mahler et al., 2003), and increased sun protection behaviour (Jackson and Aiken, 2006; Pagoto et al., 2003); however, among adolescents studies to date have only demonstrated an increase in intentions to use sunscreen (Olson et al., 2008). The composite measure used in this study captured the range of behaviours adolescents perform in the sun, combining both sun-protecting and sun-exposing behaviours across a range of contexts, and was successful in detecting small changes in these behaviours across time.

This study contributes to the evidence of the effectiveness of UV photos in influencing adolescent attitudes and behaviours. To date the majority of studies using UV photographs have focused on young adults rather than adolescents (Mahler et al., 2005; Gibbons et al., 2005; Mahler et al., 2003; Mahler et al., 2007; Pagoto et al., 2003). While the use of appearance-based strategies in interventions targeting young adults has shown some success, future research should continue to explore the impact of appearance-based strategies on sun-related behaviours among the adolescent population.

Another novel contribution of this study is using in the Glitterbug activity to show participants the adequacy of sunscreen application. Sunscreens must be applied liberally and uniformly (Sambandan and Ratner, 2011); future studies should explore the effectiveness of novel strategies such as the Glitterbug activity to improve the efficacy of sunscreen application.

It is important to note the limitations of this study. Since the findings are based on self-reported data, it is possible that the differences in cognitions and behaviours were the result of social response bias. However, since data across all regions was based on self-report and all participants, including those in the comparison community, were aware the study related to sun protection, this effect should be spread across the regions. Loss to follow up was an issue as this study took place over two school years separated by a six week summer vacation. Three schools were unable to complete Time 2 data collection due to difficulties in scheduling activities over the two school years. Future studies should consider strategies that minimise the difficulties for schools participating in studies over multiple years; for example, by offering the intervention to the whole student population would reduce the impact of students changing class groups across years.

This study has demonstrated that a school based intervention was effective in changing attitudes and intentions to sun protect among adolescents. The results suggest the appearance-based message was appropriate to the target market, and the message was able to be successfully translated to a school-based intervention in secondary schools. Furthermore, the composite measure of adolescent sun-related behaviours showed promise in detecting behaviour change amongst the target group. Future research that builds on these findings is needed.

CHAPTER 10: SUMMARY AND CONCLUSION

10.1 Executive Summary

Chapter 10 provides a summary of the major findings from the two literature reviews and six empirical papers, and discusses the implications these findings have for understanding adolescent sun-related behaviours and their measurement. Furthermore, the implications for the development and evaluation of skin cancer prevention programs targeting adolescents are discussed.

10.2 Introduction

This thesis contributes to our understanding of adolescent sun-related behaviours from both a conceptual and a measurement perspective. The challenges of measurement are highlighted in Chapter 2, which identified there is substantial variation in the behaviours included in composite measures of adolescent sun-related behaviour, also identifying there is limited evidence of the validity and reliability of measures. These issues are critical in the evaluation of skin cancer prevention programs targeting adolescents and suggest a need for a comprehensive construct definition of adolescent sun-related behaviours. A significant contribution is made from a conceptual perspective in Chapter 3, which presented an extended conceptual model of adolescent sun-related behaviours. The conceptual model included specific sun-related behaviours, divided into three main categories (sun-protecting behaviours, intentional sun-exposing behaviours and incidental sun-exposing behaviours). The model fills a gap in the literature in terms of conceptual clarity of the specific individual sun-related behaviours

that adolescents exhibit in the sun and provides a framework for the operationalisation of measures of adolescent sun-related behaviours.

Further challenges of measurement are highlighted in Chapter 4, which identified different interpretations between adolescents and researchers of key terms related to sun-exposure and sun protection. These findings are critical to the development of valid measures of adolescent sun-related behaviour. Measures of adolescent sun-related behaviours should address the complete range of behaviours adolescents perform in the sun, both sun-protecting and sun-exposing, and provide specific definitions of key terms (such as sunburn); furthermore measures should include specific contexts for prompting the recall of sun-related behaviours.

Chapter 5 contributes to our understanding of sun-related behaviours by exploring the inter-relationship between sun-protecting, sun-exposing behaviours and UV exposure. This chapter identified that an expanded model of sun-related behaviours, one which included both sun-protecting and sun-exposing behaviours, provided the greatest the explanatory power of indicators of UV exposure among adolescents. Importantly, these results identify the value of assessing both sun-protecting behaviours and sun-exposing behaviours. Since fake tanning products are a relatively recent phenomenon and their relationship with UV exposure has not been well understood, the use of fake tanning products and sun protection behaviours among adolescents was explored in Chapter 6. This study identified fake tan use was associated with reduced sun protection. These results are important as they expand our understanding of the relationship between behaviours and UV exposure, as well as highlight a need for the development of health education programs that target a new group of adolescents with distinct tanning behaviours.

Chapter 7 contributes to our understanding of adolescent sun-related behaviours by exploring whether, and to what extent, self-reported habitual sun protection behaviours among adolescents vary between specific contexts during summer. This study provided in-depth information about adolescent sun protection behaviours, identifying that differences exist between habitual behaviours in key contexts and suggested that some sun protection behaviours are not transferred between key contexts relevant to adolescents. These findings identify an opportunity for future interventions to focus on enabling the transfer of positive behaviours to alternate contexts.

The validity of adolescent self-report, a major methodological issue identified in previous research, is explored in Chapter 8. In this study, direct observation of sun-protection behaviours was used to corroborate self-report survey data and a self-report behaviour diary. The results indicated that adolescent self-report of behaviours in the school context is valid using a diary measure. In this particular study, however, the survey data did not show validity of self-report. Future research should examine the validity of adolescent report of 'usual' behaviours at school using a longer period of observation than one day.

A stated aim of this thesis was to develop and pilot test the utility of a composite measure of adolescent sun-related behaviours in detecting behaviour change. In Chapter 9, a composite measure of adolescent sun-related behaviours was used to evaluate a secondary school based skin cancer prevention intervention. The intervention focused on appearance concerns. The results indicated that the intervention successfully increased appearance concerns among the intervention group and also increased intentions to use other sun-protection behaviours rather than sunscreen alone. Furthermore, a significant effect was detected over Time, suggesting the composite

measure of sun-related behaviours was successful in detecting small changes in behaviour.

10.3 Implications of the limitations of this thesis

This research has a number of limitations that should be acknowledged, and addressed in future studies. In Chapter 2, the literature review was limited to intervention studies reporting a composite measure; future research should explore the use of composite measures in population based cross-sectional studies. Advancement in the use of composite measures in population based studies would facilitate the comparison of the overall success of interventions efforts between countries. The development of the conceptual model (Chapter 3) did not include statistical modelling of each of the relationships identified in the model. Further modelling should be undertaken in future studies to confirm the strength and direction of each of the relationships within the conceptual model. The model can then provide a framework to guide the design and evaluation of skin cancer prevention programs targeting adolescents. The generalisability of the results is an overall limitation of this thesis. The data presented in Chapters 4, 5, 6, 7, and 8 are based on convenience samples of adolescents. Future studies are needed using larger representative samples. A further limitation of this research is the influence of mixed data collection methods. The data presented in Chapters 5, 6 and 7 used both on-line and paper methods. There is a lack of data available of the impact of different data collection methods used in sun-protection studies. The potential that respondents were influenced by the survey approach method cannot be excluded. Therefore, future research should explore the influence of the different approaches for data collection, particularly the impact of data collected on-line. While the limitations of self-report data are generally known, the results presented

in Chapter 8 did not confirm the validity of adolescent self- report of sun protection behaviours using a diary measure. The data collection period for this study was short, future studies should continue to explore the validity of adolescent self-report in the school context using a longer period of data collection. The evaluation study presented in Chapter 9 used a matched pre-post test design with comparison group. This study was limited by a short intervention period, being over one summer. Longer term, intensive interventions in the school context should be explored in future studies to determine the 'dose' requirement for school-based programs to change behaviours and sustain that change.

10.4 Implications for future research

This research has raised a number of important issues which are relevant for future research activities. Two main implications for future research are that (a) adolescent sun-related behaviours should be conceptualised as a range of related but distinct behaviours, and (b) that composite measures of adolescent sun-related behaviours should take into account the range of (both positive and negative) behaviours adolescents perform in the sun. Future research should focus on achieving a balance between strategies that are oriented toward reducing sun-exposing behaviours as well as strengthening sun-protecting behaviours within specific contexts. Furthermore, continued research efforts should be directed at the development of measures that enable assessment of the combined effect of sun-related behaviours on UV exposure.

The common operationalisation of key terms central to skin cancer prevention is critical to the advancement of the field. While the conceptual model presented in this

thesis (Chapter 3) represents a step towards conceptual clarity, further investigation of key relationships identified in the model is warranted. Specifically, further research is required that continues to explore the inter-relationships between sun-protecting and sun-exposing behaviours among adolescents. Additionally, while this thesis did not examine the relationship of knowledge, attitudes and beliefs to each behavioural component of the conceptual model, exploration of these influences is critical to the design of effective programs. Further research that confirms the key relationships identified in this study using the conceptual model is warranted; in particular these relationships should be explored using more representative adolescent samples.

In this thesis, the utility of a composite measure that takes into account both sun-protection behaviours and sun-exposing behaviours was confirmed. Future research focused on adolescent sun-related behaviours should consider using behavioural outcome measures that take into account both sun-protecting behaviours and sun-exposing behaviours and continue to build evidence of the psychometric properties of composite measures. While the investigation in Chapter 8 identified that self-report was valid using a diary measure, future research is needed to examine the validity of adolescent report of 'usual' behaviours at school using a longer period of observation than one day. If a valid composite measure were available it would have applications in the assessment of effectiveness of interventions, enable improved prediction of outcomes, assist in monitoring and surveillance of populations, and enable the comparison of effectiveness across programs. Should the effectiveness of programs be better determined, the most successful programs can be identified and expanded, thereby reversing the current negative trend of adolescent UV related behaviours.

10.5 Recommendations for practice

This thesis has important implications for the design of programs targeting adolescents. Sun-related behaviours are complex and the adolescent group present unique challenges for program planners. However, skin cancer prevention programs should continue to target the high risk group of adolescents. Public health efforts to reduce UV exposure need to address the range of behaviours adolescents perform in the sun. Prevention programs should consider messages that focus on equally important outcomes of sun-protection behaviours as well as sun-exposing behaviours. This is especially important for adolescents as early UV exposure is associated with increased risk later in life and because, as identified in this thesis, adolescents are concurrently performing both sun-exposing and sun-protecting behaviours. Furthermore, program designers should consider both the individual behaviours that adolescents perform when in the sun and the context they perform them in. Specifically, transferring positive sun-protection behaviours across contexts may be an important strategy in improving the overall protection of adolescents. While there is currently limited evidence on the effectiveness of programs targeting adolescent sun-related behaviours there is a continued need to target this group.

10.6 Conclusion

This thesis contributes to our understanding of adolescent sun-related behaviours and their measurement by addressing major conceptual and methodological limitations of previous research. The identification of a range of operational definitions of sun-related behaviours was used to inform the development of a conceptual model of adolescent sun-related behaviours. This model then provided the basis of three studies

testing key elements of the model. This thesis addressed a gap with regard to our understanding of the range of behaviours adolescents perform in the sun and provided data on the validity of adolescent self-report. These results are important as adolescents' exposure to UV radiation from the sun is the primary preventable risk factor for developing both melanoma and non melanoma skin cancers. Adolescents are an important group for skin cancer prevention programs to target since they demonstrate the highest level of risk behaviours in terms of low compliance with recommended sun protection behaviours, experience long periods of exposure to UV radiation and have a high incidence of sunburns. For prevention programs to reverse the current negative trend in behaviours being seen among adolescents, new and innovative program strategies are required. The obtained results have potential practical implications as they identify an increased range of behaviours that influence UV exposure which program planners can target. The results are important because it is possible that targeting a comprehensive range of sun-related behaviours could be critical in reducing adolescent UV exposure and combating the development of skin cancer. Understanding behaviours provides the foundation to skin cancer prevention programs, this thesis contributes to our knowledge of adolescent sun-related behaviours and their measurement, this information is critical for the identification, enhancement and expansion of effective interventions to prevent skin cancer.

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APPENDICIES

APPENDIX 1. ADOLESCENT SUN PROTECTION: AN EXAMINATION OF THE PREVALENCE OF UV EXPOSURE INDICATORS AMONG BRAND LOYALTY SEGMENTS

Published in conference proceedings.

Williams, M., Jones, S.C., Caputi, P. & Iverson, D. (2011), Adolescent Sun Protection: An examination of the prevalence of UV exposure indicators among brand loyalty segments, In Proceedings of the *2011 World Social Marketing Conference*, Dublin Ireland, 11-12 April 2011.

Abstract

Background: Brand loyalty segmentation has been previously used in sun protection research to identify distinct sub-groups within the general adolescent population. While audience segmentation facilitates the design of messages in social marketing programs, the success of skin cancer prevention initiatives is reduced ultraviolet (UV) exposure. The relationship between previously identified adolescent sun protection brand loyalty segments and indicators of UV exposure has not previously been explored.

Objective: We sought to examine the prevalence of UV exposure indicators among brand loyalty segments in the adolescent population.

Methods: In September 2009, 692 adolescents participated in a self-report survey about sun protection behaviours.

Results: The prevalence of indicators of UV exposure varies between brand loyalty segments. Tan Seekers and The Consciously Lazy are more likely to experience frequent sunburns, with Tan Seekers additionally more likely to have a current tan. Vigilant Defenders are more likely to report having no current tan.

Conclusions: Segmentation is one technique that allows marketers to identify the segment with the most negative behaviours and most in need of change. Segmentation of the adolescent audience along brand loyalty lines provides a useful basis for targeting interventions aimed at reducing UV exposure among adolescents.

Introduction

Social marketing has been successfully applied to changing numerous health behaviours (Gordon et al, 2006). While not used extensively in sun protection initiatives to date, it holds significant potential for improving adolescent sun protection behaviours. Adolescence is recognised as a vulnerable period for increasing skin cancer risk. National surveys of adolescents in Australia have shown consistently poor sun protection behaviours (Livingston et al, 2007), despite high levels of awareness.

Social marketing adheres to important principles in the design of interventions, one of which is segmentation of the target audience (Maibach et al, 2002). Brand loyalty segmentation has been previously used in sun protection research to identify distinct sub-groups within the general adolescent population (Lynch & Jones 2007), with segments initially developed using Rossiter -Percy's Model (1997) of advertising theory which segments target audiences along brand loyalty lines. The approach divides potential purchasers of products (or brands) into:

1. New category users- persons who have not previously used a product from this category
2. Brand loyals- persons who regularly buy that brand
3. Favourable brand switchers- persons who occasionally buy that brand as well as others
4. Other brand switchers- persons who buy a variety of other brands but not that brand
5. Other brand loyals- persons who regularly buy one other brand.

The behavioural and attitudinal composition of each segment is outlined in Table 1, with the "brand" being sun protection. Lynch and Jones (2007) used focus groups to

identify and rename the segments based on the dominant behaviour of participants within each segment.

Table 1. *Adolescents' Brand Loyalty and Sun Protection*

Group	Brand Loyalty Segment	Attitude to Sun Protection	Sun Protection Behaviour
The Vigilant Defenders	Brand Loyal	Positive	Positive
The Forgetful Attempters	Favourable Brand Switchers	Positive	Generally Positive
The Risk Reducers	Favourable Brand Switchers AND Other Brand Switchers	Positive	Negative
The Consciously Lazy	Other-Brand Switchers	Negative	Generally Negative
The Tan Seekers	Other Brand Loyals	Negative	Negative
The Unaffected	New Category Users	Neutral	Neutral

While audience segmentation has been used to facilitate effective design and tailoring of messages, the relationship of brand loyalty segments with measures of UV exposure has not been explored. Reducing UV exposure and adopting adequate sun protection behaviours are the main messages for skin cancer prevention. This paper examines the relationships between previously identified brand loyalty segments of adolescent sun protection and indicators of UV exposure; that is number of sunburns in the previous 12 months and current level of tan.

Methods

This study was undertaken as part of an Australian Research Council Linkage Grant with Cancer Council NSW as the industry partner. A non-randomised convenience sampling framework was adopted using adolescents aged 12-18 years. Three methods of recruitment were used for this study: secondary schools, an online social networking site and via a university's future student information evenings.

Six independent and catholic secondary schools from a regional coastal city in NSW were invited to participate in the pilot study. Each school was offered a $200 incentive for its participation but no individual student incentives were offered. Two schools agreed to participate in the study, one independent school and one catholic school. The survey was also promoted on the social networking site, Facebook with a chance to win a $50 gift certificate offered to those who completed the survey online. The advertisement was targeted to individuals with a Facebook account aged between 12 and 18 years of age, as defined by Facebook. To avoid previous participants from the school sample also completing the survey online, a further parameter for the advertising was limiting it to individuals whose location, as defined by Facebook, was within a 25 kilometre radius of the city of Sydney (this excluded those in the regional city where the school surveys took place as this city is approximately 80 kilometres south of Sydney). Participants were also recruited at information evenings held by the regional university for Year 12 students who had not completed the school or online survey (determined by screening questions), with respondents provided a $5 voucher for completing the survey. All participants, irrespective of the method of recruitment, were made aware prior to providing their consent that the survey related to sun protection. The study protocol was approved by the regional university's Human Research Ethics Committee.

This data reported in this paper were part of a larger survey; the items included in the current paper are shown in Appendix 1.1. Current level of tan and number of sunburns were selected as indicators of UV exposure as they represent two measures of the body's biological response to UV exposure. Creech & Mayer (1997) have identified tanning as a cumulative reaction of the skin to UV radiation, whereas sunburn or erythema is the acute reaction to UV radiation. While sunburn only partially reflects sun exposure behaviours it is frequently used as the marker of exposure levels likely to indicate increased risk of skin cancers (Dobbinson & Hill 2004). Both sunburns and level of tan are influenced by individual susceptibility (e.g. skin type) and environmental conditions (e.g. ambient UV levels).

Results

Six hundred and ninety two adolescents participated in the survey with 622 providing responses to all relevant items. Participants ranged in age from 12 to 18 years; more females than males (63.5% v 36.5%) completed the survey. The largest brand loyalty segment was Risk Reducers (30.9%) which was also composed of the highest percentage of females (75.0%) of any of the segments (see Table 2).

Table 2. Brand Loyalty Segment Size & Proportion of Males & Females by Segment (n=622)

	The Unaffected	Vigilant Defender	Forgetful Attempter	Risk Reducer	Consciously Lazy	Tan Seeker
Size	6.4% (40)	15.0% (93)	30.2% (188)	30.9% (192)	10.0% (62)	7.6% (47)
Male	60.0%* (24)	32.3% (30)	37.8% (71)	25.0%* (48)	66.1%* (41)	27.7% (13)
Female	40.0%* (16)	67.7% (63)	62.2% (117)	75.0%* (144)	33.9%* (21)	72.3% (34)

*p<0.00

Males were more likely than females to be classified as Consciously Lazy or Unaffected, and less likely than females to be classified as Risk Reducers (χ^2 [5] = 46.41 p=.000).

Number of Sunburns

Response options for the number of sunburns experienced in the previous 12 months were grouped into three categories, 'no burns' (i.e. those who reported no sunburns in the previous 12 months), '1-4 burns', and '5+ burns' and compared between segments. The number of sunburns in the previous 12 months was significantly associated with segment groups (χ^2 [10] = 43.96 p=.000). The Unaffected segment was most likely to report not experiencing any sunburns and were the major contributor to the significant chi-square result (R=5.1). Risk Reducers were least likely to report having 'no sunburns' (R= -2.5). Both the Consciously Lazy and Tan Seeking segments had higher percentages of frequent sunburns (5+ sunburns).

Table 3. *Relationship between social marketing segments & UV exposure measures (n=622)*

Segment		No sunburns	1-4 sunburns	5+sunburns	No tan	Any tan
Unaffected	Count	25	15	0	10	30
(n=40)	% within Segment	62.5	37.5	.0	25.0	75.0
	% within Indicator	14.6	4.0	.0	7.1	6.2
	Adjusted Residual	**5.1**	**-3.0**	**-2.5**	.4	-.4
Vigilant	Count	29	58	6	45	48
Defender	% within Segment	31.2	62.4	6.5	48.4	51.6
(n=93)	% within Indicator	17.0	15.5	7.8	31.9	10.0
	Adjusted Residual	.9	.5	**-1.9**	**6.4**	**-6.4**
Forgetful	Count	49	118	21	46	142
Attempter	% within Segment	26.1	62.8	11.2	24.5	75.5
(n=188)	% within Indicator	28.7	31.6	27.3	32.6	29.5
	Adjusted Residual	-.5	.9	-.6	.7	-.7
Risk Reducer	Count	40	126	26	25	167
(n=192)	% within Segment	20.8	65.6	13.5	13.0	87.0
	% within Indicator	23.4	33.7	33.8	17.7	34.7
	Adjusted Residual	**-2.5**	**1.9**	.6	**-3.8**	**3.8**
Consciously	Count	17	31	14	13	49
Lazy	% within Segment	27.4	50.0	22.6	21.0	79.0
(n=62)	% within Indicator	9.9	8.3	18.2	9.2	10.2
	Adjusted Residual	.0	-1.7	**2.6**	-.3	.3
Tan Seeker	Count	11	26	10	2	45
(n=47)	% within Segment	23.4	55.3	21.3	4.3	95.7
	% within Indicator	6.4	7.0	13.0	1.4	9.4
	Adjusted Residual	-.7	-.7	**1.9**	**-3.1**	**3.1**

Current tan

Response options for current level of tan were grouped into two categories, 'no tan' (those who reported not currently having any tan); and 'any tan' which included all respondents with a light, moderate, dark or very dark tan. The current level of tan was significantly associated with segment groups (χ^2 [5] = 54.95 p=.000). Vigilant Defenders, Risk Reducers and Tan Seekers were the major contributors to the chi-square result. Vigilant Defenders were more likely to report having no current tan (R= 6.4); Risk Reducers and Tan Seekers reported the highest percentage of any segments with 'any tan', 87.0% and 95.7% respectively.

Discussion

Social marketing demands a thoroughly researched understanding of the target market. The findings indicate an association between UV exposure and the sun protection brand loyalty segments. Specifically, Tan Seekers and the Consciously Lazy are more likely to experience frequent sunburns, with Tan Seekers additionally more likely to have a current tan. These two groups represent the highest risk groups among the segments of adolescents in terms of indicators of UV exposure and are therefore in greatest need for change. In contrast, Vigilant Defenders are least likely to report having a current tan. It is interesting to note that the Unaffected segment, while not significantly different to other segments in terms of current level of tan, is substantially more likely to report not experiencing any sunburns in the previous 12 months suggesting that sunburns, more so than current tan, is a determinant of an individual's perceived need to sun protect.

In the context of adolescent targeted sun protection programs being largely ineffective to date, the use of segmentation strategies, a feature central to the customer focus of social marketing, provides a novel way to understand the adolescent market. While the differences between segments and indicators of UV exposure may seem intuitive, this is the first study to measure the extent and direction of differences among segments. Consistent with previous research (Lynch & Jones 2007; Barrie, Jones, Lynch & Coppa 2009) on brand loyalty segments in sun protection, there were differences between genders and brand loyalty segments. Thus, males were more likely to be categorised as Consciously Lazy and females more likely to be categorised as Risk Reducers. In contrast to previous research by Barrie, Jones, Lynch and Coppa (2009), males were not significantly more likely to be categorised as Forgetful Attempters. The overall distribution of segments identified in this study, however, was similar to the previous segmentation survey by Barrie, Jones, Lynch and Coppa (2009).

These results support Lynch and Jones's (2007) original findings that different behavioural segments within the adolescent group exist. These results suggest that segmentation of the adolescent audience along brand loyalty lines provides a useful basis for determining which group is in the greatest need of change. Furthermore, the findings highlight the potential to extend the use of brand loyalty segmentation to both the design and evaluation of social marketing programs targeting improved sun protection of adolescents.

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Appendix 1. 1

Survey Questions

Select ONE statement that best describes you when you are OUTDOORS:	Social Marketing Segment:
• I know I need to protect myself from the sun and I always do	Vigilant Defender (VD)
• I try and use sun protection, but often forget	Forgetful Attempter (FA)
• I like to tan, but also use sunscreen so I don't go red or get wrinkles when I'm older	Risk Reducer (RR)
• I don't usually use sunscreen because it just takes too long and is annoying to apply	Consciously Lazy (CL)
• I like having a tan, so I avoid using sun protection	Tan Seeker (TS)
• I have never really needed to protect myself from the sun	The Unaffected (UA)
What is your current level of tan?	Notan/Light/Moderate/ Dark/Very Dark
In the past 12 months, how many times did you have a red or painful sunburn that lasted a day or more?	0/1/2/3/4/5/6/7/8 or more
What sex are you?	Male/Female

APPENDIX 2. CASE STUDY IN ACADEMIC AND INDUSTRY COLLABORATION: THE DEVELOPMENT OF AN ADOLESCENT SUN PROTECTION INTERVENTION IN NSW

Published in conference proceedings.

Williams, M., Jones, S.C., Iverson, D., Caputi, P. & Potente, S. (2010), Case Study in Academic and Industry Collaboration: The development of an adolescent targeted sun protection intervention in NSW, in Proceedings of the *2010 International Non-profit and Social Marketing Conference*, Brisbane Australian, 15-16 July 2010

Introduction

Academic and industry collaboration is increasingly identified as a critical element in the future health of Australians through linking theory and practice, with the major priority for academic institutions being the identification of new knowledge and the transfer of this knowledge into changes in policy and health services. Collaborations between academia and industry are increasingly encouraged in Australia by research funding schemes such as ARC-Linkage and, more recently, NHMRC Partnerships. While a recent US study suggests that such schemes have a moderate effect on academics' propensity to work with industry (Bozeman and Gaughan, 2007), industry groups have recognised the value of engaging in partnerships with academic institutions in joint knowledge production (Lam, 2007). However, it has been suggested that such collaborations are problematic as the two groups can have diverging agendas (Mitev and Venters, 2009); and differing priorities regarding the dissemination of findings (Welsh et al., 2007).

Background

The University of Wollongong's Centre for Health Initiatives has a research focus on social marketing and health. It also has a history of partnership with industry since its establishment in 2004; working with partner organisations to create a shared vision and delivering measurable results for both industry and academia. A significant partner of the Centre has been Cancer Council NSW; Cancer Council NSW was established in 1953 and is the leading cancer charity in NSW. Both organisations share a commitment to an evidence-driven approach to practice. In 2005, the Centre for Health Initiatives and Cancer Council NSW established a partnership to explore the use of social marketing theory and practice in campaigns to improve sun protection. A

systematic review of the evidence provided the foundation for further collaborative activities. In 2008 the Centre Health Initiatives and Cancer Council NSW jointly submitted and were awarded a second Australian Research Council (ARC) Linkage Grant to develop a social marketing program to improve the sun protection behaviours of NSW adolescents. Using this project as a case study, this paper explores some of the experiences of partnership between academia and industry. As partnerships are increasingly sought between industry and academia, understanding and exploring the experience of existing projects can assist future academics and practitioners in navigating these complex collaborations.

Partnership case study

The partnership between the Centre for Health Initiatives and Cancer Council NSW is now in the second year of a three-year commitment to the adolescent sun protection project (2008-2011). Since commencement of the project, both organisations have reassessed and adapted their approaches as organisational, operational and environmental factors have changed.

Organisational Factors

Evidence driven practice has been a clear and consistent commitment by both organisations. The significance of social marketing as a specific strategic priority and approach however has been a key point of negotiation. A critical question to the overall project has been "are we committed to developing a social marketing program?" and this question has, in part, been driven by variations in the use of terminology and changes to the wording of the Strategic Plan of Cancer Council NSW, which now

emphasises ‘social change’ (a concept which overlaps, but is not synonymous, with social marketing).

Successfully overcoming any ambiguities in the purpose of the project has been through extensive negotiation and discussion between the partners, primarily though a Management Committee comprised of representatives from both organisations. Clarity of roles and intent has been greatly facilitated through the establishment of a memorandum of understanding (MOU) between the organisations. Within the MOU, items including the deliverables of the project, timelines and resources allocated by each party as well as overall intent of the project have been articulated in detail by both parties. While these items were addressed within the original project documentation, it is the ongoing specification and review through the MOU and Management Committee involvement that has been key to the project’s success.

Operational Factors

The most critical operational element for success in this project has been the people. That is, the skill, time and commitment of the people working on this project. Numerous staff changes have occurred in both organisations since the commencement of this project. Critically, however, the commitment at an executive level in both organisations has been unwavering. Recruitment time, training and up-skilling individuals on the project have all required flexibility by both organisations; which has translated to an adjustment to timing of deliverables as well as changes to the allocation of tasks, while still maintaining the overall commitment to the project. The logistics of implementing a program across regions in NSW has also been a key operational factor. Given limited resources, a pragmatic approach has been taken to the allocation of

intervention activities between organisations, with the Centre for Health Initiatives taking the lead in the communities which are receiving a more 'traditional' social marketing intervention; and Cancer Council NSW taking the lead in the communities that are receiving a more policy-oriented environmental intervention via council-driven planning and environmental change. This has enabled both parties to maximise the use of their respective resources and expertise.

Environmental Factors

The impact of environmental factors, such as the global financial crisis (GFC), on this project must also be acknowledged. Increased uncertainty and changing resources within both organisations has been a factor in future planning. The not-for-profit and academic sectors have both been affected by the GFC, meaning that this project has been implemented in a context of global financial uncertainty and insecurity. While the impact on operational factors on a day-to-day basis is minimal, it is an important contextual challenge for the partnership, in particular the way in which significant environmental factors can influence both parties in ways far beyond their control.

Results and Discussion

There is a substantial difference between the nature of the partnership as it was initially conceptualised and as it is today. The influence on the project of organisational, operational and environmental factors has each been significant thus far. This review highlights, however, that the process of partnership is about overcoming, and in some cases living with, the challenges. As an ongoing project, the ultimate success in terms of

health outcomes and policy change is still to be determined. However this review highlights the importance of joint navigation by both parties through a complex partnership. The ultimate success of the project is perhaps less about the specific obstacles and challenges in the project and more about a clear commitment to the project and to problem solving as the project unfolds.

Conclusion and Public Policy Implications

Future collaborations between industry and academia should acknowledge organisational priorities, the complexity of the partnership and establish appropriate procedures, throughout the project, that ensure the changing nature of the partnership is captured.

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APPENDIX 3. STUDY MATERIALS FOR THINK ALOUD STUDY

Materials used and results presented in Chapter 4

1. Information sheet and consent form for think-aloud participants.
2. Information sheet and pro-forma for expert feedback (same questions used for adolescent think-aloud survey).

INFORMATION SHEET

Adolescent Sun Protection Research- Think Aloud Study

Professor Sandra Jones

Melinda Williams (PhD student)

What is a Survey?

A survey is a set of questions that seeks to gain knowledge from participants about a particular topic of interest. In research, a survey is one way of gaining information to understand people's behaviours and attitudes towards a specific issue. In this case, the researchers are attempting to determine the attitudes and current behaviours that young people, in Australia, have in relation to sun protection behaviours and tanning. Each participant will be asked to fill out a written survey containing questions about their sun protection practices, beliefs, and attitudes.

What is a Think-Aloud Study?

A think-aloud study is where a researcher asks participants to think aloud as they read through the survey and answer the questions. Participants are asked to say whatever they are looking at, thinking, doing, and feeling, as they complete the survey. An identified observer will be present who will keep a record of everything the participants say. The session will be audio taped so that developers can go back and refer to what participants said, and how they reacted. The talk aloud will take approx 60 minutes during non-school time and be held at the University of Wollongong premise.

The information obtained in the talk aloud session will be used by the Centre for Initiatives and The Cancer Council NSW to aid in the development of improved measures and methods for increasing adolescent's sun protection behaviours.

Will my (child's) data be identifiable?

All audio tapes will be destroyed after transcripts have been made. No identified data will be recorded at the session or from the transcripts. Furthermore, once returned, the consent forms will be kept separate to any data obtained from the think aloud surveys in order to ensure that individual participants can not be identified. All consent forms and transcripts will be stored securely at the university for period of 5 years.

Can we change our mind?

Participation is entirely voluntary and you or your child can choose to discontinue at any stage.

Will we receive any feedback about the results of the study?

Interested parents/participants involved in the study can be provided with a 1 page summary of study results if they so desire. Simply contact Melinda Williams or Sandra Jones from the Centre for Health Initiatives directly and the summary will be sent out to you.

How do I give consent to participate?

No child will be allowed to participate in the study unless they and their parent/guardian has given written consent to authorise their participation. To provide consent, fill in the consent form attached and return it to:

Melinda Williams
Centre for Health Initiatives
University of Wollongong NSW 2522
Room G04 Building 41

If you have any further queries, please do not hesitate to contact Dr Sandra Jones or Ms Melinda Williams (mw483@uow.edu.au). If you are dissatisfied with any aspect of how this research is conducted you can conduct the Secretary of the University of Wollongong Human Research Ethics Committee of 0242 214457.

CONSENT FORM FOR PARENT / GUARDIAN

I have read the attached information sheet on '*Adolescent Sun Protection Research- Think Aloud Study'* and I understand that my child has expressed interest in participating in research that will examine their sun protection attitudes, beliefs and behaviours. I have had the opportunity to ask the researchers any questions I had.

I understand that I am giving consent for my child to participate in the project "Adolescent Sun Protection Research-Think Aloud Study" which includes completion of a written survey during a think-aloud session which will be observed and audio taped.

I give / do not give permission for my child _____ to be a participant in this project.

Name: _____

Signature:_____

Date : _____

STUDENT CONSENT

I have been given information about the "Adolescent Sun Protection Research-Think Aloud Study" project and I understand that if I give consent to participate in this project I will be asked some questions about my personal behaviours, opinions and attitudes concerning sun protection and tanning. This will involve the completion of a written survey during a think aloud session (taking approx 1 hour).

I understand that my participation is voluntary and I am free to withdraw from this research at any time. Furthermore, my refusal to participate will not affect my relationship with the University of Wollongong. By signing below I am giving my consent to participate in the research as named and described above.

Child's Name:_____

Child's Year at school: _____

Childs signature:_____

Info Sheet for Content Validity Pre-Test with Experts

Background:

The Project: The objective of this project is to develop a psychometrically sound instrument that measures adolescent sun-related behaviours, and which enables the creation of a valid and reliable composite score. Prior to pilot testing the developed instrument, the researchers would like to pre-test the content validity of the draft instrument with experts in sun protection, assessing the clarity and relevance of questions.

The Survey: The survey is designed to assess, through self report, adolescent sun-related behaviours. Conceptually, this includes both sun exposing behaviours and sun protecting behaviours. Furthermore, sun exposure has been defined to include both intentional and incidental sun exposure. The major indicators of sun exposure included in the survey are sunburn and level of tan. The survey is designed for use in intervention research in a pre-post format where the objective of the intervention is to increase the scope and frequency of sun-related behaviours.

Recall: Multiple levels of recall have been included in the draft instrument. These include: 'usual' behaviours and behaviours on one day 'last weekend'.

Objective: Test the content validity of the draft survey instrument with experts in the field of sun protection.

Procedure: Experts in the field of sun protection are invited to review the survey and provide comments using the table included in this document for their feedback. The target is to have at least 6 experts review and provide comment on the survey.

Instructions:

On the following pages is a table which includes each question in the survey. Each question is grouped under the conceptual domain under study. Please review each question and associated answer options considering its importance to the domain under study and marking the relevant column (essential, useful but not essential, and not necessary). Space is provided in the far right column of the table for additional comments on the clarity of any element of the question and answer options.

At the end of each series of questions is space to provide comments regarding the domain under investigation. Please consider if the questions, when combined, effectively cover the domain under study. At the end of the survey, each question and domain combined should cover all the necessary elements of sun exposing behaviour and sun protecting behaviour relevant to adolescents.

Thank you for taking the time to review these questions, your feedback is appreciated.

Table for Content Review

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
1. SUMMER Sun Exposure Time: • **Overall** • **Intentional** • **Incidental**	**1.1**	In the summer, on average how many hours are you outside per day between 11am and 3pm?	Nil 30 mins 1hr 2hrs 3hrs 4hrs				
	1.2	In the summer, on average how many hours per day do you lie in the sun with the purpose of tanning between 11am and 3pm?	Nil 30 mins 1hr 2hrs 3hrs 4hrs				
	1.2	In the summer, on average how many hours per day do you participate in outdoor activities between 11am and 3pm (excluding sunbathing)?	Nil 30 mins 1hr 2hrs 3hrs 4hrs				
	Do the above questions when combined, effectively cover the domain of overall sun exposure, including both intentional and incidental exposure?						
2. WEEKEND Sun Exposure Time • **Overall** • **Intentional** • **Incidental**	**2.1**	Think back to last weekend, were you outside for greater than 15 minutes between 11am and 3pm last Sunday?	Yes (ask qns for Sunday) No (check Saturday)				
	2.2	Were you outside for greater than 15 minutes between 11am and 3pm last Sunday?	Yes (ask qns for Saturday) No (proceed to usual behaviour)				
	2.3	On this day, who were you mainly with?	Family Alone Friend Other				

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
	2.4	Where were you?	Beach/Pool/Lake Park/Playground/Sports grounds Other				
	2.5	What activity were you mainly doing when outside?	Free text				
	2.6	In which region were you located?	Wollongong Shoalhaven Newcastle Other				
	2.7	About how much time did you spend outdoors on that day between 11am and 3pm?	<30 min 2.5hrs 1hr 3hrs 1.5hrs 3.5hrs 2hrs 4hr				
	2.8	About how much of this time did you spend in the sun with the purpose of tanning?	Nil 1.5hrs 3hrs 30 min 2hrs 3.5hrs 1hr 2.5hrs 4hr				
	2.9	About how much of this time did you spend participating in other outdoor activities? Not sunbathing	Nil 1.5hrs 3hrs 30 min 2hrs 3.5hrs 1hr 2.5hrs 4hr				
	Do the above questions when combined, effectively cover the domain of weekend sun exposure, including both intentional and incidental exposure?						

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
3. WEEKEND Sun Protection Behaviour	**3.1**	What did you wear on your head?	Cap Legionnaire hat Bucket hat Broad brimmed hat No hat				
	3.2	Did you wear UV protected sunglasses?	Yes No?				
	3.3	What did you wear on your upper body?	Bikini top Sleeveless top Short sleeve top Long sleeve top Nothing				
	3.4	What did you wear on your lower body?	Bikini bottoms/Speedos Short shorts/skirt Knee length shorts/skirt ¾ length pans/skirt Long pants/skirt				
	3.5	Did you use sunscreen between 11am and 3pm?	Yes No				
	3.6	On what parts of your body did you apply sunscreen?	Face/Neck Arms Torso Legs Feet				
	3.7	What was the SPF of the sunscreen used?	<SPF 15 SPF 15 SPF 30+				
	3.8	Did you reapply the sunscreen while you were outside?	Yes No				
	3.9	Were you mostly in the shade or mostly in the open while you were outside	In the shade In the open In the shade and out in the open equally				

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
	3.10	When you were mostly outdoors between 11am and 3pm would it have been possible for you to stay indoors?	Yes No				
	Do the above questions when combined, effectively cover the domain of Sun Protecting Behaviours on one day in the weekend?						
4. WEEKEND Sun Exposure Behaviour	**4.1**	Did you wear brief clothing so as to get some sun on your skin?	Yes No				
	4.2	Did you delay using sun protection in order to get some sun on your skin?	Yes No				
	4.3	Did you wear a reduced SPF sunscreen in order to get a tan?	Yes No				
	4.4	Did you spend time in the sun with the purpose of getting a tan?	Yes No				
	4.5	Did you apply the sunscreen	As soon as you went out in the sun After you'd been in the sun for a while				
	Do the above questions when combined, effectively cover the domain of Sun Exposing Behaviours on one day in the weekend?						

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
5. Indicator Sunburn	**5.1**	Did you get at all sun burnt? By sunburn we mean any amount of reddening of the skin after being in the sun	Yes No				
	5.2	Which of the statements best describes the burn?	Red without being tender Red and tender Red, tender and blistered				
	5.3	How many times did you get sun burnt last summer?	0 5 1 6 2 7 3 >8 4				
	Do the above questions when combined adequately indicate sunburn?						
6. Indicator Tan	**6.1**	What is your current level of tan?	Light Moderate Dark Very Dark				
	6.2	How deep a tan do you like to get?	Light Moderate Dark Very Dark				
	6.3	Have you made any attempt to get a tan this summer through outdoor sun exposure?	Yes No				
	6.4	Have you made any attempt to get a tan this summer by using a solarium?	Yes No				
	6.5	Have you made any attempt to get a tan this summer by using a sunless tanning cream (fake tan)?	Yes No				

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
	Do the above questions when combined, effectively indicate tan?						
7. USUAL Sun Protecting Behaviours	When you are outside on a warm sunny day, how often do you usually During SUMMER When at SCHOOL On the WEEKEND In the SUMMER HOLIDAYS **Note: The same serious of questions (7.1-7.7) are repeated for each time period i.e. summer, school, weekend and summer holidays.**						
	7.1	Wear SPF 30+ sunscreen	Never Rarely Sometimes Often Always				
	7.2	Reapply sunscreen after 2 hours	Never Rarely Sometimes Often Always				
	7.3	Wear a broad brimmed hat	Never Rarely Sometimes Often Always				
	7.4	Stay in the shade	Never Rarely Sometimes Often Always				
	7.5	Wear a shirt with sleeves that covers your shoulders	Never Rarely Sometimes Often Always				

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
	7.6	Wear UV protected sunglasses	Never Rarely Sometimes Often Always				
	7.7	Avoid being outside between 11am and 3pm	Never Rarely Sometimes Often Always				
	Do the above questions when combined, effectively cover the domain of usual sun protecting behaviour?						
8. Usual Sun Exposing Behaviours	When you are outside on a warm sunny day, During SUMMER When at SCHOOL On the WEEKEND On the SUMMER HOLIDAYS how often do you usually						
	8.1	Expose your skin to the sun with the purpose of tanning	Never Rarely Sometimes Often Always				
	8.2	Wear a reduced SPF sunscreen in order to get a tan	Never Rarely Sometimes Often Always				
	8.3	Delay applying sun protection in order to get some sun on your skin	Never Rarely Sometimes Often Always				

Domain	Question No.	Question	Answer Options	Relevance of the Question to the Domain			Any other comments Does the question make sense? Are the answer options appropriate?
				Relevant	Relevant but not essential	Not relevant	
	8.4	Wear brief clothing so as to get some sun on your skin	Never Rarely Sometimes Often Always				
	Do the above questions when combined effectively cover the domain of usual sun exposing behaviour?						
9. Preferences	**9.1**	My order of preference for sun protection is	Wear a broad brimmed hat Wear a shirt with sleeves Wear SPF 30+ sunscreen Wear UV protected sunglasses Stay in the shade Not go outside at all				
	9.2	My order of preference to get a tan is	Sunbathing Solarium Fake tan Delay using sun protection Wearing brief clothing Use a low SPF sunscreen				
	Do the above questions when combined, effectively cover the domain of preferences for sun protecting behaviour?						

APPENDIX 4. STUDY MATERIALS FOR TESTING ELEMENTS OF THE CONCEPTUAL MODEL AND THE VALIDATION STUDY

Materials used and results presented in Chapters 4, 5, 6, 7, 8.

1. Parent information sheet and consent form for participants
2. Summer Lifestyle Survey
3. Diary Record Template
4. Observation Record Template

University of Wollongong 

Dear Parent/Guardian,

Re: Your Childs Participation in a Research Study on Adolescent Sun Protection

University of Wollongong's Centre for Health Initiatives, as part of an Australian Research Council (ARC) Linkage Grant with Cancer Council NSW, are conducting research into the area of adolescent sun protection behaviour with high school students in NSW schools. With the increasing levels of skin cancer in our society, along with the decrease in the use of sun protection by young people, this research is designed to develop valid measures to evaluate programs aimed at improving the behaviours and attitudes of adolescents. These measures are beneficial in evaluating programs designed to change the current negative behaviours exhibited by adolescents.

There are three parts to the research, a written survey, a sun protection behaviour diary over 1 day, and an observation study where the student is observed outside in the sun at school. The information gained from the study will be used to aid the University and the Cancer Council in the development of improved methods for evaluating programs aimed at increasing adolescent's sun protection behaviours. Attached is an information sheet about the study for your review. The results of the study will be used by The Cancer Council NSW and the Centre for Health Initiatives to assist in the evaluation of a sun-protection campaign targeted at adolescents and will be published. The study will be completed during class time and your child has the option to withdraw at any stage. If you do not want your child to participate please complete the attached form and they will be withdrawn from the study. Participation is entirely voluntary.

If you have any further queries about this study, please do not hesitate to contact Dr Sandra Jones or Ms Melinda Williams (mw483@uow.edu.au) from the Centre for Health Initiatives. If you are dissatisfied with any aspect of how this research is conducted you can conduct the Secretary of the University of Wollongong Human Research Ethics Committee of 0242 214457.

Yours sincerely,

Ms Melinda Williams
Centre for Health Initiatives
University of Wollongong
Phone: 4221 5811
Email: mw483@uow.edu.au

Prof Sandra Jones
Centre for Health Initiatives
University of Wollongong
Phone: 4221 4209
Email: sandraj@uow.edu.au

PARENT/GUARDIAN INFORMATION SHEET
Adolescent Sun Protection Research

Professor Sandra Jones

Melinda Williams (PhD student)

What is a Survey?

A survey is a set of questions that seeks to gain knowledge from participants about a particular topic of interest. In research, a survey is one way of gaining information to understand people's behaviours and attitudes towards a specific issue. In this case, the researchers are attempting to determine the attitudes and current behaviours that young people, in Australia, have in relation to sun protection behaviours and tanning. Each participant will be asked to fill out a written survey containing questions about their sun protection practices, beliefs, and attitudes. The survey will take approximately 15 minutes.

What is a Behaviour Diary?

A sun protection behaviour diary is a short written record of sun protection behaviours undertaken when outdoors at school, i.e. recess lunch and PE. A small group of students will be asked to complete a 1 day diary of their sun protection practices at school during recess, lunch or PE on one day to compare their surveys with their behaviour diaries. The diary will take approximately 10 minutes each day for 1 day

What is an Observation Study?

An observation study is where a researcher observes the behaviours of participants. In this case, participants will be observed when outdoors during recess, lunch or PE on one day to observe their sun related behaviours when outside. The observation study will not require any specific activity by the participant and take place over approx 30 minutes during outside activities on a given day.

The information obtained in the survey, diary and observation studies will be used by the Centre for Initiatives and The Cancer Council NSW to aid in the development of improved measures and methods for increasing adolescent's sun protection behaviours

Will my child's data be identifiable?

All surveys will be coded for analysis. Results from the surveys, diaries and observation studies will be matched with a unique code for each participant. This coding will not identify participants by name. Furthermore, once returned, the consent forms will be kept separate to any data obtained from the surveys in order to ensure that individual participants can not be identified. All information will be stored securely at the university for period of 5 years.

Can we change our mind?

Participation is entirely voluntary and you or your child can choose to discontinue at any stage.

Will I receive any feedback about the results of the study?

Interested parents of children involved in the study can be provided with a 1 page summary of study results if they so desire. Simply contact Melinda Williams or Sandra Jones from the Centre for Health Initiatives directly and the summary will be sent out to you.

How do I give consent for my child to participate?

If you object to your child participating in this study please complete the attached form and return it to your school. The students will receive notification of when the study is taking place by the school. A notice will also be made in the school newsletter notifying all parents of the date and location observation studies will occur in the outdoor school environment. If you do not want your child in attendance when observation studies on participating students are taking place please inform your child's teacher.

If you have any further queries, please do not hesitate to contact Dr Sandra Jones or Ms Melinda Williams (mw483@uow.edu.au). If you are dissatisfied with any aspect of how this research is conducted you can conduct the Secretary of the University of Wollongong Human Research Ethics Committee of 0242 214457.

If you do not want your child to participate in this study, please detach the study withdrawal form and return to the school.

WITHDRAWAL FORM FOR PARENT / GUARDIAN

I have read the attached information sheet on '*Adolescent Sun Protection Research'* and I understand that researchers from the Centre for Health Initiatives are conducting research at the school that will examine students sun protection attitudes, beliefs and behaviours.

I understand that consent is entirely voluntary and furthermore, my refusal to provide consent will not affect my child's relationship with the University of Wollongong.

I DO NOT give consent for my child to participate in the project "Adolescent Sun Protection Research' which includes completion of a written survey (taking approximately 15 minutes), completion of a 1-day diary (taking approximately 10 minutes) and observation when outside at school (during recess, lunch or PE on one day).

I DO NOT give permission for my child to be a participant in this project.

Name: _____

Signature:_____

Date : _____

Child's School: _____

Child's Year at school: _____

Centre for Health Initiatives
University of Wollongong NSW 2522 Australia
Telephone: +61 2 4221 5106
Facsimile: +61 2 4221 3370
chi_research@uow.edu.au

Summer Lifestyle Survey

Answer ***every*** question you can

If you can't answer a question or if you do not want to answer a question, leave it out and go on to the next one.

You may withdraw from the survey at any time

HOW TO ANSWER QUESTIONS:

For most questions, there is a choice of answers

Pick the one that's true for you and colour in the circle next to it like this:

Yes……. ●

Please colour ONE circle only unless otherwise requested.

A. How old are you now?

10 ……. ○ 14 ……. ○ 18…….. ○

11 ……. ○ 15 ……. ○ 19 and over.. ○

12 ……. ○ 16 ……. ○

13 ……. ○ 17 ……. ○

B. What sex are you?

Male…….. ○

Female…….. ○

C. What year level are you in?

Year 7… ○ Year 9.. ○ Year11… ○

Year 8… ○ Year 10.. ○ Year 12.. ○

D. What suburb or town do you live in?

_____

Write suburb (above)

E. Suppose your skin was exposed to strong sunshine at the beginning of summer with no protection at all. If you stayed in the sun for 30 minutes would your skin:

Just burn and not tan afterwards…. ○

Burn first, then tan afterwards…… ○

Not burn at all, just tan…….. ○

Nothing would happen …….. ○

F. How would you describe your skin colour when you don't have any tan?

Very fair…… ○

Fair…….. ○

Medium…… ○

Olive…….. ○

Dark…….. ○

Very Dark…… ○

Black …….. ○

G. Select ONE statement that best describes you when you are <u>OUTDOORS</u>:

I know I need to protect myself from the sun and I always do …….. ○

I like to tan, but also wear sunscreen so I don't go red or get wrinkles when I'm older…….. ○

I like having a tan, so I avoid wearing sun protection …….. ○

I try and wear sun protection, but often forget…….. ○

I have never really needed to protect myself from the sun …….. ○

I don't usually wear sunscreen because it just takes too long and is annoying to apply……. ○

For the following questions think about how much time you are usually <u>outside in summer on school days, weekends and during the summer holidays.</u>

1. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **SCHOOL DAYS (Monday-Friday)?**

30minutes or less……◯
31 minutes to 1 hour……..◯
2 hours……◯
3 hours……◯
4 hours……◯
5 hours……◯
6 hours……◯

2. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **WEEKEND DAYS (Saturday & Sunday)?**
30minutes or less……◯
31 minutes to 1 hour……..◯
2 hours……◯
3 hours……◯
4 hours……◯
5 hours……◯
6 hours……◯

3. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **SCHOOL HOLIDAY DAYS (Summer Holidays)?**

30minutes or less……◯
31 minutes to 1 hour……..◯
2 hours……◯
3 hours……◯
4 hours……◯
5 hours……◯
6 hours……◯

For the following questions, think about when you are <u>outside during the summer on a warm sunny day.</u>

4. How often do you spend time <u>in the sun</u> in order to get a <u>tan</u>?

Never……..◯
Rarely……..◯
Sometimes……◯
Often……◯
Always……..◯

5. How often do you spend time in the sun doing outdoor activities? Outdoor activities include sports, swimming, walking etc

Never……..◯
Rarely……..◯
Sometimes……◯
Often……◯
Always……..◯

For the following questions, think back to <u>last weekend</u>.

6. Were you outside for greater than 15 minutes between 10am and 2pm last Saturday or Sunday? By outside we mean not in a building and not in a covered vehicle. Mark the day(s) you were outside:

Saturday……..◯
Sunday……. ◯
Neither (go to Question 27)◯

7. Think about the time you were outside last Sunday between 10am and 2pm. (If you were not outside on Sunday, think about Saturday). Who were you mainly with? Mark all that apply:

Family……◯
Alone……..◯
Friends……◯
Other
(Please specify)_____

8. Where were you mainly when you were outside?

At Home……..◯
Beach/Pool/Lake……◯
Park/Playground……◯
Sportsground…….. ◯
Other (Please specify) _____

9. What activity were you mainly doing when you were outside? eg playing sport, walking.

Please specify the activity:

_____

10. In which suburb were you located when you were outside?

Please specify the suburb:

_____

11. When you were outside between 10am and 2pm, how much time did you spend:

a) Total time spent outside between 10am and 2pm (max 240 minutes)

_____ minutes

b) In the sun sunbathing
By sunbathing we mean deliberately exposing your skin to the sun with the purpose of getting a tan (max 240 minutes)

_____ minutes

c) Doing other outdoor activities (not sunbathing)
Other activities include doing activities outside such as sports, swimming, walking etc (max 240 minutes)

_____ minutes

12. When you were outside last weekend between 10am and 2pm did you get at all sunburnt? By sunburn we mean any amount of reddening of the skin after being in the sun.

Yes……..◯
No……..◯

If Yes: Which of the statements best describes the burn?

Red without being tender….◯
Red and tender.……..◯
Red, tender & blistered……◯

The following questions ask you in detail about what you were wearing on your body when you were outside last weekend between 10am and 2pm to find out how much your skin was exposed to direct sunlight.

13. Were you wearing a:

Hat……..◯
Cap……..◯
Visor……..◯
None worn……..◯
Other (Please specify)…….

If you were wearing a hat, did it have a:
Mark all that apply.
Broad brim (brim at least 7.5 cm wide). ◯

Flap which covered the back of your neck ◯

14. Did you wear sunglasses?

Yes……..◯
No……..◯

15. What clothing did you wear on the top part of your body?

Top/Dress/Wetsuit

- Wrist length……..◯
- ¾ length……..◯
- Elbow length……..◯
- Short sleeves……..◯
- Sleeveless……..◯

OR Swimwear

- One piece bathers……..◯
- Two piece/bikini top……◯
- Rash Vest……..◯

OR Topless……..◯

16. What clothing did you wear on the lower part of your body?

Trousers/Jeans/Shorts/Skirt/Dress/Wetsuit

- Ankle length……..◯
- ¾ length……..◯
- Knee length……..◯
- Mini skirt/short shorts……◯

OR Swimwear

- Long/Board shorts……..◯
- Short shorts……..◯
- Speedos……..◯
- One piece bathers……..◯
- Two piece/bikini bottom..◯

17. Did you deliberately wear brief clothing so as to get some sun on your skin?

Yes……..◯
No……..◯

18. Were you mostly in the shade or mostly in the open while you were outside?

In the shade…….. ◯
In the open…… ◯
In the shade and out in the open equally… ◯

19. Would it have been possible to do your activity indoors, in the shade, or later in the day?

Yes……..◯
No……..◯
If No, why not:_____

20. When you were outside last weekend between 10am and 2pm, did you delay using sun protection in order to get some sun on your skin? Sun protection includes wearing a hat, wearing sunglasses, wearing sunscreen, wearing protective clothing, using shade.

Yes……..◯
No……..◯

21. Did you use sunscreen between 10am and 2pm when you were outside last weekend?

Yes……..◯
No…(go to question 27)…..◯

22. On what parts of your body did you apply sunscreen?

Mark all that apply

Face……..◯ Shoulders……◯
Nose……◯ Arms……◯
Neck……◯ Hands……◯
Chest ……..◯ Legs……◯
Stomach……◯ Back of knees…◯
Back ……..◯ Feet……◯

23. What was the SPF of the sunscreen used?

<SPF 15……◯
SPF 15……..◯
SPF 30+……◯

24. Did you apply the sunscreen:

Before you went out in the sun……◯
As soon as you went out in the sun…….◯
After you'd been in the sun for a while…◯

25. Did you reapply the sunscreen while you were outside?

Yes……..◯
No……..◯

26. Did you deliberately wear a reduced SPF sunscreen, oil or lotion in order to get a tan when you were outside?

Yes……..◯
No……..◯

27. What is your current level of tan?

No tan……◯
Light ……◯
Moderate……◯
Dark……◯
Very Dark……◯

28. Do you like to get a suntan?

No……◯
Yes, a light tan……◯
Yes, a moderate tan…….◯
Yes, a dark tan……◯
Yes, a very dark tan…….◯

29. Have you made any attempt to get a tan in the last 12 months by using a solarium?

Yes……..◯
No……..◯

30. Have you made any attempt to get a tan in the last 12 months through outdoor sun exposure?

Yes……..◯
No……..◯

31. Have you made any attempt to get a tan in the last 12 months by using a sunless tanning cream (fake tan) or spray tan?

Yes……..◯
No……..◯

32. In the past 12 months, how many times did you have a red or painful sunburn that lasted a day or more?

0……◯ 5……◯
1……◯ 6……◯
2……◯ 7……◯
3……◯ 8……◯
4……◯ 9 or more…◯

The following questions ask you to rank your preferences from the most preferred to the least preferred. Write a number next to EACH option.

For example:

Rank your favourite colour:
Red……..__3__
Blue……..__1__(most preferred)
Orange…….. __6__(least preferred)
Yellow……..__2__
Green……..__4__
Purple…….. __5__

33. Rank the sun protection you prefer to use, from 1 the most to 6 the least preferred method. (Write a number from 1-6 next to each item)

Wear a broad brimmed hat……..._____
Wear a shirt with sleeves……_____
Wear SPF 30+ sunscreen……_____
Wear sunglasses……..…_____
Stay in the shade……..…_____
Spend most of the time inside…….._____

34. Rank the way you prefer to get a tan, from 1 the most to 7 the least preferred method. (Write a number from 1-7 next to each item)

Sunbathing……..…_____
Solarium……..…_____
Fake tan/Spray tan..……..…_____
Delay using sun protection.....…_____
Wear brief clothing……..…_____
Use a low SPF sunscreen, oil, lotion..._____
Wear no sun protection at all……..._____

The following questions ask you to circle your response in a particular setting. Please circle your answer for each setting.

For example:

	when at SCHOOL	on the WEEKEND	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely (Sometimes) Often Always	Never (Rarely) Sometimes Often Always	Never Rarely Sometimes (Often) Always	Never Rarely (Sometimes) Often Always

35. When you are outside on a warm sunny day, how often do you usually do the following: Please **circle** your answer.

	when at SCHOOL	on the WEEKEND	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a hat	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Stay in the shade	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a shirt with sleeves that covers your shoulders	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear long pants/skirt that cover your legs to at least your knees	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear sunglasses	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Spend most of the time inside during peak UV hours in the middle of the day	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

36. When you are outside on a warm sunny day, how often do you usually do the following: Please **circle** your answer.

	when at SCHOOL	on the WEEKEND	during the SUMMER HOLIDAYS	during SUMMER in general
Spend time in the sun in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a reduced SPF sunscreen, oil or lotion in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Delay applying sun protection in order to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear brief clothing so as to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear no sun protection at all in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

The following questions ask you about what you think and know about sun protection. Please circle your answer for each setting.

For example:		
Summer in Australia is from December to February	(True)	False

37. The following statements are true or false. Please **circle** your answer

A sunscreen with a sun protection factor (SPF) of 2 will prevent a sunburn longer than sunscreen a sun protection factor (SPF) of 15	True	False
It is recommended that you put on sunscreen only once in a day and then not reapply it	True	False
It is most harmful to your skin to be in the sun between 10am and 3pm	True	False
You can get sunburnt even on a cloudy day	True	False
People with light coloured skin are at lower risk for getting skin cancer than people with darker coloured skin	True	False
Getting sunburnt often increase your chances of getting skin cancer	True	False
Tanning beds are a safe way to get a tan	True	False
Too much sunlight causes skin cancer	True	False
People cannot die from skin cancer	True	False
I should stay out of the sun if my shadow is shorter than my body	True	False

38. The following ask about how strongly you agree or disagree with a written statement. Please read the statement and **circle** you answer.

Sunscreens are messy to use	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Sunscreens irritate or bother my skin	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Sunscreens are not in a place that is easy to get to when I need them	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It is hard to choose the right sunscreen	Strongly agree	Disagree	Not sure	Agree	Strongly agree
If I sit in the shade or stay inside between 10am and 3pm I will miss out on outdoor activities	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I have to stop what I am doing to put sunscreen on	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
A hat messes up my hair	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I don't like the way I look in a hat	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It is too hot to wear a long-sleeve shirt or long pants in summer	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
There are not enough places that provide shade	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I sit in the shade or stay inside between 10am and 3pm my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will make fun of me if I wear a hat all the time outside	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I wear a long sleeve shirt or long pants on a sunny summer day, my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I am weird if I wear sunscreen	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
A good tan makes me look more attractive	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I want to get a tan	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I think that I have a chance of getting skin cancer when I am older	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

39. The following ask if you think you <u>can do</u> a particular behaviour. Please read the statement and circle you answer.

I can stay out of the sun between 10am and 3pm	Not sure	Somewhat sure	Sure
I can use a sunscreen of a sun protection factor (SPF) 15 or higher	Not sure	Somewhat sure	Sure
I can wear a long-sleeve shirt or long pants when it is sunny and warm outside	Not sure	Somewhat sure	Sure
I can tell my friends I don't want to sunbathe	Not sure	Somewhat sure	Sure

40. The following asks you to respond to a statement. Please read the statement and circle you answer.

How important do you think it is to have a suntan	Not important	Somewhat important	Important	Very Important

Thank you for your participation!

Diary Record Template

SUN PROTECTION BEHAVIOUR DIARY				
			Class	
1. Were you indoors or outdoors?				**6. If you put sunscreen on at ANY time today, when did you put the sunscreen on?** (tick all that apply)
A. Indoors	A	A	A	
B. Outdoors, mostly in the shade	B	B	B	□ Before School □ Before Lunch
C. Outdoors, mostly in the sun	C	C	C	□ Before Recess □ Before PE
2. What were you wearing on your head?				**7. Did you have PE class today?**
A. Nothing	A	A	A	□ Yes
B. Visor/Cap	B	B	B	□ No
C. Broad brimmed/bucket hat	C	C	C	
3. What were you wearing on your shoulders & arms?				**8. If you did have PE class today, about how long were you outside during that time?**
A. No shirt	A	A	A	□ 0 minutes □ 15 minutes
B. Tank top/Sleeveless top	B	B	B	(not outside at all)
C. Short-sleeved shirt	C	C	C	□ 30 minutes □ 45 minutes
D. Three-quarter-sleeved shirt	D	D	D	□ 1 hour □ more than 1 hour
E. Long-sleeve shirt	E	E	E	
4. What were you wearing on your legs?				**9. During lunch and recess combined, about how long were you outside during that time?**
A. Short shorts or short skirt	A	A	A	
B. Knee-length pants or knee-length skirt	B	B	B	□ 0 minutes □ 15 minutes (not outside at all)
C. Three quarter length pants/skirt	C	C	C	□ 30 minutes □ 45 minutes
D. Long pants/jeans	D	D	D	□ 1 hour □ more than 1 hour
5. What were you wearing on your skin?	`			
A. Sunscreen	A	A	A	
B. No sunscreen (If no sunscreen, go to question 7)	B	B	B	

Observation Record Template

SCHOOL NAME_____Day_____Date_____**INTERVAL (RECESS/LUNCH/PE)** Time: _____

Observer name (and partner)_____

ID CODE	SKIN TONE Very fair/ fair/ medium/olive/dark/ very dark/black	HAT none visor cap bucket broad	UPPER BODY CLOTHING Sleeveless Short sleeves ¾ sleeves Long sleeves	LOWER BODY CLOTHING Short shorts/skirt Knee length ¾ length long	SHADE Fully in shade Partly in shade Full sun shade not avail Full sun shade avail Moving between	ACTIVITY sitting/standing/walking sports	OTHER eg. Sunglasses

APPENDIX 5. STUDY MATERIALS USED FOR EVALUATION OF A SKIN CANCER PREVENTION PROGRAM IN SECONDARY SCHOOLS

Materials used and results presented in Chapter 9.

1. Parent information sheet and consent form
2. Summer Lifestyle Survey Time 1
3. Summer Lifestyle Survey Time 2

University of Wollongong

Centre for Health Initiatives
University of Wollongong
NSW 2522 Australia
Ph (+61 2) 4221 5106
Fax (+61 2) 4221 3370

PARENT

INFORMATION SHEET

Adolescent Sun Protection Program and Evaluation

The sun protection program and evaluation activities that being offered to your child will include two key elements 1) Interactive Program Activities and 2) an evaluation survey, with details to follow.

It is estimated that the activities will be undertaken within one full PDHPE lesson and portions of three additional PDHPE lessons (up to 30 mins in each lesson) for each participating student.

1. The Program Activities.

UV CAMERA PHOTOAGEING ACTIVITY

A portable UV camera will be taken into PDHPE class times to offer photographs of student's faces. These photographs will reveal any acquired sun damage that sits below the skin's surface and is invisible to the naked eye. Students who wish to discuss their results will be encouraged to as part of a broader discussion regarding the importance of adopting multiple skin protection strategies. Any student who does not wish to have their photo taken will be excluded from this activity and participate in the discussion exercise only.

Why a UV Camera?
UV photography has been proven to be an effective tool in changing attitudes and behaviours relating to sun protection. Adolescents tend to exhibit strong concerns about appearance and attractiveness, hence UV photography has been identified as an important strategy to `reframe' sun protection as an important issue for young people.

Is there any risk?
UV Camera photography is identical to having a normal photograph taken. What the camera does is on one side of the image, all visible light is filtered out only allowing the UV light to penetrate the film plane. So there should be no harm or alert as to excessive UV light. It would be more harmful to stand outside for several minutes.

What will happen to the images?
Each student will receive an instant photographic printout of their face to take away with them. The UV camera equipment does not have the capacity to store images digitally. Therefore no photos will be stored or reproduced by the University of Wollongong.

What happens if my child shows extreme photoaging?
All students will be advised to contact their GP for a check up if they are showing extreme photoaging. At the end of the class, the researchers will also discuss various ways for the students to seek assistance if they are distressed about the findings in their photo.

Cancer Council New South Wales

The Cancer Council NSW
153 Dowling Street
Woolloomooloo, NSW 2011
PO Box 572 Kings Cross NSW 1340 Australia
Ph (+61 2) 9334 1900
Fax (+61 2) 8302 3530

`GLITTERBUG' SUNSCREEN APPLICATION EXERCISE

Glitterbug potion has the consistency of moisturiser and fluoresces (shines brightly) under UV illumination. In this instance we will use glitterbug lotion as an exercise in effective sunscreen application.

A small number of students who volunteer to participate as demonstrators will be asked to apply sunscreen on their arms and face in their normal manner. A UV lamp will then reveal the effectiveness of the application and will form part of a broader discussion regarding correct sunscreen application and the importance of multiple sun protection strategies. (i.e sunscreen needs to be applied properly BUT even when applied correctly it is not enough to solely rely on sunscreen to protect yourself from the sun).

Why Glitterbug?

Glitterbug is commonly used to demonstrate the importance of thorough and correct application of a substance. This reason this is important for this program is because recent research revealed that adolescents tend to rely on one form of sun protection only (if any) - sunscreen. However, we also know that they tend to apply it a slapdash manner, not use enough, and not reapply it regularly enough for it to be effective.

Are there any Risks?

Glitterbug may cause skin irritation in sensitive people. Students with identified skin sensitivities will not be permitted to volunteer for the demonstration activity. Please do not allow your child to participate as a volunteer in this activity if your child has skin sensitivities. In the consent form below you can clearly mark if you don't allow your child to volunteer for this activity.

UV DETECTION WRISTBAND ACTIVITY

This activity will take place during the school swimming or athletics carnival and will involve students wearing a UV detect wristband. When covered with sunscreen, the wristband changes colour to warn the user when to reapply sunscreen and / or get out of the sun. This exercise is designed to remind and reinforce to students the importance of adopting sun protection behaviours during all outdoor activities.

Why UV Wristbands?

During previous research, adolescents reported they simply forgot to re-apply sunscreen and would do so if they were reminded. The aim of this activity is to provide students with a novel sun protection reminder.

Are there any Risks?

Wristbands sit loosely around the wrist like a bracelet and are safe to use.

2. The Survey Evaluation

Students who are involved in the sun protection activities will also be asked to complete a short survey that is designed to measure attitudes and behaviours relating to sun protection. This survey will be delivered at two points; firstly before the sun protection program activities commence (November - December 2009) and secondly after the activities finish (March 2010).

In sum, we aim to measure whether attitudes and behaviours relating to sun protection have changed since the program activities were introduced.

What is a Survey?

A survey is a set of questions that seeks to gain knowledge from participants about a particular topic of interest. In research, a survey is one way of gaining information to understand people's behaviours and attitudes towards a specific issue.

In this case, the researchers are attempting to determine the attitudes and current behaviours that young people in Australia have in relation to sun protection. Each participant will be asked to fill out a written survey containing questions about their current sun protection, attitudes and behaviours. Surveys will be completed by the class of year 8 and class of year 9 students who are involved in the program activities at each participating school.

The surveys will take approximately 20 minutes and the information obtained from them will be used by the Centre for Health Initiatives and The NSW Cancer Council to aid in the development of improved methods for increasing adolescent's sun protection behaviours. The results of this survey will be published.

Will my child's data be identifiable?

All surveys will be coded for analysis. Results from the surveys will be matched with a unique code for each participant. The coding will not identify participants by name. Furthermore, once returned, the consent forms will be kept separate to any data obtained from the surveys in order to ensure that individual participants can not be identified. All information will be stored securely at the university for a period of 5 years.

THE CONSENT PROCESS

How do I give consent for my child to participate?

No child will be allowed to participate unless their parent/guardian has given written consent to authorise their participation. To provide consent, just fill in the consent form attached and return this to your school.

Can we change our mind?

Participation is entirely voluntary and you or your child can choose to discontinue at any stage

If you have any further queries about the sun protection program and evaluation activities, please do not hesitate to contact Professor Sandra Jones or Ms Melinda Williams on 02 4221 5106.

If you are dissatisfied with any aspect of how this program and evaluation is conducted you can contact the Secretary of the University of Wollongong Human Research Ethics Committee on 02 4221 4457.

Please detach the consent form and return to the school by (insert date)

Yours sincerely

Ms Melinda Williams
Centre for Health Initiatives
University of Wollongong
Phone: 02 4221 5811
Email: mw483@uow.edu.au

Prof Sandra Jones
Centre for Health Initiatives
University of Wollongong
Phone: 02 4221 4209
Email: sandraj@uow.edu.au

University of Wollongong

Centre for Health Initiatives
University of Wollongong
NSW 2522
Australia
Ph (+61 2) 4221 5106
Fax (+61 2) 4221 3370

CONSENT FORM FOR PARENT/GUARDIAN

I have read the attached information sheet about the Adolescent sun protection program and survey evaluation that will be occurring with Year 8 and Year 9 students in my child's school.

I have had the opportunity to ask the researchers any questions about these activities.

I give permission for my child to be involved in the following activities (tick all that apply):

Adolescent Sun Protection Program

1. **UV Camera Photoageing Activity** ☐
2. **'Glitterbug' sunscreen application activity** ☐
3. **UV Detection Wristband Activity** ☐

Adolescent Sun Protection Evaluation Survey

4. **Sun Protection Survey (Nov – Dec 2009)** ☐
5. **Follow up Sun Protection Survey (Feb- March 2010)** ☐

I understand that as part of this program I am giving consent for my child to complete a survey about sun protection attitudes and behaviours.

I give/ do not give permission for my child ..... to be a participant in this project as specified above.

Name..... Signature.....

Date.....

Child's school.....

Child's year at school.....

Cancer Council New South Wales

The Cancer Council NSW
153 Dowling Street
Woolloomooloo, NSW 2011
PO Box 572 Kings Cross NSW 1340 Australia
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Summer Lifestyle Survey (TIME 1 SURVEY)

- Answer ***every*** question you can
- If you can't answer a question or if you do not want to answer a question, leave it out and go on to the next one.
- You may withdraw from the survey at any time

HOW TO ANSWER QUESTIONS:

For most questions, there is a choice of answers
Pick the one that's true for you and colour in the circle next to it like this:

Yes…… ●

Please colour ONE circle only unless otherwise requested.

A. How old are you now?

10 ……..◯ 14 ….◯ 18…….. ◯
11 ……..◯ 15 ….◯ 19 and over.. ◯
12 ……..◯ 16 ….◯
13 ……..◯ 17 ….◯

B. What sex are you?

Male……..◯
Female……..◯

C. What year level are you in?

Year 7...◯ Year 9….◯ Year 11…◯
Year 8...◯ Year10…◯ Year 12…◯

D. What suburb or town do you live in?

_____
Write suburb (above)

E. Suppose your skin was exposed to strong sunshine at the
beginning of summer with no protection at all. If you stayed in the sun for 30 minutes would your skin:

Just burn and not tan afterwards……. ◯
Burn first, then tan afterwards……..◯
Not burn at all, just tan……..◯
Nothing would happen ……..◯

F. How would you describe your skin colour when you don't have any tan?

Very fair……..◯
Fair……..◯
Medium……..◯
Olive……..◯
Dark……..◯
Very Dark……◯
Black ……..◯

G. Select ONE statement that best describes you when you are <u>OUTDOORS</u>:

I know I need to protect myself from the sun
and I always do ……..◯

I like to tan, but also use sunscreen so I don't go
red or get wrinkles when I'm older……..◯

I like having a tan, so I avoid using sun
protection ……..◯

I try and use sun protection,
but often forget……..◯

I have never really needed to protect
myself from the sun …… ◯

I don't usually use sunscreen because it just
takes too long and is annoying to apply……. ◯

For the following questions think about how much time you are usually <u>outside in summer on school days, weekends and during the summer holidays.</u>

1. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **SCHOOL DAYS (Monday-Friday)?**	2. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **WEEKEND DAYS (Saturday & Sunday)?**	3. In the summer, on average, how many hours are you outside per day between 10am and 4pm… on **SCHOOL HOLIDAY DAYS (Summer Holidays)?**
30minutes or less……..◯	30minutes or less……..◯	30minutes or less……..◯
31 minutes to 1 hour…….◯	31 minutes to 1 hour…….◯	31 minutes to 1 hour…….◯
2 hours……..◯	2 hours……..◯	2 hours……..◯
3 hours……..◯	3 hours……..◯	3 hours……..◯
4 hours……..◯	4 hours……..◯	4 hours……..◯
5 hours……..◯	5 hours……..◯	5 hours……..◯
6 hours……..◯	6 hours……..◯	6 hours……..◯

For the following questions, think about when you are outside during the summer on a warm sunny day.

4. How often do you spend time in the sun in order to get a tan?

Never……..◯
Rarely……..◯
Sometimes……..◯
Often……..◯
Always……..◯

5. How often do you spend time in the sun doing outdoor activities? Outdoor activities include sports, swimming, walking etc

Never……..◯
Rarely……..◯
Sometimes……..◯
Often……..◯
Always……..◯

For the following questions, think back to last weekend.

6. Were you outside for greater than 15 minutes between 11am and 3pm last Saturday or Sunday? By outside we mean not in a building and not in a covered vehicle. Mark the day(s) you were outside:

Saturday……..◯
Sunday……..◯
Neither (go to Question 25) ◯

7. Think about the time you were outside last Sunday between 11am and 3pm. (If you were not outside on Sunday, think about Saturday). Who were you mainly with? Mark all that apply:

Family……..◯
Alone……..◯
Friends……..◯
Other (Please
specify)_____

8. Where were you mainly when you were outside?

At Home……..◯
Beach/Pool/Lake……..◯
Park/Playground……..◯
Sportsground……..◯
Other (Please specify)
_____

9. What activity were you mainly doing when you were outside? eg playing sport, walking.
Please specify the activity: _____

10. In which suburb were you located when you were outside?
Please specify the suburb: _____

11. When you were outside between 11am and 3pm, how much time did you spend:

d) Total time spent outside between 11am and 3pm (max 240 minutes)

_____ minutes

e) In the sun sunbathing
By sunbathing we mean deliberately exposing your skin to the sun with the purpose of getting a tan (max 240 minutes)

_____ minutes

12. When you were outside last weekend between 11am and 3pm did you get at all sunburnt? By sunburn we mean any amount of reddening of the skin after being in the sun.

Yes……..◯
No……..◯

If Yes: Which of the statements best describes the burn?

Red without being tender….◯
Red and tender……..◯
Red, tender & blistered……◯

The following questions ask you in detail about what you were wearing on your body when you were outside last weekend between 11am and 3pm to find out how much your skin was exposed to direct sunlight.

13. Were you wearing a:

Hat……..◯
Cap……..◯
Visor……..◯
None worn……..◯
Other (Please specify)……

If you were wearing a hat, did it have a:
Mark all that apply.
Broad brim (brim at least 7.5 cm wide).....◯
Flap which covered the back of your neck..◯

14. Did you wear sunglasses?

Yes……..◯
No……..◯

15. What clothing did you wear on the top part of your body?

Top/Dress/Wetsuit

- Wrist length……
- ¾ length……
- Elbow length……
- Short sleeves……
- Sleeveless……

OR Swimwear

- One piece bathers……
- Two piece/bikini top……
- Rash Vest……

OR No shirt……

16. What clothing did you wear on the lower part of your body?

Trousers/Jeans/Shorts/Skirt/Dress/Wetsuit

- Ankle length……
- ¾ length……
- Knee length……
- Mini skirt/short shorts……

OR Swimwear

- Long/Board shorts……
- Short shorts……
- Speedos……
- One piece bathers……
- Two piece/bikini bottom..

17. Did you do any of the following (mark all that apply):

- Attempt to get a tan……

- Deliberately wear brief clothing so as to get some sun on your skin……

- Delay using sun protection in order to get some sun on your skin……

- Deliberately wear a reduced SPF sunscreen, oil or lotion in order to get a tan…

18. Were you mostly in the shade or mostly in the open while you were outside?

In the shade……..

In the open……

In the shade and out in the open equally……

19. Would it have been possible to do your activity indoors, in the shade, or later in the day?

Yes……

No……

If No, why not:_____

20. Did you use any sunscreen between 11am and 3pm when you were outside last weekend?

Yes……

No…(go to question 25)……

21. On what parts of your body did you apply sunscreen? Mark all that apply

Face……
Nose……
Neck……
Chest ……
Stomach……
Back ……
Shoulders……..
Arms……
Hands……
Legs……
Back of knees….
Feet……..

22. What was the SPF of the sunscreen used?

<SPF 15……
SPF 15……
SPF 30+……

23. Did you apply the sunscreen:

- Before you went out in the sun……
- As soon as you went out in the sun…….
- After you'd been in the sun for a while….

24. Did you reapply the sunscreen while you were outside?

Yes……

No……

25. What is your current level of tan?

No tan……
Light ……
Moderate……
Dark……
Very Dark……

26. Do you like to get a suntan?

No……
Yes, a light tan……
Yes, a moderate tan……
Yes, a dark tan……
Yes, a very dark tan……

27. Thinking about the last 12 months have you done any of the following (mark all that apply)

- Used a solarium (tanning bed)……

- Attempted to get a tan through outdoor sun exposure……

- Used a sunless tanning cream (fake tan) or spray tan……

28.Last summer, how many times did you have a red or painful sunburn that lasted a day or more?

_____(write the number of sunburns)

The following questions ask you to circle your response in a particular setting. Please circle your answer for each setting.

For example:

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely (Sometimes) Often Always	Never (Rarely) Sometimes Often Always	Never Rarely Sometimes (Often) Always	Never Rarely (Sometimes) Often Always

29. When you are outside on a warm sunny day, how often do you usually do the following: Please **circle** your answer.

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a hat	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Stay in the shade	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a shirt with sleeves that covers your shoulders	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear long pants/skirt that cover your legs to at least your knees	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear sunglasses	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Spend most of the time inside during peak UV hours (11am-3pm) in the middle of the day	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

30. When you are outside on a warm sunny day, how often do you usually do the following: Please **circle** your answer.

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Spend time in the sun in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a reduced SPF sunscreen, oil or lotion in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Delay applying sun protection in order to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear brief clothing so as to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear no sun protection at all in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

Below are some questions about your future behaviour. Please circle your answer.

31. The following ask about how strongly you agree or disagree with a written statement. Please read the statement and **circle** you answer.

I plan to use sunscreen regularly.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use a sunscreen with an SPF of at least 15 on my face.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use a sunscreen with an SPF of at least 15 on my body.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use sunscreen on my face if/when I sunbathe	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use sunscreen on my face when I do any outdoor activity	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on my face on a daily basis.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on all exposed areas of my body if/when I sunbathe.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on all exposed areas of my body when I do any outdoor activity.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on all exposed areas of my body on a daily basis.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

I plan to reapply my sunscreen often if/when I sunbathe.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear a wide-brimmed hat when I do any outdoor activity.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to seek out shady areas when I have to be outdoors	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to avoid being outdoors between the hours of 11 AM and 3 PM whenever possible.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear shirts with long sleeves when I have to be outdoors between 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear long pants when I have to be outdoors between 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to try to avoid going to the beach between the hours of 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to seek out shade (e.g., bring an umbrella) when I go to the beach.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear a wide-brimmed hat when I go to the beach.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

Below are some questions about your opinions. Please circle your answer.

32. We are interested in your opinions. Please read the statement and **circle** you answer.

I am too young to spend much time thinking that I might get wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I don't need to worry about getting wrinkles and age spots until I am much older.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear long sleeves or long pants while in the sun during summer months because it would be too hot.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I have more self-confidence when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I don't spend enough time in the sun to be concerned about getting wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
The possibility of getting wrinkles and age spots worries me.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I think I look healthier when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Hanging around the pool or at the beach with friends on a sunny, summer day is just too nice to pass up.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Using sunscreen regularly is just too much trouble.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear long sleeves or long pants while in the sun during summer months because it would prevent me from getting “some colour.”	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because I often am rushed or don’t have time	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
The older I get, the more I think about the possibility of getting wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because I like to be tanned.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

I would not use a wide-brimmed (4 inches) hat because it would not look good on me.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Whenever I see a friend or relative who has a lot of wrinkles or age spots, it makes me realise that I could get them too.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because it is too messy.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because it is too greasy.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I feel more attractive when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
No matter what I do, I don't think it is likely that I am going to have many wrinkles or age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It is very important to me to have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear a wide-brimmed (4 inches) hat while at the beach or in the sun because it would be too hot.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Most people look better with a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Sunscreens are not in a place that is easy to get to when I need them	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Most of my CLOSE FRIENDS think that a suntan is a good thing	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

33. The following ask if you think you <u>can do</u> a particular behaviour. Please rate how confident you are that you could *really* get yourself to do each of the things listed consistently. Please read the statement and circle you answer.

	Certain I could NOT do			I probably could NOT do			I probably could do			Certain I could do
Use sunscreen while in the sun even if I already have a base tan.	1	2	3	4	5	6	7	8	9	10
Use sunscreen while in the sun even though other people I am with are not using it.	1	2	3	4	5	6	7	8	9	10
Use sunscreen while in the sun even when I am feeling pale.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if I am going out that Night and want to be tanned.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if my friends tell me that I look healthier with a tan.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if people tell me that I don't need it.	1	2	3	4	5	6	7	8	9	10
Stay out of the sun between 11am and 3pm	1	2	3	4	5	6	7	8	9	10
Wear a long sleeve shirt or long pants when it is sunny and warm outside	1	2	3	4	5	6	7	8	9	10
Seek out shady areas when I have to be outdoors	1	2	3	4	5	6	7	8	9	10
Wear a wide brimmed hat when I have to be outdoors	1	2	3	4	5	6	7	8	9	10

34. The following ask about how strongly you agree or disagree with a written statement. Please read the statement and **circle** you answer.

If I sit in the shade or stay inside between 10am and 3pm my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will make fun of me if I wear a hat all the time outside	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I wear a long sleeve shirt or long pants on a sunny summer day, my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I am weird if I wear sunscreen	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It would be terrible to look older than I really am due to too much sun exposure	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I regularly protect myself from the sun I can avoid age spots and wrinkles	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

35. During the past three months have you seen or heard any messages in your local community targeting teenagers and encouraging them to do things to improve their health?

Yes……◯
No……◯

(If yes)What were these messages about?

_____

36. During the past three months have you seen or heard any messages in your local community targeting teenagers that were about looking after their skin?

Yes……◯
No……◯

(If yes) What were these messages about?

_____

37. During the past three months have you seen or heard any messages in school about teenagers looking after their skin?

Yes……◯
No……◯

(If yes) What were these messages about?

_____

38. During the past three months, have you learned anything new about the effects of the sun on the health or appearance of your skin?

Yes……◯
No……◯

(If yes) What did you learn?

_____

39.What reminds you to reapply sunscreen or use other sun protection menthods when you are out in the sun?

_____

40. Finally, do you know of anyone, either a family member or a friend, who has had skin cancer at any time?
Yes, family member…◯
Yes, friend……◯
No…… ◯

Thank you for your participation!

Summer Lifestyle Survey (TIME 2 SURVEY)

- Answer ***every*** question you can
- If you can't answer a question or if you do not want to answer a question, leave it out and go on to the next one.
- You may withdraw from the survey at any time

HOW TO ANSWER QUESTIONS:

For most questions, there is a choice of answers
Pick the one that's true for you and colour in the circle next to it like this:

Yes……. ●
Please colour ONE circle only unless otherwise requested.

A. How old are you now?

10 ……..◯ 14 ……..◯ 18…….. ◯
11 ……..◯ 15 ……..◯ 19 and over..◯
12 ……..◯ 16 ……..◯
13 ……..◯ 17 ……..◯

B. What sex are you?

Male……..◯
Female……..◯

C. What year level are you in?

Year 7……◯ Year 9….◯ Year 11….◯
Year 8……◯ Year10…◯ Year 12…..◯

D. What suburb or town do you live in?

_____
Write suburb (above)

E. Suppose your skin was exposed to strong sunshine at the beginning of summer with no protection at all. If you stayed in the sun for 30 minutes would your skin:

Just burn and not tan afterwards…..◯
Burn first, then tan afterwards……◯
Not burn at all, just tan……..◯
Nothing would happen ……..◯

F. How would you describe your skin colour when you don't have any tan?

Very fair……◯
Fair……..◯
Medium……◯
Olive……..◯
Dark……..◯
Very Dark……◯
Black ……..◯

G. Select ONE statement that best describes you when you are <u>OUTDOORS</u>:

I know I need to protect myself from the sun and I always do ……..◯

I like to tan, but also use sunscreen so I don't go red or get wrinkles when I'm older……..◯

I like having a tan, so I avoid using sun protection ……..◯

I try and use sun protection, but often forget……..◯

I have never really needed to protect myself from the sun …… ◯

I don't usually use sunscreen because it just takes too long and is annoying to apply……..◯

For the following questions think about how much time you were usually <u>outside this summer on school days, weekends and during the summer holidays.</u>

1. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **SCHOOL DAYS (Monday-Friday)?**	2. In the summer, on average, how many hours are you outside <u>per day</u> between 10am and 4pm… on **WEEKEND DAYS (Saturday & Sunday)?**	3. In the summer, on average, how many hours are you outside per day between 10am and 4pm… on **SCHOOL HOLIDAY DAYS (Summer Holidays)?**
30minutes or less……..◯	30minutes or less……◯	30minutes or less……◯
31 minutes to 1 hour……◯	31 minutes to 1 hour……◯	31 minutes to 1 hour……◯
2 hours……◯	2 hours……◯	2 hours……◯
3 hours……◯	3 hours……◯	3 hours……◯
4 hours……◯	4 hours……◯	4 hours……◯
5 hours……◯	5 hours……◯	5 hours……◯
6 hours……◯	6 hours……◯	6 hours……◯

For the following questions, think about when you were outside during this summer on a warm sunny day.

4. How often do you spend time in the sun in order to get a tan?

Never……..◯
Rarely……..◯
Sometimes……..◯
Often……..◯
Always……..◯

5. How often do you spend time in the sun doing outdoor activities? Outdoor activities include sports, swimming, walking etc

Never……..◯
Rarely……..◯
Sometimes……..◯
Often……..◯
Always……..◯

For the following questions, think back to last weekend.

6. Were you outside for greater than 15 minutes between 11am and 3pm last Saturday or Sunday? By outside we mean not in a building and not in a covered vehicle. Mark the day(s) you were outside:

Saturday……..◯
Sunday……..◯
Neither (go to Question 25)◯

7. Think about the time you were outside last Sunday between 11am and 3pm. (If you were not outside on Sunday, think about Saturday). Who were you mainly with? Mark all that apply:

Family……..◯
Alone……..◯
Friends……..◯
Other (Please
specify)_____

8. Where were you mainly when you were outside?

At Home……..◯
Beach/Pool/Lake……..◯
Park/Playground……..◯
Sportsground……..◯
Other (Please specify)
_____

9. What activity were you mainly doing when you were outside? eg playing sport, walking.

Please specify the activity: _____

10. In which suburb were you located when you were outside?

Please specify the suburb: _____

11. When you were outside between 11am and 3pm, how much time did you spend:

f) Total time spent outside between 11am and 3pm (max 240 minutes)

_____ minutes

g) In the sun sunbathing
By sunbathing we mean deliberately exposing your skin to the sun with the purpose of getting a tan (max 240 minutes)

_____ minutes

12. When you were outside last weekend between 11am and 3pm did you get at all sunburnt? By sunburn we mean any amount of reddening of the skin after being in the sun.

Yes……..◯
No……..◯

If Yes: Which of the statements best describes the burn?

Red without being tender….◯
Red and tender……..◯
Red, tender & blistered……◯

The following questions ask you in detail about what you were wearing on your body when you were outside last weekend between 11am and 3pm to find out how much your skin was exposed to direct sunlight.

13. Were you wearing a:

Hat……..◯
Cap……..◯
Visor……..◯
None worn……..◯
Other (Please specify)……

If you were wearing a hat, did it have a:
Mark all that apply.
Broad brim (brim at least 7.5 cm wide).....◯
Flap which covered the back of your neck..◯

14. Did you wear sunglasses?

Yes……..◯
No……..◯

15. What clothing did you wear on the top part of your body?

Top/Dress/Wetsuit

- Wrist length……
- ¾ length……
- Elbow length……
- Short sleeves……
- Sleeveless……

OR Swimwear

- One piece bathers……
- Two piece/bikini top……
- Rash Vest……

OR No shirt……

16. What clothing did you wear on the lower part of your body?

Trousers/Jeans/Shorts/Skirt/Dress/Wetsuit

- Ankle length……
- ¾ length……
- Knee length……
- Mini skirt/short shorts……

OR Swimwear

- Long/Board shorts……
- Short shorts……
- Speedos……
- One piece bathers……
- Two piece/bikini bottom..

17. Did you do any of the following (mark all that apply):

- Attempt to get a tan……
- Deliberately wear brief clothing so as to get some sun on your skin……

- Delay using sun protection in order to get some sun on your skin……

- Deliberately wear a reduced SPF sunscreen, oil or lotion in order to get a tan……

18. Were you mostly in the shade or mostly in the open while you were outside?

In the shade……..
In the open……
In the shade and out in the open equally……

19. Would it have been possible to do your activity indoors, in the shade, or later in the day?

Yes……
No……
If No, why not:_____

20. Did you use any sunscreen between 11am and 3pm when you were outside last weekend?

Yes……
No…(go to question 25)……

21. On what parts of your body did you apply sunscreen? Mark all that apply

Face……
Nose……
Neck……
Chest ……
Stomach……
Back ……
Shoulders……..
Arms……
Hands……
Legs……
Back of knees….
Feet……

22. What was the SPF of the sunscreen used?

<SPF 15……
SPF 15……
SPF 30+……

23. Did you apply the sunscreen:
- Before you went out in the sun……
- As soon as you went out in the sun……
- After you'd been in the sun for a while….

24. Did you reapply the sunscreen while you were outside?
Yes……
No……

25. What is your current level of tan?
No tan……
Light ……
Moderate……
Dark……
Very Dark……

26. Do you like to get a suntan?
No……
Yes, a light tan……
Yes, a moderate tan……
Yes, a dark tan……
Yes, a very dark tan……

27. Thinking about the last 12 months have you done any of the following (mark all that apply)

- Used a solarium (tanning bed)……
- Attempted to get a tan through outdoor sun exposure……
- Used a sunless tanning cream (fake tan) or spray tan……

28. This summer, how many times did you have a red or painful sunburn that lasted a day or more?

_____(write the number of sunburns)

The following questions ask you to circle your response in a particular setting this summer. Please circle your answer for each setting.

For example:

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely (Sometimes) Often Always	Never (Rarely) Sometimes Often Always	Never Rarely Sometimes (Often) Always	Never Rarely (Sometimes) Often Always

29. When you were outside on a warm sunny day this summer, how often did you usually do the following: Please **circle** your answer.

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Wear sunscreen	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a hat	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Stay in the shade	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a shirt with sleeves that covers your shoulders	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear long pants/skirt that cover your legs to at least your knees	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear sunglasses	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Spend most of the time inside during peak UV hours (11am-3pm) in the middle of the day	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

30. When you were outside on a warm sunny day this summer, how often did you usually do the following: Please **circle** your answer.

	when at SCHOOL during summer	on the WEEKEND during summer	during the SUMMER HOLIDAYS	during SUMMER in general
Spend time in the sun in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear a reduced SPF sunscreen, oil or lotion in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Delay applying sun protection in order to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear brief clothing so as to get some sun on your skin	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always
Wear no sun protection at all in order to get a tan	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always	Never Rarely Sometimes Often Always

Below are some questions about your future behaviour. Please circle your answer.

31. The following ask about how strongly you agree or disagree with a written statement. Please read the statement and **circle** you answer.

I plan to use sunscreen regularly.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use a sunscreen with an SPF of at least 15 on my face.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use a sunscreen with an SPF of at least 15 on my body.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use sunscreen on my face if/when I sunbathe	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to always use sunscreen on my face when I do any outdoor activity	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on my face on a daily basis.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on all exposed areas of my body if/when I sunbathe.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to use sunscreen on all exposed areas of my body when I do any outdoor activity.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

I plan to use sunscreen on all exposed areas of my body on a daily basis.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to reapply my sunscreen often if/when I sunbathe.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear a wide-brimmed hat when I do any outdoor activity.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to seek out shady areas when I have to be outdoors	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to avoid being outdoors between the hours of 11 AM and 3 PM whenever possible.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear shirts with long sleeves when I have to be outdoors between 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear long pants when I have to be outdoors between 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to try to avoid going to the beach between the hours of 11 AM and 3 PM.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to seek out shade (e.g., bring an umbrella) when I go to the beach.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I plan to wear a wide-brimmed hat when I go to the beach.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

Below are some questions about your opinions. Please circle your answer.

32. We are interested in your opinions. Please read the statement and **circle** you answer.

I am too young to spend much time thinking that I might get wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I don't need to worry about getting wrinkles and age spots until I am much older.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear long sleeves or long pants while in the sun during summer months because it would be too hot.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I have more self-confidence when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I don't spend enough time in the sun to be concerned about getting wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
The possibility of getting wrinkles and age spots worries me.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I think I look healthier when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Hanging around the pool or at the beach with friends on a sunny, summer day is just too nice to pass up.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Using sunscreen regularly is just too much trouble.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear long sleeves or long pants while in the sun during summer months because it would prevent me from getting “some colour.”	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because I often am rushed or don’t have time	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
The older I get, the more I think about the possibility of getting wrinkles and age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

I would not use sunscreen regularly because I like to be tanned.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use a wide-brimmed (4 inches) hat because it would not look good on me.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Whenever I see a friend or relative who has a lot of wrinkles or age spots, it makes me realize that I could get them too.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because it is too messy.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not use sunscreen regularly because it is too greasy.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I feel more attractive when I have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
No matter what I do, I don't think it is likely that I am going to have many wrinkles or age spots.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It is very important to me to have a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
I would not wear a wide-brimmed (4 inches) hat while at the beach or in the sun because it would be too hot.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Most people look better with a tan.	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Sunscreens are not in a place that is easy to get to when I need them	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
Most of my CLOSE FRIENDS think that a suntan is a good thing	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

33. The following ask if you think you <u>can do</u> a particular behaviour. Please rate how confident you are that you could *really* get yourself to do each of the things listed consistently. Please read the statement and circle you answer.

	Certain I could NOT do			I probably could NOT do		I probably could do				Certain I could do
Use sunscreen while in the sun even if I already have a base tan.	1	2	3	4	5	6	7	8	9	10
Use sunscreen while in the sun even though other people I am with are not using it.	1	2	3	4	5	6	7	8	9	10
Use sunscreen while in the sun even when I am feeling pale.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if I am going out that night and want to be tanned.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if my friends tell me that I look healthier with a tan.	1	2	3	4	5	6	7	8	9	10
Use sunscreen even if people tell me that I don't need it.	1	2	3	4	5	6	7	8	9	10
Stay out of the sun between 11am and 3pm	1	2	3	4	5	6	7	8	9	10
Wear a long sleeve shirt or long pants when it is sunny and warm outside	1	2	3	4	5	6	7	8	9	10
Seek out shady areas when I have to be outdoors	1	2	3	4	5	6	7	8	9	10
Wear a wide brimmed hat when I have to be outdoors	1	2	3	4	5	6	7	8	9	10

34. The following ask about how strongly you agree or disagree with a written statement. Please read the statement and **circle** you answer.

If I sit in the shade or stay inside between 10am and 3pm my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will make fun of me if I wear a hat all the time outside	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I wear a long sleeve shirt or long pants on a sunny summer day, my friends will think I am weird	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
My friends will think I am weird if I wear sunscreen	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
It would be terrible to look older than I really am due to too much sun exposure	Strongly disagree	Disagree	Not sure	Agree	Strongly agree
If I regularly protect myself from the sun I can avoid age spots and wrinkles	Strongly disagree	Disagree	Not sure	Agree	Strongly agree

35. During the past three months have you seen or heard any messages in your local community targeting teenagers and encouraging them to do things to improve their health?

Yes……◯

No……◯

(If yes)What were these messages about?

_____

36. During the past three months have you seen or heard any messages in your local community targeting teenagers that were about looking after their skin?

Yes……◯

No……◯

(If yes) What were these messages about?

_____

37. During the past three months have you seen or heard any messages in school about teenagers looking after their skin?

Yes……◯

No……◯

(If yes) What were these messages about?

_____

38. During the past three months, have you learned anything new about the effects of the sun on the health or appearance of your skin?

Yes……◯

No……◯

(If yes) What did you learn?

_____

39.What reminds you to reapply sunscreen or use other sun protection menthods when you are out in the sun?

_____

40. Finally, do you know of anyone, either a family member or a friend, who has had skin cancer at any time?

Yes, family member…◯

Yes, friend……◯

No……◯

Thank you for your participation!