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Process evaluation of a school- and home-based sun safety education intervention

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Process Evaluation of a School- and Home-based Sun Safety Education Intervention

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ABSTRACT

Effective interventions that reduce children's sun exposure are likely to reduce melanoma incidence in the longer term. However, for such interventions to have an impact they must be adequately implemented. School-based sun protection programs have been evaluated to determine their effectiveness in changing behaviours, however, few studies have assessed the implementation of such programs, or the effect of their implementation on outcomes.

Kidskin was a five-year intervention trial designed to assess the effectiveness of a multi-component intervention in reducing sun exposure in children in Perth, Western Australia. This thesis describes the process evaluation of the school- and home-based educational components of Kidskin's intervention. This process evaluation incorporated data from 873 students, their parents and teachers in Years 1 to 4 at the 19 intervention schools involved in the larger Kidskin study.

Schools were assigned to either a high or moderate intervention group. In each of the four intervention years both intervention groups received the Kidskin educational program that incorporated teacher pre-training, four or six, 40-minute classroom-based sun safety learning activities, plus accompanying extension and home-based activities. The high intervention group received additional components, including a mail-out summer holiday program, cost-price sun-protective swimwear and assistance for schools to develop sun protective policies and environments.

Process evaluation instruments developed and administered during the four years of program implementation included a teacher pre-implementation questionnaire, a teacher self-report program checklist, student work sample assessment and a parent/student questionnaire addressing implementation of the summer holiday intervention. Student baseline data were assessed in 1995, and the process evaluation assessed the effect of level of program dose delivered by teachers over the four years of implementation on outcomes evaluated at post-test in 1999. Outcomes included student sun-related behaviours, suntanning and naevus development.

Teacher self-report and work sample evidence indicated teachers taught, on average, 66% of program components in Year 1, 78% in Year 2, 79% in Year 3 and 71% in Year 4. Each student was assigned high, medium or low level cumulative program dose scores based on the summed intervention dose received from his/her teacher each year.

Multivariate analyses indicated no dose effect on type of swimwear worn, hat usage, sunscreen use on the back, or time spent outside between 11 am and 2 pm. A high level of program dose during Years 1 to 3 was associated with increased back coverage, shade use and sunscreen use on the face and arms at post-test in 1999 compared to a low program dose. In the first two years of the program a high program dose was also related to increased back coverage and shade use compared to a medium program dose.

Dose had no impact on tanning on the back, but a high level of program dose during the first three years of the program was related to reduced tanning on the forearm at post-test compared to a low program dose. There was no relationship between dose and naevi on the back, although a medium program dose in Year 1 and Years 1 to 4 was related to fewer naevi on the face and chest respectively, than a low program dose. A high cumulative program dose in the first three years of the intervention was associated with fewer naevi on the arms at post-test than a low dose.

Therefore, higher levels of program dose, generally lead to more positive outcomes, with the most consistent effects being found for sun protection of the arms. Further dissemination should encourage implementation over most of the school year to maximise intervention implementation, particularly to children aged 5 to 8 years when the program appeared to have the most consistent effect on outcomes.

However, in spite of the relatively high levels of teacher implementation reported in this study, improvements in student outcomes overall were only moderate, indicating that classroom dose alone may not be sufficient to elicit long-term changes in sun protection. Enhancement of the existing socio-ecological components of the intervention, including parental and community involvement, and policy and environmental adaptations may be required to further enhance student outcomes. Future dissemination of Kidskin should incorporate school-level capacity building to enable the maintenance of high levels of

teacher and parent program implementation and further develop the socio-ecological components of the intervention to maximise program effectiveness.

DECLARATION

I certify that this thesis does not, to the best of my knowledge and belief:

(i) incorporate without acknowledgement any materials previously submitted for a degree or diploma in any institution of higher education;

(ii) contain any material previously published or written by another person except where due reference is made in the text; or

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I also grant permission for the library at Edith Cowan University to make duplicate copies of my thesis as required.

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Robyn Johnston

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1. INTRODUCTION

1.1 STATEMENT OF THE PROBLEM

Skin cancer is a leading cause of morbidity and mortality in Australia [1]. Most skin cancers are caused by over exposure to the sun's ultra violet (UV) radiation [2, 3], with sun exposure during childhood being particularly important in the development of skin cancer in adults [3-6]. Therefore, well-designed interventions to reduce sun exposure in childhood should be effective in reducing the long-term incidence of skin cancer [7].

School-based education programs have been shown to be effective in changing sun protection knowledge, attitudes and behaviours [7, 8]. Involving families in health promotion interventions for children has also been recommended to improve program effectiveness [7, 9-21]. However, such school- and home-based interventions can only be effective if they are adequately implemented.

While a number of school-based sun safety education programs have been evaluated in terms of their impact on behavioural outcomes [22-33], little in the way of process evaluation has been conducted to assess program implementation and how this may have influenced these program outcomes.

Process evaluation measures the quality and quantity of delivery (implementation) of a program [34-37]. Without process evaluation of program implementation, evaluators have limited information about how much of the program was used and by whom, which components of the program were used and whether they were used as planned. This is important in a large intervention trial such as Kidskin to ensure the program being evaluated has, in fact, been implemented. Failure to do so can lead to invalid assumptions about the program's effectiveness [38]. Additionally, knowing the processes that led to the observed outcomes can assist in the development of more effective and parsimonious health promotion programs.

Process evaluation can also be used to assess the extent to which the level of implementation (dose) affected the outcomes of the program ie. whether there was a

'dose-response relationship' [34, 39, 40]. A positive dose-response relationship can strengthen the construct validity of a study's results by providing evidence that the observed outcomes occurred as a result of the intervention and were not the result of external factors [41].

Information on the amount and type of intervention required to facilitate sun-related behaviour change is vital for health promotion practitioners who must allocate limited resources to such health promotion programs. Information on program implementation can assist practitioners to develop strategies and allocate resources to maximise participation accordingly.

1.2 SIGNIFICANCE OF THE STUDY

The purpose of this study is to evaluate the implementation of a sun safety education program developed as part of the larger Kidskin Project. Kidskin assessed the effectiveness of a multi-component intervention in reducing sun exposure in children in Perth, Western Australia. This thesis will detail the process evaluation of that intervention, in particular the implementation of the school- and home-based educational components of the Kidskin intervention.

The Kidskin program school- and home-based intervention was delivered over four years and incorporated classroom curricula and other socio-environmental components. It is based on theories of education and health behaviour change. The program materials are appropriate for most metropolitan primary schools in WA, and the Cancer Council of Western Australia has supported their state-wide dissemination based on outcomes from the Kidskin study. To date, there have been no other primary school-based skin cancer prevention programs developed in this state and no coordination of dissemination of such programs to primary schools. This study provides an excellent opportunity to develop and evaluate a health promotion resource for which there is a demand from schools and local agencies.

Key to this thesis is the measurement of the process of implementation of the Kidskin educational intervention in primary schools. It will, therefore, provide valuable information on how the program was used by the target group and how this influenced

student outcomes. Such information can be used to build our understanding of effective methods of introducing health education and health promotion activities into schools.

As well as the school-based intervention, the Kidskin program incorporates a home-based 'booster' intervention delivered during the summer school holidays, when children's sun exposure is likely to be high. This home-based, holiday intervention is a unique method of reinforcing health messages, involving parents in the program and providing behavioural cues to action. Its use will be explored in this study.

1.3 OBJECTIVES OF THE STUDY

The Kidskin study was a seven-year (1995 – 2001) school- and home-based intervention trial conducted with a cohort of 1776 children in Perth, Western Australia, commencing when they were in Year 1, aged five to six years. The aim of Kidskin was to design, implement and evaluate an intervention to reduce sun exposure in young children. The work described in this doctoral thesis forms part of this larger study.

The objectives of the larger Kidskin study were:

1. To measure the extent to which a school-based intervention designed to reduce sun exposure and increase sun protection behaviours prevents the appearance of new naevi.
2. To measure the impact on the levels of sun exposure and sun protection practices of a school-based intervention designed to reduce sun exposure and increase sun protection behaviours.
3. To determine whether the intervention components were implemented as planned, adapted or omitted by classroom teachers.
4. To determine whether there is a dose-response relationship between the fidelity of program implementation and study outcomes.
5. To determine whether school sun safe policies were enforced.
6. To show that counting naevi is an appropriate way to evaluate sun-protection programs.
7. To develop accurate, cheap methods for counting naevi in longitudinal surveys.

Objectives One and Two were the subject of a doctoral dissertation by another student (Elizabeth Milne) completed in 2001 [42]. These results and methods will be referenced throughout this dissertation as sections of these data comprise the outcome data against which program dose is evaluated in this thesis.

This doctoral research relates to Objectives Three and Four of the Kidskin study. These objectives comprise the process evaluation of the Kidskin educational intervention. The aims of this process evaluation were to evaluate the quality and quantity of teacher implementation of Kidskin's school- and home-based sun safety education program and the effect of this implementation dose on student sun-related outcomes.

The specific objectives of this doctoral study are as follows:

1. Determine the dose of the Kidskin classroom and home intervention delivered to students.

2. Determine the association between the level of dose of the Kidskin classroom and home intervention and student sun-related behaviours, level of tanning and number of naevi (moles) at post-test in 1999.

1.4 RESEARCH HYPOTHESES

The research hypotheses address Objective Two of this study, described above. The research hypotheses addressing this objective are divided into hypotheses addressing:

- the relationship between implementation dose level and student behavioural outcomes;
- the relationship between implementation dose level and student tanning outcomes, and;
- the relationship between implementation dose level and student naevi outcomes.

These hypotheses are listed below.

Hypotheses addressing the effect of level of program dose on student sun-related behaviours

Hypothesis One

H_0: There is no association between the level of dose of the intervention in Year 1 and student sun-related behaviours at post-test in 1999.

H_1: There is an association between the level of dose of the intervention in Year 1 and student sun-related behaviours at post-test in 1999.

Hypothesis Two

H_0: There is no association between the level of cumulative dose of the intervention in Years 1 and 2 and student sun-related behaviours at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1 and 2 and student sun-related behaviours at post-test in 1999.

Hypothesis Three

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and student sun-related behaviours at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and student sun-related behaviours at post-test in 1999.

Hypothesis Four

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and student sun-related behaviours at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and student sun-related behaviours at post-test in 1999.

Hypotheses addressing the effect of level of program dose on student suntanning

Hypothesis Five

H_0: There is no association between the level of dose of the intervention in Year 1 and student level of tan at post-test in 1999.

H_1: There is an association between the level of dose of the intervention in Year 1 and student level of tan at post-test in 1999.

Hypothesis Six

H_0: There is no association between the level of cumulative dose of the intervention in Years 1 and 2 and student level of tan at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1 and 2 and student level of tan at post-test in 1999.

Hypothesis Seven

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and student level of tan at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and student level of tan at post-test in 1999.

Hypothesis Eight

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and student level of tan at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and student level of tan at post-test in 1999.

Hypotheses addressing the effect of level of program dose on the number of naevi students developed

Hypothesis Nine

H_0: There is no association between the level of dose of the intervention in Year 1 and students' number of naevi on the back at post-test in 1999.

H_1: There is an association between the level of dose of the intervention in Year 1 and students number of naevi on the back at post-test in 1999.

Hypothesis Ten

H_0: There is no association between the level of cumulative dose of the intervention in Years 1 and 2 and students' number of naevi on the back at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1 and 2 and students' number of naevi on the back at post-test in 1999.

Hypothesis Eleven

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and students' number of naevi on the back at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2 and 3 and students' number of naevi on the back at post-test in 1999.

Hypothesis Twelve

H_0: There is no association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and students' number of naevi on the back at post-test in 1999.

H_1: There is an association between the level of cumulative dose of the intervention in Years 1, 2, 3 and 4 and students' number of naevi on the back at post-test in 1999.

1.5 STATEMENT OF PARTICIPATION

As stated in Section 1.3, this doctoral study formed part of the larger Kidskin intervention trial. The doctoral candidate (RJ) was employed as part of the multi-disciplinary team that designed and coordinated the study. Three team members acted as project coordinators, each having sole responsibility for certain tasks, and sharing responsibility for other tasks. Tasks for which this doctoral candidate had sole responsibility (in consultation with the project's Chief Investigators) included:

- Design of the process evaluation of the Kidskin educational intervention;
- Conducting formative research and interviews to guide the development of the Kidskin educational interventions;
- Writing and coordinating the design of the Kidskin school- and home-based educational intervention for Years 1-4;

- Development, coordination and conduct of the Kidskin in-service training for teachers of Years 1-4;
- Writing, coordinating the design, and distribution of the Kidskin summer holiday intervention for Years 1-4;
- Development of the teacher and parent process evaluation instruments;
- Collection of teacher and parent data via process evaluation instruments;
- Analysis of teacher and parent process evaluation data and its association with student outcome data.

Tasks in which this doctoral candidate participated with other members of the project team included:

- Project coordination;
- Liaison with schools, teachers and parents;
- Collection of student baseline and post-test one outcome data at schools.

Funding for the Kidskin intervention trial had been granted prior to the doctoral candidate (RJ) joining the project. Therefore, a number of study decisions were made before candidacy for this dissertation commenced (eg. sample size calculations). Further, some between-group analyses of student outcome data were completed as part of the first doctoral dissertation from Kidskin (the grant required two PhD fellowships). Some of these data will be presented to explain methods used in the current research. In the methods section of this dissertation the candidate will indicate clearly what is and is not her work.

One paper has been published by the doctoral candidate (RJ) based on the formative development and content of the Kidskin educational interventions and initial teacher use of and satisfaction with these materials [(43)]. However, this paper did not discuss the final results of this dissertation.

1.6 DEFINITION OF TERMS

Dose-response relationship – this term was borrowed from drug-trial terminology to describe the effect that changes in the amount of exposure to an intervention (dose) will have on a specified outcome measure (response).

Implementation quality / fidelity – Measurement of the degree to which an intervention was delivered as planned or described by its developers. Also referred to as program integrity.

Implementation dose - Measurement of the number or proportion of intervention activities or components utilised. Also referred to as program **quantity / completeness**.

Kidskin – is the larger intervention trial in which the effect of the Kidskin intervention between a comparison group and two intervention groups was assessed.

Kidskin classroom- and home-based intervention – educational intervention delivered to students in Years 1 through 4 of primary school. This intervention comprised teacher-led classroom lessons and take-home activities for students to complete with their parents/families during school term time.

Naevus – a brown to black pigmented macule or papule of any size that is darker in colour than the surrounding skin (a mole) [(44)].

Process evaluation – an evaluation designed to document the delivery of an intervention and to determine the degree to which the program was implemented as planned by its designers. Process evaluation measures: which program activities were delivered and when; which program participants received the intervention and how much they received; and satisfaction with the program [(45)].

Program implementation – the component of a process evaluation that determines the amount of the intervention that was delivered ('completeness') and the degree to which the intervention was delivered as planned or as written in the intervention guide ('fidelity' or 'quality').

Skin reflectance – skin colour measurement assessed using a reflectance spectrophotometer.

Suntan – darkening of natural skin pigmentation due to exposure to ultra violet radiation.

Totally Cool Summer Club – Kidskin's summer holiday 'booster' educational intervention distributed to students in the high intervention group. Distributed to students at school just prior to the long summer holidays and mailed to their home/holiday address during the holiday period.

UVR – Ultra violet radiation.

2. REVIEW OF RELATED LITERATURE

This literature review examines factors relevant to the process evaluation of a school- and home-based sun safety intervention. It is divided into three parts. The first is a review of the relevant skin cancer prevention literature. The importance of skin cancer as a public health issue and factors associated with sun exposure in children is addressed. Children's sun safety education programs, including a discussion of the larger Kidskin study, its results, and the findings of other previously evaluated programs are reviewed. Parental involvement in health education and sun protection programs is also discussed.

The second part of this chapter reviews the use of process evaluation to measure implementation of school-based health education programs. This section discusses the structure and content of such evaluations, as well as methods used to collect process data and the validity of these measures. Previous studies assessing the impact of program implementation on student outcomes are also reviewed.

Thirdly, this chapter reviews issues and processes related to the formative development of the Kidskin educational intervention. This section describes the steps taken in the formative evaluation and the theoretical basis for the intervention and reviews structures associated with effective curricula and features influencing implementation.

2.1 SKIN CANCER PREVENTION

2.1.1 SKIN CANCER AND SUN EXPOSURE

An important public health issue

Skin cancer is a major threat to public health in this country with Australians experiencing the highest rates of this form of cancer in the world [1, 46]. Melanoma is the fourth most common cancer in Australian males (excluding non-melanoma skin cancers) and the third most common in females [1]. Melanoma killed over 1000 people in Australia in 2001 and was ranked fifth among cancers in terms of potential years of life lost [1].

Exposure to solar ultra violet radiation (UVR) is a key risk factor in the aetiology of melanoma and non-melanoma skin cancer in white populations [2] [3]. The amount of sun exposure received in childhood appears to be particularly important [3-6]. Case-control studies have shown the amount of time spent outside during childhood and adolescence to be linked to an individual's lifetime risk of developing melanoma [5, 47]. Studies of migrants to Australia provide further evidence that childhood sun exposure is an important skin cancer risk factor, with immigrants who arrived during childhood being at greater risk than those who arrived later in life [48, 49].

Reducing UVR exposure may, therefore, considerably reduce the risk for melanoma and non-melanoma skin cancer [5, 7]. Interventions effective in achieving a reduction in sun exposure could relieve a considerable burden on the health of individuals and our health care system [50]. Such interventions are likely to have the most benefit if they involve young children and as such they are an important target population for preventive efforts [51].

Sun exposure in children

The majority of lifetime sun exposure occurs during childhood and adolescence with children receiving approximately three times the sun exposure of adults [52]. This is due to a combination of factors such as school scheduling of break times [53], higher levels of participation in organised sport by children and adolescents, greater amounts of leisure time during childhood, and long annual school holidays during the summer period.

Community-wide skin cancer risk-reduction programs, which have been running in Australia since the 1980s [53, 54] appear to have increased children's awareness and level of sun protection [55]. However, Australian children's levels of sun exposure are still sufficiently high to cause concern [56-60]. In a national survey of Australian school students in grades 7-12 (aged12-17 years), over two-thirds reported they had been sunburnt during the previous summer [59]. Dixon et al. [58] surveyed 735 primary school children in Victoria, Australia and found that over half the children in the study had been burnt over an eight week period, although most were not severe burns.

Girgis et al. [22] assessed 648 Year 5 and 6 students' solar protection during school break times using self-report diaries. Only 21% of students were found to have a high level of sun protection (where a high level equalled >75% of the body protected by clothing or shade).

Younger children appear to be more amenable to changing to more sun protective behaviours than adolescents. Foot et al. [61] surveyed beachgoers and found that children aged between 0 and 9 years tended to be more protected from the sun than older children. Gillespie et al. [62] found primary students were more likely than older students to report wearing hats the last time they were in the sun. Similar results were reported by Schofield et al. [57] who observed student behaviours at 40 primary and secondary schools and found 13% of primary students wore hats compared to 0% of secondary students. Lowe et al. [59] also found that students' self reported levels of sun protection decreased from age 12 to age 17.

Summary

Australia has the highest rates of skin cancer in the world. An important risk factor for skin cancer in adults is sun exposure during childhood. This is of concern as levels of sun exposure are high among Australian children. Therefore, to be most effective, interventions to reduce UVR exposure should include children. Effective interventions to reduce sun exposure in children can contribute substantially to public health in this country.

2.1.2 SCHOOL AND HOME-BASED SUN SAFETY EDUCATION

Schools as a setting for sun safety education

Schools, as a social environment in which children spend much of their day, can play an important role in promoting health [63]. Schools routinely reach the majority of children and their families [63, 64] and are a setting which is an established environment for encouraging learning with the structures and resources in place for educating and informing. Schools are ideally placed to facilitate health-related learning via their curricula and policies, through the modelling and reinforcement of positive health behaviours, and via influence on community norms [63]. School policies and environments, the services they provide and their links with parents and the wider

community can all reinforce and enable actions to promote health [64]. Schools have therefore been recognised as a useful setting in which to address sun protection for children [53, 55, 65].

Most children spend a considerable proportion of their first two decades at school during the hours spanning the middle of the day when solar UVR is at its strongest [8]. Thus, schools can potentially have a major influence on children's sun exposure and future risk of developing skin cancer [22, 57]. This influence may be exerted at three levels: via school sun protection policies; through shade provision in the school grounds; and via the educational curriculum [8, 22, 57]. Additionally, links with students' families and the local government and community can support health behaviours [66].

However, the amount of time spent on sun safety teaching in school settings may be limited. Schofield et al. [57] surveyed 77 school principals in NSW and found that while most of the primary schools delivered some formal sun safety education (73%), the median time spent on this issue was only 45 minutes per year for Years K-2, and 60 minutes per year for Years 3-6.

In Western Australia, at the time this study commenced, sun safety was incorporated in the Health Education K-10 Syllabus but comprised less than 2% of the total content for lower primary school aged students [67]. Furthermore, there are no statutory requirements for teachers to teach all aspects of this syllabus. Few other prepared resources to assist junior primary teachers to teach sun protection strategies in the classroom were available. Since that time, The Department of Education and Training in Western Australia has moved toward an outcomes-based curriculum framework which guides the curriculum by specifying key learning outcomes for a range of learning areas, including Health and Physical Education [68]. This resource, however, does not provide teachers with individual activities or resources to assist them to teach specific health-related topics such as sun safety and is still supported by the Health Education K-10 Syllabus.

A sun protection education program can accompany and support policy and environmental change. Most primary schools in WA have "No hat, no play in the sun" policies operating for part or all of the school year and shade provision in WA schools is increasing slightly due to a program of building covered assembly areas [69]. Thus,

sun safety may also be addressed within an extracurricular context when children are informed, or reminded of policies and appropriate places to play. However, the duration of these policies, their stringency with regard to type of hat worn and the extent to which they are enforced varies from school to school and is not always optimal [57, 70]. For example, the SunSmart Schools program conducted by the Cancer Council of Western Australia, requires participating schools to meet minimum standards with regard to sun protection which include having and enforcing an appropriate sun protection policy. However, only about 10% of schools in WA currently participate in this program (personal communication 20/7/06, P. Flinn, SunSmart Schools Coordinator, Cancer Council of WA) indicating the enforcement and expansion of sun protection policies is not a priority in many schools.

Schofield et al. [57] found primary school-aged children participated in outdoor activities for an average of 7.5 hours per week during school hours. About 85% of these outdoor activities occurred between 11 am and 3 pm when solar UVR was at its strongest. However, none of the schools studied had a policy regarding the timetabling of outdoor activities to avoid the "highest-risk" times of the day and few had policies regarding the provision of shade for students.

Traditionally, health education in schools, including sun protection education, has taken the form of a single didactic presentation by a visiting health professional. Evaluations of health promotion interventions on a range of health topics, including sun safety [22, 23, 55], have indicated this approach is generally not effective in eliciting behaviour change. Longer-term, interactive approaches that are theory-driven and incorporate affective and skills-based activities, as well as whole-school policy and structural and other socio-environmental changes, are generally required to achieve sustained health-related behaviour change [23, 71]. A number of more extensive sun protection education programs, incorporating some or all of these elements, have been developed during the last two decades, however, only a few have evaluated their level of implementation or effectiveness in changing behaviours.

2.1.3 SHORT DURATION SCHOOL-BASED SUN SAFETY INTERVENTIONS

A number of short duration programs have been developed for use in primary schools, incorporating a variety of teaching modes [24-26, 72-76]. These programs are detailed in Table 2.1.

'Sunny Days, Healthy Ways', a condensed, one-lesson version of the multi-unit 'Sunshine and Skin Health' program [27], was evaluated to determine the effectiveness of this lesson compared to an interactive sun safety fair and a no intervention condition [24]. While both interventions increased student knowledge scores, the classroom curriculum had a slightly greater effect. Neither intervention changed behavioural intentions. Further, the single classroom lesson intervention was less effective in changing students' attitudes to sun protection than the original, more intensive, 5-unit program on which it was based [24]. While this study assessed the feasibility of the program and differences in the interventions, the small sample size (three schools – one per study condition) limits the generalisability of the results.

LaBat et al. [25] evaluated a two-part intervention program for grade 5 and 6 students, including a single classroom lesson and a 20-minute program delivered to groups of children at a local fair. Brief pre- and post-test (one week later) surveys were completed by 1047 students to assess knowledge and intentions to use sun protection. Positive changes in knowledge, decrease desirability of a tan and positive changes in intention to use sunscreen, clothing and shade as sun protection were recorded. While this study indicates the feasibility of using a fair-type setting to impart sun safety information, the results measured only intentions, not actual behaviours and the lack of a control group limits the validity of the findings.

The impact of the "Sun Cool" sun safety education program on 145 Year 7 students was assessed at one secondary school in the UK [74]. The intervention was delivered by a health visitor with classroom teacher support and used a video addressing attitudes to sunbathing and skin cancer, a student workbook and a leaflet to impart sun safety messages. Assessment via student questionnaire indicated improved knowledge and attitudes in the intervention group over the control group. While this study supports the findings of Hughes et al [77], who evaluated this program with older students, and controls for variability in implementation by using a trained implementer to teach all

lessons, its small sample size limits the generalisability of the findings. Further, there may have been contamination between study groups as all classes attended one school.

The effect of a children's book encouraging sun protection and awareness was evaluated with a sample of 82 Grade 3 (eight year old) students [75]. The story incorporated the use of a UV sensitive badge as a tool to promote understanding of UV light. Student questionnaires administered at pre and two post-tests showed a significant increase in sun protection knowledge at the first post-test which was still present at post-test two, six weeks later. While the gains in knowledge were retained over time, the lack of control group limits the degree to which the change can be attributed to the intervention. The authors also acknowledge the difficulty of accurately assessing the frequency of sunscreen use via self report in children so young.

Vitols and Oates [78] compared the effect on knowledge of a 30 to 40 minute formal presentation versus a similar length informal question and answer session about sun safety. They found little difference between approaches except in the youngest age group for whom the formal approach was more effective. This may reflect that younger children are more readily influenced by authority figures such as teachers than are older children [78]. Levels of knowledge were found to be high prior to the intervention (79% correct responses), reflecting the high level of exposure of Australian children to sun safety messages. The large sample size (n=983 at five schools) used in this study supports the external validity of the results, however the dose provided by the intervention was very low and the effect of improvements in knowledge on sun related behaviours is uncertain.

The effect of a program where medical students presented interactive sun awareness talks to Grade 4 (aged 9-10 years) students was evaluated in seven randomly selected schools in Ontario [26]. The intervention included one hour pre-training for the medical students, a standard package of slides, discussion guidelines and incentives such as stickers, and pamphlets. The school students also completed a sun safety awareness book the week before the presentation. Responses showed a significant increase in knowledge and self-reported use of sun protection immediately after the presentation and at a second post-test one month later, although intent to improve sun protection was greater than actual behaviour change. As with several of the previous studies, the

intervention dose was low. The lack of control group threatens the internal validity of this study and it relies on students' self-reported intent to change, rather than on actual changes in behaviour.

Hewitt et al. [76] assessed the effect of a 20-minute computer program addressing sun protection, or an equivalent workbook-based activity on 10-11 year old students sun-related knowledge, attitudes and behavioural intentions. Knowledge increased in all study groups, however only the students in the workbook group had significantly greater sun related knowledge than the control group. Students from both intervention groups attained more positive sun-related attitudes and behavioural intentions than those in the control group, however the computer program appeared no more effective than the workbook. This study provided a useful examination of the feasibility of using a computer format to deliver sun safety messages, however, did not directly assess the effect of the programs on behaviours, relying on student report of behavioural intention. The dose administered was very low (20 minute activity) and the duration of these students' behavioural intentions was not assessed beyond six weeks.

These programs show the feasibility of teaching a low-dose sun safety intervention in primary and secondary schools and most have been effective in improving student sun safety knowledge, and in some cases attitudes and self reported behaviours. However, the long-term effects of these brief interventions were not assessed and are likely to be limited in terms of behaviour change [7]. Further, a number of features of some the study designs such as small sample size, lack of randomisation, no control group, possible contamination between classes in different study groups, low program dose and reliance on self-report of behaviours may limit the validity of their findings. Level of program implementation was not reported for any of these studies.

Table 2.1 - Overview of school-based sun safety education interventions - short duration/low dose programs for primary school-aged children

Study details	**Study design**	**Sample**	**Intervention**	**School Year (age group)**	**Who administered intervention**	**Implement-ation/process assessed**	**Outcomes measured**	**Reported significant effects of intervention**
Loescher et al. 1995 [24]	No information on randomisation; pre-post test; control group	n=318 at 3 schools	Intervention 1 – 'Sunny Days Healthy Ways' – condensed to 1 lesson plus teacher training Intervention 2 – sun safety fair.	Grade 4 (aged 8-9)	Teachers and Dermatologists	No	Knowledge, attitudes, self-report behaviours	Yes (knowledge) No effect on attitudes or behaviours
La Bat et al. 1996 [25]	No information on randomisation, pre-post test; no control group	n=1047	1 x classroom lesson and 1 x interactive outdoor field experience (health fair style)	Grades 5 and 6	Teachers and Researchers	Yes, health fair sessions observed	Knowledge, attitudes, self-report behaviours	Yes (knowledge, attitudes and self-report behaviours)
Syson-Nibbs 1996 [74]	Randomised by class; control grp	n=145 at 1 school	'Sun Cool' – 1 lesson (video, workbook & leaflet)	Grade 7 (aged 11-12 years)	School nurse	-	Knowledge, attitudes	Yes (knowledge & some attitudes)
Thornton and Piacquadio 1996 [75]	No information on randomisation; pre-test and 2 x post-tests; no control group	n=82 at 1 school	1 x classroom lesson reading educational picture book 'A Day With Ray' and question time	Grade 3 (aged 8 years)	-	Yes, assessed student opinion of intervention materials	Knowledge, immediately and 6 week after implementation	Yes (knowledge)
Vitols and Oates 1997 [78]	Not randomised; pre-post test; no control group	n=983 at 5 schools	Formal skin cancer presentation or informal question and answer session	Grade 3-6 (age 8-12 years)	-	No	Knowledge, behavioural intentions	No difference between groups except for youngest where formal lecture more effective
Gooderham and Guenther 1999 [26]	7 schools randomly selected from group of 35; no control group	n=244 at 7 schools	1 x slide presentation plus activity book (completed one week beforehand)	Grade 4 (aged 9-10 years)	Medical students and teachers	-	Knowledge, self-report behaviour immediately and 4 weeks later	Yes (knowledge and self-report behaviours)
Hewitt et al. 2001 [76]	15 schools randomly assigned to intervention (n=11) or control (n=4)	n=376 at 15 schools	20 minute sun safety computer program or equivalent sun safety workbook	Grades 5-6 (aged 10-11 years)	Teachers	No	Knowledge, attitudes, behavioural intentions after 1 day and 6 weeks	Yes, knowledge, attitudes behavioural intentions increased in intervention group

- No information provided

2.1.4 LONGER DURATION SCHOOL-BASED SUN SAFETY EDUCATION INTERVENTIONS

Health programs using longer-term, multiple-component interventions have generally been found to be more effective in changing student behaviours [71]. A review of such longer duration school-based sun protection programs for younger children is provided below and in Table 2.2. This review is limited to the more recently evaluated (from 1992) school-based programs for pre-school, primary school and middle school aged children as these represent a similar age range to the Kidskin target population. This section will begin with a review of the larger Kidskin intervention study. Following this, programs assessing non-behavioural outcomes, then behavioural outcomes will be addressed chronologically.

Overview of the larger Kidskin study

The process evaluation described in this thesis forms part of the evaluation of the larger Kidskin Project evaluation study. The design and evaluation of this larger study have been described previously [43, 70, 79-85]. Kidskin was a non-randomised, 7-year, sun protection intervention trial involving a cohort of 1776 children recruited from primary schools in the Perth metropolitan area of Western Australia. Students in the study cohort were tracked from 1995 when they were in Year 1 (aged 5 or 6 years) until 2001 when they were in Year 7. Outcome data were collected in years 1, 3, 5 and 7 of the study [85]. The aims of the trial were to design, implement and evaluate an intervention to reduce sun exposure in children [80]. Schools were assigned to one of three groups – a control group, a moderate intervention group or a high intervention group. The control group received the standard Western Australian Department of Education and Training health education curriculum (which included several sun safety education activities) while the intervention groups received the four-year Kidskin sun safety intervention from 1995 to 1999. Students and their families at high intervention schools were also mailed a school holiday 'booster program' addressing sun protection over these four-years [43]. These intervention components are described in more detail in Chapter 3 of this thesis. High intervention schools also received additional support to make sun protective policy and environmental changes and students at these schools had the opportunity to purchase cost-price sun protective swimwear prior to summer [70, 80].

The key outcome measures were the number of naevi on the back, face, arms and chest, level of tanning on the back and arms, and students' sun protective behaviours over summer [80]. Melanocytic naevi were used in the larger Kidskin study as the main outcome measure assessing the effectiveness of the Kidskin intervention to provide a more objective measure of sun exposure than self-report of behaviours [80].

Melanocytic naevi are a major risk factor for the development of melanoma [86]. They are highly related to an individual's past sun exposure [44, 87, 88] and, unlike melanomas, are common in children from a relatively early age [44, 87]. Reducing the number of naevi children develop may decrease their risk of developing melanoma in adulthood [89].

Two other studies have used naevi to assess intervention effects in children [89, 90]. One showed no effect following the implementation of a three-year community based program on the development of naevi [91] in 311 Australian children aged 5-7 years in 11 pair-matched country towns [90]. The other, a Canadian study of 309 children aged 6-10 years, found children whose parents received a three-year intervention providing them with high SPF sunscreen at the start of summer developed fewer naevi than control group children [89].

A number of constitutional factors are related to the development of naevi, including gender, southern European ethnicity, hair colour, constitutional skin colour, level of freckling, ability to burn, and tendency to tan [44]. Parental education has been shown to be associated with children's sun exposure [92]. The Kidskin study assessed these variables at baseline and they were adjusted for in analyses, along with observer variables and variables related to timing of observations [93]. The three study groups were similar at baseline except for parent education level, southern European ethnicity and level of sun exposure, which was highest in the high intervention group [80].

In 1997, after two years of the Kidskin intervention, students in the intervention groups, and particularly the high intervention group, were less tanned at the end of summer than control group students [84]. Intervention group students also had lower levels of sun exposure according to parent report than the control group [84]. Children in the intervention groups were also significantly more likely to wear sun protective swimwear, were more likely to have their back covered when outside, and spent more

time in the shade when outdoors than those in the control group [83]. There appeared to be no effect of the intervention on hat wearing or sunscreen use when outside at this mid-point evaluation [83].

Post-test 2 was conducted at the end of summer in 1999 after four years of the Kidskin intervention. Results indicated the positive effect of the intervention was still apparent at this time, although it appeared to have weakened. Students in the high intervention group reportedly spent significantly less time outdoors between 11am and 2pm when UV radiation is at its strongest, however control and intervention groups were similar in terms of level of tanning on the back and forearm [85]. Students in the intervention groups were significantly more likely than those in the control group to have their back covered all the time when outside and high intervention group students were more likely to have worn sun protective swimwear, although the between group differences were smaller than in 1997 [85]. In 1999, students in the intervention groups were no more likely than control group students to use shade, wear a hat all the time or wear sunscreen all the time when outside [85].

Data on the number of naevi students developed on the face, arms, back and chest were also collected in winter 1999 [91]. Although students in the intervention groups tended to have fewer naevi at each body site, these differences were not statistically significant. The differences between the moderate and high intervention groups were also not significant [91].

A final post-test was conducted in 2001, three years after the conclusion of the intervention when the cohort were in their final year of primary school. Differences between groups were seen for the number of naevi on the trunk only [81]. Boys in the intervention groups had developed fewer naevi on the chest than those in the control group. A similar pattern was seen for naevi on the backs of boys, but not for girls. The number of naevi students developed on the face and arms was similar across the three groups at this time point [81].

There were also few differences between groups in terms of sun protective behaviours and tanning by the 2001 post-test. Level of tanning and time spent outdoors were similar across the three study groups. Students in each study group were no more likely

than control group students to have their back covered all the time when outside, wear sun protective swimwear or a hat, or remain in the shade at least half the time when outside. Intervention groups students were more likely than controls to use sunscreen on their back in 2001, but no more likely to wear it on their face or arms [85].

Therefore, the results indicate that the Kidskin program was effective in encouraging sun protective measures and reducing sun exposure and tanning, at least initially, however benefits tapered off over time. The program may also have had some effect on reducing the number of naevi on the trunks of boys but did not significantly reduce the development of naevi on other body sites or in girls.

A number of possible reasons for the null effect on naevi, in spite of the relatively positive behavioural outcomes at post-test in 1999 and also reductions in tanning at midterm in 1997 [83, 84] have been postulated by Milne et al. 2002 [91] and English et al 2006 [94].

Firstly, naevi may not be sensitive indicators of sun exposure and any effect of the Kidskin intervention on reducing sun exposure may not have been large enough to lead to reductions in naevi. This may be particularly true in an Australian population where levels of knowledge of sun protection are already relatively high [95], and improvements in the intervention groups relative to the control group were likely to have been more limited [91, 94].

The intervention may have not commenced at a young enough age to have impacted on naevi development [91]. However, another study found an effect with an older cohort aged 6-7 and 9-10 years [89].

It was also hypothesized that insufficient time was allowed with a five year project to see the impact of protective behaviours on development of naevi [91]. However, results of other studies [89, 96] indicated a two or three year development time between sun exposure and naevi development.

The null effects on naevi at post-test in 1999, in spite of reductions in sun exposure, may indicate that other factors, such as childhood sunburn, were more important in

naevi development. Baseline data on sunburn were not collected, therefore it was not possible to know if differences at post test were due to the intervention [91].

Further, insufficient dose of the Kidskin intervention may have led to null results. The process evaluation data reported in this thesis will provide further information about the intervention and its implementation which can support and help to explain these outcome study findings.

The Kidskin study included a large sample size, a control group and obtained both pre- and post-test data, however the non-randomised design is a limitation of this study and may have been a source of bias [97]. Additionally assessment of behavioural outcomes relied on parent recall of their child's behaviours which may have been subject to social desirability bias. However, objective data on suntanning supported patterns of parent report indicating social desirability bias may not have had a large effect on results.

Review of other longer duration school-based sun safety education interventions

Evaluations of sun protection curricula for schools have generally assessed their effectiveness in terms of behaviour change, although several examined only changes in knowledge and attitudes [72, 73].

For example, the effects on knowledge of a program using peer education methods to educate students about sun safety was assessed by Fork et al [72]. Seven Grade 3 and 5 students were given a one-hour didactic presentation about skin cancer prevention and then spent five, one-hour sessions developing sun safety activities which they then delivered to nine Grade 1 students. A significant increase in sun protection knowledge from pre- and post-test, was recorded for students in both year one and the higher grades. While this pilot study indicates peer teaching methods may be useful in increasing sun safety knowledge, the small sample size and lack of a control group limits the generalisability and validity of the results.

Another study [73] piloted the resource "Living With Sunshine" in 2 primary schools in three provinces of Canada. Teachers and students in Grades 1 - 3 at one school served as controls while students at the second school completed three activities from the

program. Sun safety knowledge was assessed using drawing-related tasks and individual interviews with 243 students. Knowledge levels were high in both groups, but significantly higher in the intervention group. However, the post-test only design of this study means it is difficult to determine the amount of change in knowledge directly attributable to the intervention. As schools were not randomly assigned to intervention or control groups, biases may have occurred and the generalisability of the results may be limited. No information about teacher implementation of the activities in this program was reported.

Multi-unit sun safety programs in primary schools have been shown to be effective in improving children's sun related behaviours, as well as knowledge and attitudes. Girgis et al. [22] evaluated different sun protection programs using a randomised, controlled trial with 648 children in Years 5 and 6 (ages 9-11 years) at 11 primary schools in NSW. Schools were randomly assigned to an intensive intervention group, a standard intervention group or a control group. The intensive intervention group received "Skin Safe", a four-week, teacher-delivered, program which aimed to increase students' knowledge, attitudes and skills to reduce their risk of skin cancer. The program used cross-curricular, experiential and problem solving activities to increase student awareness and self-efficacy related to sun protection. Students in the standard intervention group received a 30 minute didactic lecture on skin cancer prevention by a representative of the NSW Cancer Council while students in the control group received no intervention.

Student skin cancer and sun protection knowledge and attitudes were assessed via questionnaire and levels of solar protection were assessed via a self-report diary. This diary had previously been validated using direct observation of students by trained observers [22]. At post-test one, five weeks after the pre-test, students who received the Skin Safe curriculum were more than twice as likely as those in the control group to report use of high levels of sun protection. These results were sustained at post-test two, eight months after the pre-test, with students who received the Skin Safe intervention three times more likely to have reported using a high level of sun protection than the controls. There was no difference between students in the standard intervention and control groups at either post-test.

This larger study used a robust randomised controlled design, and assessed both baseline and post-test data. The use of a validated measure of student behaviours increases the internal validity of the findings of this study, however the assessment of implementation of the intervention was not reported.

Buller et al. [27] evaluated the feasibility of using a school-based sun protection intervention with 139 students in Grades 4 to 6 at two U.S. primary schools randomly assigned to intervention or control group. Questionnaires to assess student sun safety knowledge, attitudes and behaviours were administered prior to the intervention and at post-test on completion of the program and again eight weeks later. The intervention, a cross-curricular program entitled 'Sunshine and Skin Health,' aimed to improve students' knowledge and skills in sun protection, engender positive attitudes and develop environments supportive to sun protection. The program comprised a two-hour teacher in-service, five units containing teacher instructions, classroom- and home-based activities, a review activity and a student/parent newsletter.

Students who received the curriculum had significantly improved sun protection knowledge and more negative attitudes to tanning at both post- tests than students at the control school [27]. Intervention students also reported increases in preventive behaviours, including requests for and use of sunscreen and lip balm, use of sunscreen in winter, more frequent wearing of protective clothing when in the sun in summer, and less frequent sun bathing. However, not all of these behaviours were present at the second post-test and there was a variation in behaviours reported by students in Grades 4, 5 and 6. The authors concluded that more persistent changes in behaviour may be seen with programs which: commence at an earlier age and continue throughout elementary school; are supported by whole school sun protection activities; and have further parent involvement [27]. The small sample size used in this study is a limitation to the external validity of the results and as this evaluation relied on students' self-reported behaviours, the data obtained may be biased due to the social desirability of certain responses. While the implementation of this program was not assessed, the use of teacher training prior to implementation may have increased the likelihood that the activities were implemented as planned.

Loescher et al. [98] evaluated a sun safety education curriculum for pre-school students to determine its effect on sun protection knowledge, understanding and application. Pre-school classes at 12 schools were randomly assigned to either the intervention group (six classes) or control group (six classes). Trained interviewers pre- and post-tested the sun safety cognition of 142 children across both groups using an age-appropriate pictorial questionnaire. The "Be Sun Safe" curriculum was taught by research assistants to each intervention class during three 45-50 minute sessions on three consecutive days. The curriculum emphasised the importance of covering up, finding shade and asking for sun safe protection, and included teacher background information, take-home activities and interactive classroom activities.

Post-tests were conducted two and seven weeks after pre-test. Students who received the curriculum had significantly higher sun safety knowledge and comprehension at both post-tests. There was no significant difference in the control and intervention groups' ability to apply/transfer the sun safety concepts learned in one situation into another.

There were a number of limitations of this study. The sample size was small and the young age of the subjects (four and five years) limited the cognitive tasks they were able to complete and the design of tools to evaluate the curriculum. Additionally, the authors reported the reliability of the student instrument as being low even though students appeared to understand the questions being asked. There were no direct observations of student behaviours, so it is uncertain whether a lack of application of sun safety knowledge in the test setting was related to a lack of sun safe behaviour by the child in a natural setting. Trained research assistants taught the program, so implementation was likely to be similar across classes, however, whether this was assessed was not reported.

Buller et al. [28] assessed the effect of the 'Sunny Days, Healthy Ways' curriculum on the knowledge, attitudes and sun protective behaviour of 447 students in Grades 4 to 6 at four schools in Arizona. The curriculum comprised five, fifty-minute cross-curricular lessons taught over five weeks in spring by classroom teachers, trained to use the materials. Each lesson included classroom and take-home activities and a student/parent newsletter.

A Solomon Four-Group design [221] was used such that half the students received a pre-test and half did not, and half completed a post-test immediately after the intervention and half completed it eight weeks later. Students' knowledge, attitudes and self-reported sun protection behaviours were assessed using a self-administered questionnaire, while level of sun tanning was assessed using a Chroma Meter to measure skin colour.

The curriculum was effective in increasing students' term recognition and knowledge about the effects of the sun and methods of sun protection. Intervention group students showed significantly more favourable attitudes to sun protection at the eight-week post-test, but not at the immediate post-test. Intervention group students were also significantly less tanned at eight weeks post-intervention than control group students as assessed by a Chroma Meter. Student self-reported behaviours showed more variable results. Intervention group students reported less sunbathing and more use of sun protective clothing in winter than control students. Students who weren't pre-tested reported more frequent use of sunscreens and used higher SPF sunscreens. However, overall the intervention had no significant main effect on students' self-reported sun protection behaviour. The Chroma Meter results, suggest self-report methods may lack validity with children of this age.

This study supports findings from previous studies of school-based health curricula that multi-component, comprehensive programs are required to influence health related behaviours. While limitations to this study include low participation rates (62%) and no accounting for clustering effects within classrooms and schools, the study design attempts to address several threats to validity common to the studies previously mentioned. The use of the Chroma Meter to measure tanning addresses issues of bias or inaccuracy that may arise from student self-report of sun related behaviours. Further, the delayed post-test may have allowed longer-term changes from the intervention to be detected.

While teacher interviews about the program were conducted, the results of these interviews and levels of program implementation were not reported.

Hoffman et al. [23] assessed the effects of a school-based sun safety program on Grade 5 students' knowledge and attitudes regarding sun exposure, and their use of sunscreen. The intervention was conducted over three, 50-minute lessons on three consecutive days and comprised both didactic and interactive student components.

Eight classes at two schools participated in the study and assignment to study group (n=99) or control group (n=82) was by school and not randomised. Sun safety knowledge, attitudes, intentions to use sunscreen and self-reported sunscreen use were assessed using a self-administered pre-test, post-test questionnaire.

At post-test, students who received the intervention showed significantly greater sun-related knowledge, greater intention to wear sunscreen and increased self-reported use of sunscreen than the control group students. There was no significant change in attitudes attributable to the program.

While the results of this study were positive, they rely on students' self-report of behaviour and the lack of randomisation of schools to study group may have affected internal validity. The key focus of the evaluation was sunscreen use and the effect of the intervention on other sun protective behaviours was not assessed. No evaluation was made of the level of implementation of program components or activities.

Lowe et al. [99] used a randomised control trial to determine the effectiveness of a three-year, multi-unit sun safety intervention for junior high school students in Queensland. Twenty-six schools from two regions were pair matched then randomised to either the intervention or control group. All students in Grade 8 (n=3730) at the start of the study were eligible to participate. Students' sun protection knowledge and attitudes were assessed via self-administered questionnaire and sun related behaviours were monitored using a Sun Protection Behaviour Index (SPBI) developed from behaviours reported via a two-day retrospective diary. Teacher implementation of the program was also assessed via teacher post-test, self-administered questionnaires, brief one-page surveys completed at the end of each lesson and lesson observations by trained observers.

The intervention comprised three skin cancer prevention units, delivered to students in early summer each year as they moved through Years 8, 9 and 10. Each year, the

intervention included a minimum of four, 50-minute classroom lessons plus two optional lessons. Health and Physical Education teachers received a full-day training on the materials prior to implementing them. The intervention incorporated interactive activities and skill-development techniques to address individual, social, and environmental factors related to sun protection.

As with the previous studies, the greatest changes were seen in student knowledge, with the intervention having a lesser effect on behaviours. In Years 8 and 9, the intervention group students obtained significantly higher knowledge scores than control group students and in terms of attitudes were more likely to show 'concern about minor skin damage' than controls [99]. In Year 8, the intervention group students also obtained significantly higher SPBI scores than control students, however, this was not maintained throughout Years 9 and 10.

A process evaluation was conducted via teacher self-report surveys to collect quantitative and qualitative use and satisfaction data [100]. At least two observations per school per year were conducted by trained observers [100] and results indicated that in each year teachers completed all components of the lesson plan about 95% of the time [99]. The use of observational methods increases the validity of these findings. Teacher satisfaction with the intervention was positive. Information on the total number of lessons observed, or the proportion of lessons completed by teachers was not reported.

These implementation results suggest the positive findings were attributable to the intervention. Given the high levels of teacher implementation of this classroom intervention, the authors concluded that expanded structural and community support may be required to elicit a significant change in student behaviours [99].

Grant-Petersson et al. [101] assessed the educational component of the larger SunSafe project in New Hampshire delivered to primary schools and child-care/pre-school centres. Teachers were asked to deliver a minimum of two classroom lessons or conduct two theme days on sun safety during the year. While this is not an extensive intervention, the larger project supplemented this with community-based interventions delivered at local beaches and through primary health care providers. In-service training and discussions with the school nurse and principal were included, as well as pre-

planned sun protection activities for teachers. The impact of the program on student knowledge and attitudes was assessed via pre-post test surveys with Grade 4 students. Students in the intervention group had more positive sun protection knowledge and attitudes than those in the control group at post-test. Changes in behaviours were not assessed, however, a follow up of this study by Dietrich et al [102] used observation of children's sun protection behaviour at the beach and found intervention group children were more likely to use sunscreen on the back and to use at least one sun protection measure compared to control group children.

Implementation of the educational intervention in schools and childcare centres was assessed via policy surveys completed by principals and teacher report of use of the materials and satisfaction with the activities. Eighty one percent of teachers reported using the materials, whereas only 22% of teachers indicated they had taught sun safety the previous year. Intervention group teachers spent an average of three hours teaching the program. Just over half the teachers used the lesson plans provided and about a third of teachers created their own supplemental activities. Between 60% and 75% of teachers used other program resources. Ninety percent planned to implement the program the following year. In year two of the study, only 20% of teachers and 60% of child care teachers used the pre-prepared lesson plans, with teachers developing their own materials into the teaching units. Further, teachers tended to spend more time, an average of four hours per teacher, implementing sun protection activities in this year [101].

This study is an example of the effective adoption of a sun protection program, and the inclusion of process evaluation data in the study indicates that the sun safety program was taught in schools. The use of a randomised control trial with a large sample size increased the internal and external validity of the findings, however, a limitation to this evaluation is the reliance on teacher self report, which may have been influenced by recall or social desirability bias. Also, given that many teachers did not use the intervention materials as planned, and particularly in the second year of implementation, adapted the materials extensively, it is difficult to determine what components of the educational intervention were effective, or what teachers actually taught. However, Rogers [103] stated that the easier it is to adapt an innovation or program to specific

needs, the more likely it is to be adopted. This may be reflected in the increased time spent on sun safety in year two of the program.

Another sun safety education program evaluated in terms of implementation as well as student outcomes for a formative evaluation was the 'Safe in the Sun' curriculum [104]. The program comprised a teacher manual of classroom activities and a video with student and teacher components. Student pre-test via 'draw and write' survey [105] took place at the beginning of summer and post-test occurred after the summer school holidays. Both tests were completed by 998 students in 43 classes. The intervention group was assigned based on teacher implementation of the program and ranged from teachers who used the video and some teaching material activities (n=10), through teachers who taught their own sun related activities with (n=5) or without the video (n=9), to teachers who only used the video (n=2), to teachers who did not use any program activities (n=17). Teacher interviews revealed 60% of teachers used some components of the program [104]. Students in classes where teachers used the program materials as planned by the designers tended to have better knowledge and awareness of sun protection compared with other levels of implementation. Teachers indicated they found the materials suitable for their students, however they were less likely to be used by Year 5 teachers than those of the younger grades.

This study assessed the relationship between degree of implementation dose/fidelity and student knowledge outcomes, however, did not assess the program's effect on behavioural outcomes. The lack of randomisation to intervention group is a limitation of this study, however the reported implementation provided useful information about teacher use of the intervention in a 'real world' setting [104].

SunWise is a sun safety education program distributed nationally in the U.S. by the Environmental Protection Authority. Schools register to participate in the program which includes cross-curricular classroom activities for teachers to choose to implement with children in Kindergarten through Grade 8, a support website and a SunWise awards program for schools [29]. Cross sectional surveys were conducted with over 5000 students in all grades at schools across the U.S. randomly selected from those registered for the program, and 1285 students in Grades 4 and 5 at control schools in one school district [29]. Students who received the intervention scored better on knowledge items

related to sun protection from hats, shirts and sunscreens and use of the UV index at post-test. They also had more negative attitudes to tanning. These changes were particularly seen in younger children in the 5-9 age group [29]. There was no increase in knowledge or attitudes for control school students and intentions to play in the shade decreased in this group [29].

Implementation of SunWise by teachers was not reported in the process evaluation, however, 90% of the 320 teachers who completed assessments (53% response rate) indicated their satisfaction with program materials was 'high' or 'very high' [29]. Nearly one third implemented whole-school sun protection activities and 12% adapted school policies on sun protection.

While the results indicate the program was effective in improving sun protection knowledge, attitudes and behaviours, the use of self report measures is a limitation of this study, as with a number of the others previously mentioned. Further, there was no randomisation to study condition and the control group participants were all recruited from schools in one school district so results may not be generalisable to participants in other areas. Schools in the intervention group had all previously registered to use the SunWise materials, therefore self-selection bias is likely to have influenced the findings. Implementation of the program was not assessed so the study results are at risk from Type III error [135].

Buller et al. [30] evaluated the Sunny Days Healthy Ways curriculum developed for middle school children in Grades 6-8. Children from 30 schools (n=2038 students) were assessed in a pair-matched, group-randomised, controlled trial via pre- and post-test surveys and diary reports of sun protective behaviours. The intervention comprised teacher training and a kit outlining six, 50-minute sessions containing activities addressing key sun protection skills, goal setting and monitoring, building self efficacy and overcoming barriers to sun protection. Skin colour measures were used on a sample of about 10% of children to assess the validity of the self report measures [30]. Children who received the program were more knowledgeable about sun protection, had less positive attitudes to tanning, perceived fewer barriers to sunscreen use and believed they were more able to protect themselves from the sun than control group students. They were also more likely to use sunscreen and clothing for sun protection at lunchtime and

report more frequent use of sun protection as assessed by a composite sun protection measure. Reported improvements in behaviours were associated with less redness and tanning as measured by colorimeter, indicating the self report data were valid [30]. This robust study provides good evidence that school-based sun protection programs can lead to behaviour change in middle school-aged students. However, the findings are limited by a lack of measurement of program implementation.

Summary

This review was limited to recently evaluated (post 1992) school-delivered programs for children of pre-school, primary school and middle school ages. Single lesson programs appear to have limited effect on behavioural outcomes. Of those longer duration school-based sun protection education programs that have been evaluated, several were assessed only in terms of changes in knowledge and attitudes [72, 73, 104]. A number of programs have been evaluated to determine their effect on sun-related behaviours and while many of these studies relied on student self-report [23, 24, 27, 29] a number of studies attempted to validate this measure using observations and/or biomedical markers [22] [28, 30, 99, 102]. While several studies reported they assessed implementation [28, 29, 99, 101, 104], only a few of these reported the results obtained in detail [101, 104] and only one included a dose-response analyses for these implementation data [104].

The Kidskin program is unique in that it is a longitudinal, multi-component, multiple unit intervention addressing school- and home-based components. It used a rigorous study design and both self-report and biomedical assessment of program outcomes. The documentation of the process evaluation assessing, use, satisfaction and dose-response analyses is the subject of this thesis.

Table 2.2 - Overview of school-based sun safety education interventions - longer duration programs for pre-primary, primary and middle school-aged children

Study Details	Study Design	Sample	Intervention	School Year (Age Group)	Who Administered Intervention	Implement-ation/process assessed	Outcomes Measured	Significant Positive Effects of Intervention
Fork 1992 [72]	One group pre-post test	n=16 at 1 school	1 hour lecture / video; 5 hours peer training & activities for Yr 1 children	Grades 1 and 3-5 (aged 5 - 10 years)	Researcher	-	Knowledge	Yes
Girgis et al. 1993 [22]	Randomised (by school) controlled trial; pre-post test	n=612 at 11 schools	Intensive intervention 'Skin Safe' - 4 week, interactive, cross-curricular program Standard intervention - 30 min lecture	Grades 5 and 6 (aged 9-11 years)	Teachers (intensive int.) Cancer Council educ. Officer (standard int.)	No	Knowledge, attitudes, behaviours (validated diary)	Yes (behaviours) in intensive intervention group only
Buller et al. 1994 [27]	Randomised (by school) controlled trial; pre-post-test	n=139 at 2 schools	'Sunshine and Skin Health' – 5 unit, interactive, cross-curricular, program, including take-home activities & teacher training	Grades 4-6 (aged 8-11)	Teachers	No	Knowledge, attitudes, self-report behaviours immediately after implementation and 8 weeks later	Yes (knowledge, attitudes & some behaviours)
Hughes 1994 [73]	Non-randomised, post-test only; control group	n=243 at 2 schools	'Living With Sunshine' (pilot version) - 3 classroom lessons	Grades 1-3 (aged 6-8 years)	Teachers	No	Knowledge	Yes
Loescher et al. 1995 [98]	Randomised (by school) intervention-control; pre-post test	n=142 at 12 schools	3 x 50 min interactive lessons	Pre-school (aged 4-5 years)	Researcher	-	Knowledge, comprehension & application	Yes (knowledge & comprehension) No effect on application
Buller et al. 1996 [28]	Randomised (by school and class within school); quasi-experimental 2x2x2 Solomon four-group design	n=447 in 24 classes at 4 schools	'Sunny Days, Healthy Ways'- 5 x 50 min multidisciplinary units with teacher training. Each unit contained in-class activities, take-home activities, a glossary of terms, a quick review and a student/parent newsletter	Grades 4, 5 and 6	Teachers	Yes, teacher interviews, but results not reported.	Knowledge, attitudes, self-report behaviours and level of suntanning immediately after implementation and 8 weeks later	Yes (knowledge, attitudes, level of tanning & some behaviours)
Hoffman et al. 1999 [23]	Non-randomised intervention-control; pre-post test	n=181 in 8 classes at 2 schools	3 x 50 min lessons over 3 consecutive days. (Video, discussion, demonstrations, a take-home activity, sunsafe poster/ video development and signing commitment posters)	Grade 5	-	-	Knowledge, attitudes, intention to use sunscreen and self-report sunscreen use	Yes (knowledge, intention to use sunscreen and self-report sunscreen use). No effect on attitudes

- No data provided

Table 2.2 (continued)

Study Details	Study Design	Sample	Intervention	School Year (Age Group)	Who Administered Intervention	Implement-ation/process assessed	Outcomes Measured	Significant Positive Effects of Intervention
Lowe et al. 1999 [99]	3-year randomised (by school) controlled trial; pre-post-test	n=3730 at 26 schools	3-year program. Each year comprises at least 4, 50-minute classroom lessons and 2 optional extension lessons. Student-directed, participatory activities. Teacher training included.	Grades 8, 9 and 10 (aged 13-16 years)	Health/physical education teachers	Yes, via teacher post-test feedback surveys and lesson observations	Knowledge, attitudes, sun-protective behaviours (via 2-day retrospective diary)	Yes (knowledge, some attitudes, short-term behaviour change)
Grant-Petersson et al. 1999[101]	2-year randomised (by community) study control group, student pre-post test in Year 1	n=1077 Year 4 students at 25 primary schools	Head teacher and school nurse meetings and a teacher inservice. Minimum of two classroom lessons (schools) or two theme days (child care) plus reminders, posters and supplementary materials	Children aged 2-9 years	Teachers at primary schools and child care settings	Yes – principal policy surveys; teacher report of activity use and satisfaction	Knowledge and attitudes via year 4 student survey	Yes, (improved knowledge and attitudes in intervention group)
McWhirter et al. 2000 [104]	pre- post-test design; formative study, no control group, comparison group only; non-randomised.	n=998 from 11 primary schools in U.K.	'Safe in the Sun' program – includes a teacher's activity book, video (1 program for children, 1 for teachers). Teachers invited to use the materials as they wished	Children in Grades 1,3 and 5 (aged 5-6, 7-8, 9-10 years)	Primary school classroom teachers	Yes – teacher interviews to assess how materials were used and satisfaction with materials	Knowledge and awareness	Yes, improved knowledge and awareness of sun protection in group with higher fidelity of implemetation
Milne et al. 2002 [91] Milne et al. 2006 [85]	Non-randomised, controlled cohort trial; pre- post-test	n=1623 at 33 schools	'Kidskin intervention' –4-year cross-curricular program of 4-6 units with approx. 4 activities in each year; teacher training; high intervention received booster program during summer holidays	Grades 1-4 (aged 5-9 years	Teachers	Yes, via teacher self-report checklist, work sample assessment and parent/student report	Parent report of child's behaviours; level of tanning; number of naevi developed	Yes, some behaviours, tanning in intervention groups. Change in naevi not significantly different between study groups

- No data provided

Table 2.2 (continued)

Study Details	Study Design	Sample	Intervention	School Year (Age Group)	Who Administered Intervention	Implement-ation/process assessed	Outcomes Measured	Significant Positive Effects of Intervention
Geller et al. 2003 [29]	1-year, randomly selected from self-selected intervention group Student pre- post-test cross-sectional and cohort surveys	n=5625 students from 156 schools in 42 U.S. states	U.S. E.P.A. SunWise School program. 1-2 hours of cross-curricular classroom activities per year; support web-site, SunWise school awards program	Children in Grade K-8 (aged 5-15 years)	Primary and middle school teachers	Yes – teacher surveys on satisfaction , infrastructure improvements, personal sun protection	Knowledge, attitudes, self-report behaviours, behavioural intentions via student survey	Yes (improved knowledge, attitudes, intentions to play in shade in intervention group – cross sectional surveys)
Buller et al. 2006 [30]	3-year, pair-matched group-randomised controlled trial. Student pre-post-test	n=2038 students from 30 U.S. middle schools	Sunny Days, Healthy Ways middle school curriculum; 2-hour teacher training; 6 x 50-minute skills-based lessons	Grades 6-8	Health education and science teachers	Limited, not reported	Knowledge, attitudes self-report behaviours	Yes, improved knowledge, attitudes and self-reported behaviours in intervention group

- No data provided

2.1.5 SUN SAFETY EDUCATION PROGRAMS FOR CHILDREN IN SETTINGS OTHER THAN SCHOOLS

While most sun protection education programs for children have traditionally been delivered through schools, other settings for sun protection education have been used. Several of these studies have incorporated a process evaluation component and these programs will be discussed in this section. An overview of each program is provided in Table 2.3.

Mayer et al. [31] evaluated the effectiveness of an intervention to reduce children's sun exposure, delivered through summer holiday swimming classes. Children aged 6-9 years attending 48 swimming classes at four YMCA's in California (n=169) participated in the study. Swimming classes were randomised into intervention and control groups. The SUNWISE intervention comprised a six-week sun exposure reduction curriculum, comprising four, five-minute lessons delivered at the poolside by swimming class instructors, plus home-based activities for children to complete with their parents. Completed activity sheets were returned to swimming instructors at subsequent lessons. Outcome measures were change in skin colour/tanness, as assessed by a colorimeter and parent self-report of their child's daily and general sun protection behaviours obtained via telephone interview. Solar protection scores were assigned for each body part to give a total body score.

Exposure to the intervention was monitored via swimming lesson attendance records, parent telephone interview report of use of the home activities, and through the collection of children's work sheets. Attendance records showed 89% of students were exposed to at least half the lessons, and 76% were exposed to at least three of the four lessons. Almost all intervention parents (99%) reported receiving the home activity materials, while 92% reported reading at least half the material and 45% reported reading it all. Parent report, however differed from the work sample evidence. While 90% of parents reported their child completed at least half the child activities, only 57% returned work samples for at least half these activities. For family activities, 72% of parents said their family completed at least half the family activities, however, activity forms were received from only 43% of children.

All analyses controlled for clustering at the swimming class level and at post-test no significant differences between groups were found for skin colour/tanness, daily solar protection scores or general sunscreen use. The only significant difference between the two groups was that the intervention group had a higher reported level of general hat use than the control group.

A number of factors may explain the lack of significant differences between the two groups. Firstly the length of the intervention and the length of time between pre- and post- tests were only short – in some cases only one-and-a-half weeks. Further, each intervention session was only three to five minutes long. While this would have allowed knowledge to be imparted, it was likely to have been insufficient time to develop affective- and skills- based activities to facilitate sun protective behaviour change. Information on student attendance was assessed, however no details were given as to whether the implementation of lessons by swimming instructors was monitored. Therefore it is possible variations in implementation may have influenced the results. Rates of exposure to the intervention by children and parents tended to be high. However, the reported high level of use of the home materials was not supported by the work sample evidence. This may have been due to social desirability bias influencing parent responses, or have resulted from difficulties in getting children to return work samples in an informal holiday setting.

Glanz et al. [32] assessed the effect of an intervention to reduce children's sun exposure conducted at five outdoor recreation sites. 'SunSmart' was a four-week skin cancer prevention program for six to eight year old children, their parents and staff at outdoor recreation centres. The intervention included training for staff, group activities and incentives, take-home interactive activity booklets to involve families, brochures provision of sunscreen on site and support for sun-protective environment and policy changes. Evaluation included surveys at baseline and post-test for parents and recreation staff, observations and monitoring of program activities. A cohort of 94 parents (60%) and 30 staff (66%) completed both pre and post tests. Significant improvements were seen in parents' and children's stage of change and parent-reported sun-protective behaviours and sun protection policies. Program implementation was reported to be high, however no further details of its assessment or rates were provided. While the results indicated that the program was feasible and had positive short term

impacts, they should be interpreted with caution due to the relatively small sample size, lack of randomisation, moderate response rates and attrition, and the reliance on parent report of behaviours.

Following on from this field trial, Glanz et al. [33] conducted a randomised dissemination trial of the effects of this program via children's swimming classes at 28 pools in two U.S. states. The Cool Pool program was delivered by pool staff to 5-10 year old children at the start of each swimming lesson and incorporated eight, five-minute lessons. Control pools utilised an equivalent injury prevention intervention. 'Cool Pool' materials provided to staff included a lesson plan, a 'big book' [33] and incentives to reinforce sun protection messages and involve parents. Lessons addressed use of sunscreen, covering exposed skin, protection of the eyes and face, shade use and reducing sun exposure. Interventions to improve sun protection available in the pool environment over the summer were also incorporated, and included provision of sunscreen pump packs, portable shade structures, signage promoting sun protection and a sun protection policy and guidelines booklet for pool managers [33]. Parent surveys were completed by 1010 parents at baseline and 842 parents at follow-up at the end of summer. Parents reported significantly greater use of sunscreen and shade by children in the intervention group than the control group at follow up and the intervention group scored significantly better than the controls on a composite child sun protection habits index. Intervention children were also less likely to have been sunburnt than control group children. There was no significant effect in intervention group children for wearing hats, sunglasses or shirts [33].

Implementation of the program was also assessed via monitoring forms completed by staff and parent report of receipt of materials. Control and Cool Pool lessons were taught by 76% of swimming teachers and 62% reported teaching at least five out of eight lessons. Lessons lasted approximately five minutes on average and student satisfaction with the activities was moderate. Parents were present at approximately 10% of the Cool Pool lessons [33]. About 60% of parents reported their pool delivered the sun safety activities at their child's swimming class and about 66% indicated they received sun protection or injury prevention information. However, results indicated the proportion of students receiving the full sun protection intervention was low due to varied timing/duration of individual children's swimming classes. Dose-response

analyses indicated that children who received two or more sun protection lessons had a better score on the composite sun protection habits index than those who received fewer than two lessons. Improvements in pool environments and policies were also seen at the end of the intervention [33].

The positive results of this study were more pronounced than those of the Sunwise intervention [31] described previously. The use of a randomised controlled design and large sample size supports the validity of the findings, however the reliance on parent and staff self-report of outcomes and implementation was a limitation.

Summary

These studies show that while it is feasible to deliver sun safety education through a recreation or pool setting it is important to ensure sufficient program dose if the program is to be effective in changing children's behaviours and skin characteristics. Such programs, if used to boost sun protection messages received at school to children and families, could be particularly useful in a complementary role, especially during the summer holiday period.

Table 2.3 - Overview of evaluations of non-school-based sun safety education interventions for primary school-aged children that assessed implementation

Study Details	**Study Design**	**Sample**	**Intervention**	**School Year (Age Group)**	**Who Administered Intervention**	**Implement-ation /process assessed**	**Outcomes Measured**	**Significant Positive Effects of Intervention**
Mayer et al. 1997 [31]	Randomised (by class) controlled trial; pre-post-test	n=169 in 48 aquatic classes at 4 pools	4x 5 min lessons plus take-home information and age-appropriate activities for child and family (over 6 weeks)	6-9 year old children	Swimming instructors, parents	Yes (attendance rates, work samples, parent report)	Tanning, parent report of child's sun-protective behaviours	Yes (some sun protective behaviours). No effect on tanning, daily sun protection or sunscreen use
Glanz et al. 1998 [32]	Non-randomised; pre-post-test	n=94 parents and 30 recreation staff	4-week intervention including staff training, on-site children's activities, take-home activities for children and families, incentives, sunscreen provision and policy/environmental support	6-8 year old children, their parents and outdoor recreation staff	Outdoor recreation leaders	Yes, although details not reported	Knowledge, stage of change, parent report of their own and child's sun protection behaviours, sun protection policies	Yes in longitudinal cohort (parent and child stage of change, sun protection behaviours, policies)
Glanz et al. 2002 [33]	1-year randomised controlled trial; pre-post-test	n=1010 children and their parents at 28 pools in 2 U.S. states	(Cool Pool Program) 1-hr training for pool staff; educational components including 8-10, five minute on-site lessons over 2-4 weeks of swimming lessons, teaching materials, incentives, activities to involve parents; environmental components including signage, sunscreen and policy guidelines for pools.	5-10 year old children, their parents and lifeguards, aquatic staff.	Pool staff	Yes, staff completed forms monitoring delivery of program components and participation logs; parent report of participation, materials received, satisfaction	Parent/child knowledge and attitudes, parent report of child's sun protection practices and sunburn experience over summer	Yes – improved parent-reported behaviours and reduction in parent–reported sunburn in children; improved pool policies and environments

2.1.6 INVOLVING FAMILIES IN SUN SAFETY INTERVENTIONS

Why involve parents?

The importance of involving parents in health promotion programs seeking to change children's behaviour [9-15], including sun protection behaviour [7, 16-21, 106], is widely recognised. Social Cognitive Theory (SCT) [107] explains this relationship such that a person's behaviour is determined by expectations about the consequences of their actions and the rewards received for that action. These expectations are based on information gained from the individual's environment, such as the behaviours he/she sees other individuals carrying out. As the family is the key social learning environment for most children [11, 15], it is not surprising that the health behaviours of parents can have a major influence on those of their children. As well as by their behaviours, parents influence their children's health behaviours through the health related attitudes and values they transmit [13].

In addition to serving as the key role models for and reinforcers of their children's behaviours, parents serve as gatekeepers to a number of prerequisites for carrying out health behaviours [10]. Young children usually rely on adults to purchase, or provide access to, items that may affect their health. For example, in the case of skin cancer prevention, children often rely on parents to purchase appropriate clothing, hats and sunscreen, and to make decisions about shade provision at home. Parents also play a key role in making decisions about the type and timing of leisure activities, particularly for younger children.

Parents are also important targets for health promotion for their own health benefits [9]. They are reaching the age where diseases such as cancer may begin to manifest thus increasing their awareness of and susceptibility to these conditions. This may increase their likelihood to act on relevant information provided at this stage and can enable parents to benefit from positive health behaviour changes [22, 108]. Additionally, children can be effective change agents within their family, so introducing sun protection programs with this group may lead to other family members adopting more healthy behaviours [22].

Family-based approaches to sun safety education have been recommended, rather than focusing only on children's sun protection. Several studies of the sun-related

behaviours of parents and children [19, 92, 109] reported that parent use of sun protection was a good predictor of a child's use of sun protection with parents were more likely to use sun protection measures on their child that they used for themselves.

Parent knowledge has tended to have an inconsistent association with sun protection. In several studies knowledge has been positively associated with parents' use of sun protection on their child [92, 110] while other studies showed no relationship [111, 112]. Parental knowledge alone may not be enough to make parents protect their children, however may do so through an association with parent behaviour [19].

The Health Belief Model [108], Social Cognitive Theory [107] and Stages of Change Model [98] have been used to guide studies of parental attitudes to sun exposure and sun protection and their influence on their protection of their children. Perceived benefits and barriers have been found to influence parents' use of sun protection for their child [19, 112, 113] as have perceived susceptibility, self-efficacy [20, 112] and parents' stage of change [19]. One study of parent attitudes to sun exposure in children [110] found parents had a positive attitude to sunscreen use and to tanned skin, but a negative attitude towards sun exposure in children. However, about one-third of respondents believed sun protection was no more important for children than adults. These combined beliefs were seen as a major obstacle to increased sun protection by parents, both for themselves and on their child's behalf.

Mothers may be a particularly important source of contact in children's sun protection. Mermelstein et al. [114] found females tended to have better skin cancer knowledge than men, had greater perceived susceptibility to skin cancer and were more in touch with social norms associated with sun protection.

A cross sectional survey of 205 randomly selected parents of children under 13 years [115] assessed parents' skin cancer knowledge and sun protection behaviours. Parents with high skin cancer knowledge scores were more likely to use sun-protective measures for themselves. However, they were not more likely to protect their children from the sun, nor to believe their children were more susceptible to skin cancer than parents with lower skin cancer knowledge scores. Parents who indicated they used more sun

protection practices themselves were more likely to use sun protection practices with their children.

The sun protection strategies parents indicated they used most often with their children were applying sunscreen and warning them not to get sunburned. Encouraging their children to wear protective clothing and limiting children's sun exposure were less frequently used strategies. Therefore, while parents warned their children against sunburn, they were less likely to give instructions about how to do so, which may limit the effectiveness of this advice with young children.

Parents' sources of sun safety information were also assessed [115]. The most commonly received information was from healthcare providers and family or friends. Parents who received the most information from healthcare providers had higher skin cancer knowledge scores ($r=0.14$, $p<0.10$) and were significantly more likely to use sun protection for themselves ($r=0.13$, $p<0.10$) and their children ($r=0.21$, $p<0.05$). Schools, teachers, day care centres and baby sitters were not commonly used sources of skin cancer information, possibly due to the lack of information provided by them on this topic [115].

These studies indicate parents' knowledge, attitudes and behaviours about sun protection can influence the steps they take to protect their children from the sun and the encouragement they give their children to protect themselves. They support the inclusion of home-based components in a sun protection program to increase the likelihood of parents encouraging and supporting their child's sun protection behaviours.

Strategies used to involve parents - sun safety programs

Several approaches have been used to involve parents in children's sun protection. One approach has been to intervene directly with parents, targeting them with an intervention to assist them to protect their children from the sun. For example, one program used a group session on sun protection incorporating behavioural skills development and experiential learning techniques to significantly improve parents' sun protection attitudes and self-reported behaviours over that of parents who attended a didactic session aimed at improving knowledge of skin cancer facts and behaviours [116]. Other

interventions have used multiple sources of contact with parents through community-wide interventions. For example, Miller et al. [117] aimed a sun protection program at parents of children aged 0 to 13 years where intervention sites included hospitals, child care centres, schools, beaches and sporting programs.

Another method of involving parents has been through the inclusion of home-based components within programs targeting school-aged children. This approach was used in the Kidskin Program, with the inclusion of a summer holiday 'booster' intervention and take-home activities during term time [43] and was found to be associated with some positive sun-protective behaviour changes [85]. Other programs have also provided take-home information and strategies for parents so they could support and reinforce the lessons their children received. Examples of such programs have been discussed in previous sections [27, 31-33, 39, 43, 77, 85, 91].

Take-home packs for parents of younger children at child care have been used to promote sun protection messages. Crane et al. [118] reported an intervention including take-home materials for parents that had no impact on parental sun protection of their children, although there were significant positive effects on child care staff sun safety behaviours. Gritz et al. [119] however, found that an intervention for children and child care centre staff including take-home components for parents (video, newsletters and handbooks) [120] was effective in improving parents' use of hats and particularly sunscreen on their children. Use of a video format utilising parents from the target community may have been more useful in permitting modelling of desirable behaviours and attitudes to sun protection [119] than pamphlets, brochure or tip sheets.

Buller et al. [121] used direct mailouts of printed materials to 804 parents of children aged 5 to 11 years, randomly assigned to intervention group, and found that the style in which sun protection messages were worded in these materials affected parents' behavioural intentions with regard to sun protection for themselves and their children. Messages given in high intensity language that used a deductive logical style (ie. indicated the problem and then a solution) were most effective in increasing parent intentions of protecting their children and themselves in summer. Inductive messages, listing sun-related facts without discussing solutions were more effective in improving behavioural intentions for parents who had no plans to improve sun protection practices before

receiving the program. A follow-up analysis of 568 parents in the winter following the intervention indicated that high intensity, deductive messages were the most effective in improving family sun protection measures over the longer term [122]. The authors concluded that high intensity language may reinforce parents' decisions to use sun protection and that such language did not provoke a negative reaction over the long term. These studies indicate that not only is the content of sun safety interventions important, but also that the style in which the information is delivered may be more effective with some families than with others.

Strategies used to involve parents - other health promotion programs

A variety of strategies to involve parents and family members in school-based health promotion programs have been adopted.

Traditionally parent evenings using a workshop approach have been used to involve parents in school health promotion. While this method has been shown to be successful [12, 116] its usefulness has been limited due to low attendance rates and difficulties in recruitment [10, 12]. There is evidence to support the use of a take-home or correspondence format to deliver health promotion information to children and parents from other areas of health promotion literature [10, 123-130]. Parents have reported preferring such flexible approaches to receiving health promotion information [10, 131] and this format may overcome barriers to participation that may limit participation in onsite educational programs (eg. parent nights) and enhance participation [9, 10, 131]. Barriers may include factors such as time and scheduling requirements, transportation, work and child-care commitments, family privacy issues and financial costs [130, 132-136].

The Child and Adolescent Trial for Cardiovascular Health (CATCH) utilised school- and home-based interventions to improve diet and physical activity levels of students in Grades 3 to 5 in 96 U.S. elementary schools [12]. Intervention schools were randomly allocated to either a 'school-only' program or a 'school plus family' intervention. The aim of the additional family component was to reinforce the concepts and skills taught in the school-based curriculum in the home environment. The family intervention comprised between four and six weekly take-home activity packets for children in each of Grades 3 to 5, plus a 'family fun night' health fair in Grades 3 and 4. The packets contained activities for students to complete at home with their families.

Implementation was monitored through students returning activity cards to school indicating the activities they had completed and attendance at the fun nights.

A student health behaviour questionnaire was administered at baseline and then at the end of each year of the study. A 24-hour dietary recall was recorded for 30 students per school, a self-administered physical activity checklist was given to students in the fifth grade and total cholesterol was measured at baseline and final post-test.

The addition of the family program had no significant effect on any of the physiological measures or behaviours of the students, however it did lead to increases in positive knowledge and attitudes regarding diet and physical activity. Dietary knowledge was the only factor that was significantly greater in the family program than in the school-only program.

This lack of change in behavioural outcomes may have been due to the family intervention being of insufficient intensity to have a significant change on behaviours. Levels of implementation were generally high with an average of over 60% of activity cards being returned, with 80% of students completing at least one activity each year and 36% completing all activities each year. However, differences in response related to gender and ethnicity suggested that the interventions may need to be more specifically tailored to suit different families [(12)].

Perry et al. [(124)] compared a school-based heart health program to an equivalent home-based program. The 15 session, school-based program was delivered to Grade 3 students over five weeks. The home-based program was a five-week correspondence course for Grade 3 students in which parental involvement was required to complete the activities. Eighty-six percent of parents participated in the home-based program and 75% completed the five-week course. Students in the school-based program had greater levels of knowledge gain at the end of the program than students who had received the home-based program. However, students in the home-based program were found to have healthier eating habits than those who had not received this program.

A one-year follow-up study found that those students who had received the home-based program still had healthier eating habits than those who had not received the home-based program, but this difference was no longer significant [10].

Two pilot evaluations of a home-based smoking prevention program by Perry et al. [127] also indicated high participation rates among parents and students using this take-home format. These evaluations focused on use of and satisfaction with the program with Grades 4 to 6 students and their families from a middle class population and Grades 5 and 6 students and their families from a lower middle class, mainly Portugese speaking population. In both studies, program reach was high, with 95.5% and 70% of parents receiving program packets from their children in the two studies respectively.

Petchers et al. [137] found that incorporating a parental involvement component in a heart health curriculum for sixth-Grade students had no effect on student knowledge or behaviours related to cardiovascular disease prevention. The family program consisted of a Health Activity Log which contained information on nutrition, exercise, non-smoking and risk factors for cardiovascular disease and a Health Tips Newsletter which reinforced materials taught in the classroom curriculum. However, no measures of implementation rates for the family program were reported, so it was not possible to determine whether the program was ineffective or inadequately implemented. Additionally, the program commenced when students were 11 years old, by which time health related attitudes and behaviours may be more resistant to change.

The effectiveness of mailed information has been supported in other studies. For example, Newell et al. [123] found written health-related information was more likely to be read if it was mailed, personally addressed, to an individual than if it was given to an individual by a general practitioner. When combined with the greater population coverage possible from mailing information, this method appears to have merit.

Summary

A variety of methods to involve parents in primary school-based health promotion programs have been trialled. While the effect of incorporating family components has been varied, it seems parents are likely to be receptive to mailed materials they can complete at home with their children, rather than those requiring them to attend classes

or workshops. Depending on how their content is structured, however, these materials are likely to be more effective with some parents than with others.

2.2 PROCESS EVALUATION

2.2.1 THE RATIONALE FOR PROCESS EVALUATION

Process evaluation monitors and records the processes associated with program implementation and forms an important component of the cycle of evaluation [35, 38, 41, 45, 138, 139]. In contrast to impact or outcome evaluations, which describe program efficacy or effectiveness and the outcomes it obtained, process evaluation provides information to help explain why a program achieved its outcomes [41, 45, 138-140].

Windsor et al [41] defined process evaluation as an assessment 'designed to document...how well and how much of the assessment and implementation procedures were provided, to whom, when and by whom' (pg 23). Process evaluation assesses the quality and quantity of program implementation, including the extent the program is being delivered and received, whether this delivery is 'as planned' by program developers and the acceptability of the program to the target audience [41, 45, 140, 141]. Process information may be obtained via the collection of qualitative or quantitative data about program components [41] .

The evaluation of program implementation can fulfil a number of functions. Firstly, it can provide 'formative data' [139, p.136] to improve programs by identifying factors that may enhance or impede program implementation and acceptability [141]. This information can be incorporated into successive program activities in an 'iterative process' [139, p. 135] to ensure the program is operating effectively. Secondly, if accountability to funding agencies is required it can provide documentation to verify implementation [38]. Thirdly, implementation evaluation can enhance the internal validity of impact evaluation by ensuring the program being evaluated has been properly implemented [38, 142]. Basch [38] used the term "Type III error" to describe the bias introduced to a study by evaluating an intervention that was not adequately implemented. Implementation evaluation can also provide information for use in 'dose-response' and construct validity analyses [38].

Figure 2.1 illustrates the relationship between formative, process and outcome evaluation and the role of process evaluation in the development and assessment of a new health promotion intervention.

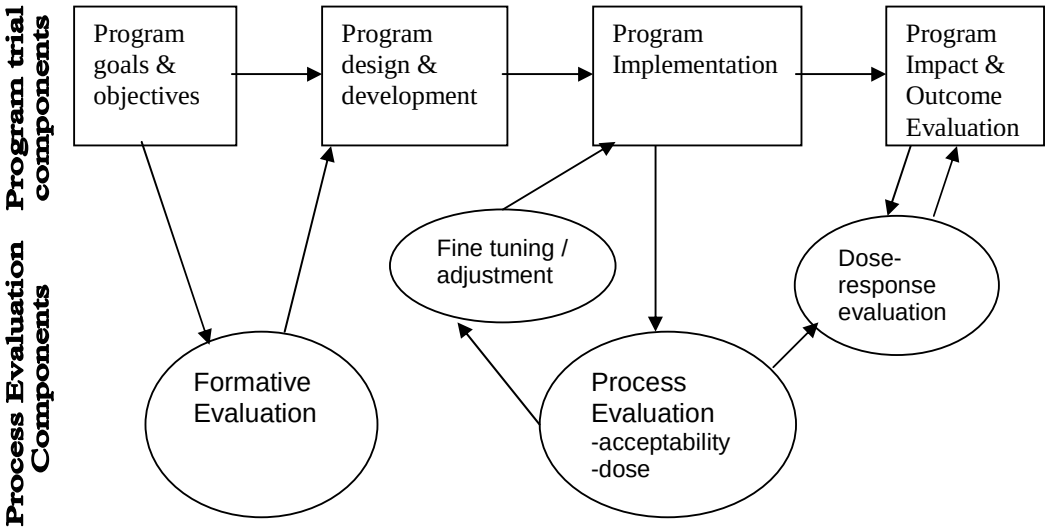

Figure 2.1-The role of process evaluation in the development and trial of a new health program (Adapted from Dignan and Carr [138], pg144)

While the importance of process evaluation of school and community-based health promotion programs has long been acknowledged [38, 41, 143], such process evaluation is not routinely included in evaluations of school-based health promotion interventions. Most studies evaluating health programs have focused on changes in outcome measures, such as knowledge, attitudes and behaviours while there has been more limited evaluation of the processes by which the program achieved (or did not achieve) these outcomes [144]. This may be due to the fact that early evaluations of school-based programs focussed on program efficacy, and were taught or supervised by researchers which tended to minimise variability in implementation. However, the focus of research has turned to assessing more widely disseminated programs in regular classroom settings, where the importance of studying implementation and its influence on outcomes has been recognised [36]. Additionally, over time school-based health promotion programs have become more comprehensive, incorporating environmental, policy and community based components as well as classroom curricula. The value of process evaluation in helping to explain findings on these complex programs has been acknowledged [139, 140].

Until recently there have been few practical guidelines for health promotion researchers to assist in the formulation of process evaluation plans [139, 140] and there appears to be no consensus on the definitions of various components of process evaluations [140] or the most valid methods of collecting data on health program implementation [34, 140]. This is due in part to the necessity of linking measures to the activities and structure of individual interventions and in part to limited research on the reliability and validity of the different methods of evaluating implementation [35].

2.2.2 STRUCTURE AND THEORETICAL BASIS OF PROCESS EVALUATION

As process evaluation becomes more widely utilised in public health research, systematic approaches to planning process evaluations are being developed. Using theory to guide the development of the intervention and its evaluation is a recommended starting point [139, 140]. Roger's Diffusion of Innovations theory [103, 145] provided the framework for the planning of the current process evaluation and guided the formative evaluation to develop the intervention materials. Diffusion of Innovations theory was developed as a means of exploring the processes by which new ideas, activities, inventions or programs (innovations) are communicated (diffused) and then adopted or not adopted by members of a social group [103]. This theory suggests that when exposed to an innovation an individual passes through five stages when deciding whether or not to adopt the innovation. Firstly, knowledge or awareness of the innovation, then through attitude development and persuasion about the innovation. The third step is decision making about whether to adopt or reject the innovation, followed by implementation of the innovation and confirmation of this decision [103].

When used as a guide to planning the process evaluation of a new school-based health education intervention (an innovation), these five stages may be put into practise as questions to be addressed in the evaluation [146] such as those listed in Figure 2.2.

Diffusion Phase	Process Evaluation Questions
Knowledge	Did the intervention reach the target group?
Persuasion	Was the target group satisfied with the intervention?
Decision-making	What factors influenced the use or non-use of the intervention?
Implementation	How much of the intervention was implemented and by whom?
Confirmation	Would the target group use the intervention again?

Figure 2.2 - Diffusion of Innovations Theory as used to guide process evaluation planning (Adapted from Hall, 2000 [146], pg 31)

The planning of a process evaluation should be guided by the intervention itself, including its theoretical basis and its structure and contents [139, 140]. The development of the Kidskin intervention objectives and activities was guided by the theoretical frameworks of Social Cognitive Theory [107] and the Health Belief Model [108, 147]. The process evaluation addressed these theoretical constructs by assigning higher weightings to activities that met more of the theoretically-based program objectives.

A comprehensive description of the program is needed, including its objectives, expected outcomes and program components [139]. This allows 'complete implementation' of different program components to be described, to enable researchers to determine what level of implementation has been achieved [139].

Once the intervention components have been described, a program evaluator must decide which dimensions of program implementation will be assessed. A number of components have been identified as making up a process evaluation [139, 140, 148]. When applied to the process evaluation of a school-based program, these components include the assessment of:

- Recruitment - procedures used to recruit schools and their students, parents and teachers into the study;
- Context – the broader community environment and events that may have influenced school-based program implementation. Also facilitators and barriers within the school organisation;
- Reach – the percentage of schools, students, school staff and parents that took part in the program activities;
- Satisfaction – School, teacher, parent and student satisfaction with the intervention;

- Dose delivered – Completeness of implementation, assessing how many of the program activities were implemented with the target population eg. by teachers to students;
- Dose received – amount of the intervention to which the target population was exposed;
- Fidelity – the quality of implementation in terms of the degree to which the intervention was implemented as planned by the program designers;
- Degree of implementation – a combined score including a combination of any or all of the dose of the intervention delivered, dose received, program reach and implementation fidelity.

Other factors such as teacher-student rapport have also been assessed [34, 36]. Steckler and Linnan [140] recommend that, at a minimum, process evaluations assess program context, reach, dose or quantity delivered and received, and implementation fidelity. The degree to which each of these factors will be evaluated which will be determined by the requirements of key stakeholders, the logistics and structure of the program, the availability of project funding and staff, the availability of assessment tools to evaluate different aspects of implementation, and the level of acceptance of evaluation methods by the target population [139].

For example, Markham et al. highlight that evaluating the dose received by students in school based programs is not simple in practise [149]. While student questionnaires may be used to assess exposure to program activities in older children this is less useful in younger children. Previous studies have provided teachers with attendance lists for each activity to provide accurate information on student exposure [150], however, with more complex programs and large sample sizes, the burden on teachers and researchers managing the data may limit the usefulness of this method.

2.2.3 MEASUREMENT OF IMPLEMENTATION

Implementation of school-based health programs has most commonly been evaluated in terms of its terms of its quantity (completeness, or dose) and its quality (fidelity) [34-37]. A variety of measures have been used to assess implementation in school-based health promotion programs. Dose or quantity has been measured via teacher self-report logs,

checklists or questionnaires [29, 33, 36, 37, 101, 143, 149-156], student report of teacher implementation [157] examination of students' work samples [152], teacher interview [28, 34, 155, 158] and lesson observations [150, 156, 158, 159].

Fidelity of school-based implementation has been measured via self-report logs [37, 38, 153, 156, 160, 161], single lesson observations [158, 162, 163], multiple lesson observations [36, 156, 159, 161] and teacher interviews [34, 104, 155].

Measures used to assess implementation dose of home-based components of health promotion programs, or children's health promotion programs delivered outside the school setting include, recording attendance at family or parent evenings [12, 164], assessing activity logs [12, 32, 33, 124], telephone-based self-report interviews [127] parent report questionnaires [33], parent telephone interviews [31, 150, 158, 159], collection of student work samples or diaries [31, 159], and collection of cards signed by parents to indicate activity completion [12, 150, 155, 156].

Each method of measurement has its own strengths and weaknesses [35] and it has been suggested that a number of criteria be considered when developing or choosing implementation measures [38]:

- the use of multiple measures;
- the inclusion of an operational definition of the program, its components and activities;
- an assessment of reliability and validity of the measure;
- the use of sampling techniques;
- the acceptability of the measure to both the participants who will be providing the data and the agencies who will be utilising the results.

Triangulation of data from multiple measures

It is recommended that implementation studies, to increase their validity, use several sources of data to describe program implementation [38, 159]. The triangulation of data from different sources can permit assessment of the reliability and validity of different measures [34, 165]. Further, different measures may assess different aspects of an intervention and its implementation (eg dose and/or fidelity). The use of multiple measures can provide a more complete picture of teacher implementation [159]. Several

studies have created composite measures of implementation from multiple measures of either dose and fidelity, or observational and self-report data [146, 153, 166, 167]

Individual measures which have been used to obtain implementation data are described in more detail below.

Lesson observations

Observations have been referred to as the 'gold standard' for measurement of fidelity [34, 155], however, their feasibility, for logistic, staffing and cost reasons, is not always high [149, 155]. Further, teachers may find them an intrusion and observations may influence the level or style of implementation [35].

The number of observations used varies between studies. In some cases only a small proportion of lessons per teacher were observed with data from these observations used to generalise about fidelity to the whole curriculum [34, 156, 168] and/or to assess the criterion validity of teacher self report [34, 38, 149, 156]. Other studies have observed all lessons from a program [159]. While this method provides a more precise measure of dose and fidelity it has been used less frequently due to its resource intensive nature.

Teacher self-report logs or surveys

Teacher self-report logs or surveys are the most commonly used method of obtaining data on school-based health program implementation. In a number of studies these have taken the form of a brief log, checklist or survey, indicating activities taught or modifications made [34, 38, 150, 155, 156, 158, 168, 169], which is completed after each lesson to minimise recall bias [170]. Teacher self-report logs, often distributed at the teacher in-service, are cost-effective and can be relatively simple to complete, however, they place the onus of data completion and return on teachers [35]. They have been used to assess both dose and fidelity of implementation, although assessments of the validity of teacher self-report logs have provided variable results [34, 149, 152, 156].

Work sample assessment

The assessment of student work samples has been used to objectively measure program completion and fidelity in an evaluation of the Know Your Body comprehensive school health program [152]. At the completion of program implementation a sample of four

student workbooks were collected per class and the average number of pages completed per class were assessed. This mean score was then ranked into tertile groups to indicate low, moderate or high level implementation. While this may be a more valid measure than teacher self report [152] error may arise due to the loss or non-return of work samples [35]. This method may also be less useful for assessing skills based activities (eg. role plays) that may not include written components and for use with younger children.

Reliability and validity of implementation measures

Reliability of observation data has been assessed by correlating the results of two observers assessing the same lesson. Three studies that assessed inter-observer reliability reported high levels of agreement between observers[34, 36, 168]. Standardised forms and trained observers have been used to maximise reliability of observation measures [34, 171].

Several studies have found discrepancies between teacher reports of completion and other methods of measuring dose [34, 152, 158, 172] however, other studies found teacher reports of dose to be relatively similar to the results of more objective measures [40, 149, 156].

In an evaluation of the Know Your Body comprehensive health program, Resnicow et al. [152] compared teacher year-end self-report ratings of completion to principal and project coordinator ratings of teacher quality and quantity of implementation, and also to students' workbook completion. Project coordinator ratings were found to be more conservative than teacher ratings, resulting in a lower proportion of high implementers. Teacher ratings of completion were less correlated with number of student workbook pages completed (Spearman's rank correlation=0.56) than project coordinators (Spearman's rank correlation=0.68), although more correlated than Principals' ratings (Spearman's rank correlation=0.49). These results indicated that in this study the project coordinator report of implementation was more objective than teacher report.

Teacher logs of activity completion have also been compared to observations of fidelity and teacher interview of completeness as part of the process evaluation of the 'Gimme-5' program designed to increase fruit and vegetable intake in Grades 4 and 5 students [34,

[158]. The program comprised 12, forty to fifty minute lessons in each year, designed to be taught over six weeks by classroom teachers. Data from 69 teachers were assessed to determine implementation of the intervention. According to the teacher self report questionnaire, 90% of activities were completed each year. Observation of one or two lessons annually indicated that teachers taught approximately half the activities each year (51% in Grade 4 and 46% in Grade 5). Teachers were less likely to complete the skills-based activities. Teacher interviews conducted at the end of Grade 5 only gave more similar results to the teacher self report questionnaires. Interviews were coded two ways. According to coding method one ('most' and 'all' coded 'yes') teachers reported teaching 80% of activities. Using the less stringent coding method two ('some', 'most' and 'all' coded 'yes') teachers indicated they completed 91% of activities. Data from 40 teachers were assessed to evaluate the construct validity of the measures. The correlation between self-report log of completion and observed fidelity was low ($r=0.23$). The correlation between the log and a self-report interview measure of completion was higher ($r=0.51$ and $r=0.61$, $p<0.01$). The interview measure was more highly correlated with observed fidelity ($r=0.33$, $p<0.05$) indicating it may have been a more valid measure of dose than the teacher log of completion. However, the authors noted that conducting interviews was more costly than administering teacher logs and the small gains in validity may not justify the increased cost [34].

Markham et al. [149] compared teacher self-report logs of implementation of a sexual health education program for teenagers to observation data of lesson completeness for three lessons from the 22 lesson program. There was agreement between teacher self-report and observer report for 89% of activities from these lessons. There was non-agreement in 12.4% of the activities, with over-reporting in 8.6% of activities and underreporting in 3.8% of activities. This difference was not significant, indicating that teacher self-report was a valid measure of program completeness. The validity of teacher reported program fidelity was not assessed.

Story et al. [156] found teacher reports of completion and fidelity of a program to increase fruit and vegetable consumption in primary school children similar to those obtained via trained observers. The program comprised 16, forty to forty-five minute lessons to be taught in class over an eight week period. Teachers reported teaching between 85% and

95% of the required activities for each curriculum lesson. Observations indicated 91% to 97% of the classroom activities were implemented.

In an assessment of an intervention delivered via swimming lessons, Mayer et al. [31] compared parent report of completion of home activities to returned activity sheets from children. While about 72% of parents reported they participated in at least two of the four home-based family activities, only 43% of children returned at least two of the activity sheets. While this may indicate over-reporting of a favourable practice by parents, it may also highlight the difficulties associated with obtaining work sample evidence in an out-of-school setting.

2.2.4 EFFECT OF IMPLEMENTATION ON PROGRAM OUTCOMES: DOSE-RESPONSE EVALUATIONS

The impact of a health program at a given site is determined by the effectiveness, or efficacy of the program, its reach and its level of implementation [173]. *Effectiveness* is defined as the degree to which an existing intervention caused a change in outcomes under normal practice conditions, while *efficacy* describes the degree to which a new intervention caused a change in outcomes under optimal or test conditions [41]. Therefore, even an efficacious program will not have an effect on student outcomes if it is inadequately implemented.

Within and between primary schools there may be significant variation in the quantity and quality of a program taught by different teachers [152, 163]. Primary school health programs are usually taught by classroom generalists who may have a number of competing curricular demands on their teaching time, limited training in health education, a lack of interest in health and limited administrator support for health education [174]. Parents will also vary in their availability, interest and ability in assisting their children with home-based components of such programs. Such variations in implementation can have an influence on a program's effectiveness in impacting on student outcomes.

Both the quality and quantity of implementation have been shown to be positively associated with student outcomes in both school-based [34, 36, 38, 40, 119, 152, 156, 160, 163, 166, 167, 175] and home- and non-school-based [12, 33, 176] health programs for students. Several

of these studies found implementation to be associated with physiological or behavioural outcomes [33, 119, 152, 156, 160, 166, 167], while the remaining studies found implementation to be associated with changes in knowledge and attitude.

Connell et al. [166] evaluated the effect of school health education teaching in 688 intervention classrooms and 383 control classrooms of Grades 4 to 7 students in the U.S. The effects on student outcomes of full implementation and average implementation were compared to no implementation (control group classrooms). Full implementation was measured via a composite measure defined as greater than 80% of activities taught, hours of instruction greater than or equal to the minimum recommended by the program's designers and higher than average fidelity to the program's activities [166]. In classrooms where teachers fully implemented the intervention, effects were between 5% and 20% greater for student knowledge-based outcomes, 90% greater for attitudes and 85% for student-reported health-related practices compared to classrooms with average level implementation[166].

Pentz et al. [160] assessed the effect of teacher dose of a one-year classroom-based substance use prevention program that was part of a larger community-based intervention trial. The study involved over 5000 Grades 6 and 7 students at 50 schools in the U.S. Sixty five teachers from 27 intervention schools implemented the program with the other schools forming the control group. Teacher self-report surveys indicated dose of the curriculum delivered and using a median split implementation group teachers were categorised as low or high implementers and control group teachers were categorised non-implementers. Dose-response analyses indicated high implementation dose was related to reduced student drug use compared to no, or low implementation levels [160].

Rohrbach et al. [36] evaluated the effect of teacher fidelity as assessed through lesson observations, to student outcomes in a substance abuse prevention program. The study involved 1147 students and 60 teachers from 25 schools in the U.S. Observed intervention group teachers (n=36) were categorised as high fidelity or low fidelity teachers using a median split on a composite integrity index score made up of observed measures of teacher and class enthusiasm, class control and degree of fidelity to program goals [36]. Students whose teachers taught the program with high fidelity had

higher scores for program acceptance, knowledge, resistance skills than low fidelity teachers [36]. The effects on behavioural outcomes were not assessed.

The effects of implementation were investigated as part of the evaluation of the 'Know Your Body Program' for heart disease prevention in U.S. schools [167]. The curriculum was taught to children in Grades 4 to 9 over four years by 82 teachers in 13 schools. Teaching quality was scored from one to five based on lesson observations by trained staff while dose was measured on a scale from zero to three based on combined teacher self report and lesson observation scores. These quality and quantity scores were added to create a composite measure, where a score of six or more was considered an effective teacher who completed most, but not all curriculum activities. Just under half the teachers scored a six or better. Effective teachers were found to have more positive student outcomes related to reduced heart disease risk factors such as cholesterol level and blood pressure, than ineffective teachers.

In a separate study, Resnicow et al. [152] assessed the KYB program over three years in a non-randomised, longitudinal cohort of over 1000 students in Grades 1 to 6 in New York. Dose response analyses indicated that after three years of receiving a comprehensive heart health promotion program, students who had received at least two years of moderate or high level implementing teachers (high exposure students) had significantly lower blood pressure and total cholesterol levels than the comparison group who did not receive the program. The high exposure students also had lower total cholesterol than students in the moderate (one year of high or moderate implementing teachers) or low exposure (all other lower levels of implementation) groups.

While the KYB interventions appeared effective overall in these studies, the dose–response analyses provide important information in interpreting these results, as impact on student outcomes in both cases was higher for those students who received more of the program.

Another school-based curriculum addressing cardiovascular health, which was part of the larger, multi-component 'CATCH program', was also assessed in terms of the effect of dose on student outcomes [40]. These analyses included self-report data from a cohort of 1071 students followed for three years from Grade 3 to Grade 5. Teacher

implementation was assessed via self-report and lesson observations, however, only observation data on lesson fidelity was included in the dose-response analyses. Results indicated that the percentage of observed teacher modifications to lessons in Grade 5 was positively associated with student-reported dietary knowledge and self-efficacy. These findings indicate that teacher modification of the lessons had a positive impact on student outcomes.

In an assessment of the dose–response relationship for the parent component of the CATCH study Nader et al. [12] found that higher levels of parent participation in a family health promotion program were associated with increases in student knowledge and attitudes, but had no effect on students' behaviour.

In their evaluation of the 'Gimme-5' project mentioned previously, Resnicow et al. [34] assessed the association between teacher implementation measures and Grade 4 and 5 students' health-related knowledge, asking behaviours and fruit and vegetable consumption. The curriculum comprised a one-day teacher in-service and 12, 40-50 minute lessons in each of Grades 4 and 5 designed to be taught twice weekly over six weeks. Sixteen schools were randomised into intervention and control groups and implementation data were collected from 40 teachers. Student outcomes were assessed via pre-and post-test questionnaire and seven-day food diary. A dose response relationship was found between measures of teacher-student rapport and fidelity (both assessed by lesson observation) and student knowledge. Teacher interview self-report dose was also related to student knowledge. However, there was no association between student behaviours and any of the implementation measures when baseline values were controlled for in the analyses [34].

Story et al. [156] analysed the association between several process measures and student outcomes for a program designed to increase fruit and vegetable consumption in fourth and fifth-grade children in Minnesota. The effect on fruit and vegetable consumption for schools with high (above average) and low (below average) process measures of self-reported dose, fidelity, and degree to which experiential taste-testing activities were taught as planned, was assessed. No significant dose-response relationship was found for the Grade 4 implementation and fruit and vegetable consumption, or for dose or fidelity in Grade 5. However, in schools that were low implementers of the experiential

taste-testing activities in Grade 5, students ate significantly fewer serves of fruit and vegetables than in schools where implementation of these activities was high [156].

The 'Pool Cool' program [33] has been described previously and is one of few sun protection programs that have reported results of dose-response analyses. This study found that students receiving over two of the program's eight, five-minute sun safety lessons reported using more sun protective behaviours than students receiving less than two lessons. When dose was assessed as a continuous variable a small but significant trend was found indicating students with the most involvement in the program had higher levels of parent-reported sun protection.

Gritz et al. [119] assessed the relationship between program components used by parents and outcomes obtained in the evaluation of a child-care-based program to improve young children's sun protection. Parents were asked to report, via self complete cross sectional surveys conducted at 12 and 24 months, their use of a video, a sun safety handbook, sun safety guide and newsletters.

At the 12 months post-test about 60% of parents reported watching the video, 70% read the newsletter and three quarters of parents read the hand book. At the end of year two, use of each intervention component was 65%, 74% and 75% respectively and just over half the parents read the guide book implemented that year. At 12 and 24 months use of each of the materials except the guide was positively associated with sunscreen use on children. Use of the video was also associated with increased children's hat use in year two. Parents who read the newsletter were more likely to report using protective clothing and shade for their child in year two, and those who read the handbook reported increased use of shade structures (years one and two) and hats for their children (year two). These dose-response results provide useful information on the relative contributions of various components of the intervention, although the lower response rates to the questionnaire (53% – 71%) mean the results may be limited to more enthusiastic parents.

While a variety of implementation measures were used in these studies, and the definition of implementation varied, the findings indicate that program implementation can influence students' physiological and behavioural outcomes.

These dose-response analyses were employed to facilitate the assessment of the predictive validity of different dose measures [34], explain program effects [12, 33, 35, 36, 119, 156, 166, 167] and assist program developers in enhancing program effectiveness [12, 36, 119, 152, 156, 160, 167]. Such dose-response analyses can therefore be a valuable addition to outcome data analysis in program effectiveness trials [41].

Summary

Process evaluation is an important component in the evaluation of school-based health promotion programs. As well as providing formative data to enhance program development, process evaluation can evaluate the extent to which program implementation has occurred and examine the effect of implementation on program outcomes. A variety of measures have been used to assess the implementation of school-based health promotion programs and the triangulation of measures has been recommended to permit the assessment of concurrent validity between self-report and more objective measures of implementation. A number of such process evaluation studies have indicated that the dose and fidelity of program implementation can impact on health outcomes in children. Higher levels of implementation dose and fidelity tend to be associated with more positive student outcomes.

2.3 FORMATIVE DEVELOPMENT OF THE KIDSKIN EDUCATIONAL INTERVENTION

While program implementation can have an effect on outcomes, the overall effect of a school-based intervention is a function of its effectiveness, its dissemination and the program's implementation by schools and teachers [173, 177]. This can be represented as follows:

IMPACT = effectiveness x implementation x dissemination [177]

Therefore, the impact of an effective program may be diminished if it is insufficiently disseminated, or insufficiently adopted and implemented by schools [178].

Health promotion programs are most likely to be effective in addressing outcomes when the determinants of the health issue are understood, the target group's requirements have been addressed and the environment and context in which implementation is occurring has been considered [145]. To facilitate the development of an effective program incorporating features that would increase the likelihood of its adoption and implementation by schools, formative evaluation was conducted to guide the development of the Kidskin educational intervention assessed in this study [43].

2.3.1 FORMATIVE EVALUATION AND INTERVENTION DEVELOPMENT

Formative evaluation, or pre-testing, is carried out prior to, and during the development of, intervention strategies or materials. It is used to obtain information from and about the target groups which can be used to ensure interventions are appropriate for those groups [179]. Intervention development is guided through the identification of content and features which will increase the likelihood of the intervention being implemented and achieving its objectives [45, 62, 180-182]. While the importance of formative evaluation has been recognised [92, 179, 183], many health promotion programs still place a disproportionate emphasis on impact and outcome research, with little time and resources spent on the development of the intervention [184]. This may be reflected in the effectiveness of the program developed.

Formative evaluation was conducted [43] to guide the development of the Kidskin educational interventions described in this thesis. This formative evaluation followed a four phase approach as recommended by Sussman [185] for the development of effective classroom curricula. Firstly, pre-existing knowledge and theories were identified and extended to guide program development. Secondly, a review of related literature and existing resources was conducted to obtain further information on recommended content, methods and strategies for the intervention. Formative interviews were conducted with teachers and parents to determine current practices and resources used for sun safety teaching and to determine features that may facilitate implementation of a new resource [43]. Parent focus groups were used to obtain information on attitudes, beliefs, perceived barriers and parenting practices associated with the use of sun protection by their children [43]. Thirdly the activities were piloted with a similar population to the target population [43]. The fourth phase, involving the process and impact evaluation of the intervention is in part being addressed within the current study.

Program activities and methods that have been used previously were identified, adapted, and revised into new activities to suit the target audience based on feedback from the interviews and focus groups. Pilot testing of the theme and content of individual activities was conducted with teachers, parents and children and feedback was incorporated into the development of the final educational intervention used in the study [43]. Additionally, process data collected in each year of the study was used to develop the following year's activities. Further information about the formative evaluation of the Kidskin school and home, and summer holiday interventions has been provided in Chapter 3 as has a description of the educational interventions developed via this process.

Theoretical and empirical factors influencing the structure and content of the educational intervention are discussed below.

2.3.2 THEORETICAL BASIS FOR THE EDUCATIONAL INTERVENTION

Health promotion curricula are more likely to be effective if they are based on current theoretical understandings [186]. Several theories and frameworks addressing health behaviour, health behaviour change and their application in schools, guided the development of the Kidskin intervention [43].

The structure and design of the Kidskin intervention materials had its basis in theoretical models of learning, including Social Cognitive Theory [107], and models of health behaviour change and development including Health Belief Model [108, 147, 187], and the PRECEDE/PROCEED framework [64] for health promotion planning. These were implemented through a comprehensive [188], socio-ecological school-based approach.

Comprehensive School Health Promotion

The Comprehensive approach to school health [188] and the Health Promoting Schools model [189] provided the framework for the larger Kidskin program. The Health Promoting Schools model is characterised by a focus on three domains: the health curriculum, teaching and learning; the school environment, health services and policies and school and community interactions. Comprehensive school health programs incorporate eight domains, addressing: planned and sequential health education

curriculum throughout all grades; school health services; the school environment; school-based physical education; school food services; counseling services; health promotion for school staff; and integration of school and community health promotion efforts [188]. This approach addresses the socio-ecological determinants of health more wholistically than is possible through classroom instruction alone [63, 64].

The larger Kidskin intervention utilized a comprehensive approach that incorporated classroom curriculum materials, support for environmental and policy changes in schools, and involvement of parents through home-based activities.

Social Cognitive Theory

Social Learning Theory/Social Cognitive Theory (SCT) [107, 190] suggests that learning by observing others is the basis for many behaviours and that behaviours are influenced by our beliefs about how actions influence each other, about the consequences or reinforcement of our actions, and about our ability to perform an action (self efficacy). The Kidskin program addressed these SCT constructs via a number of methods. The program encouraged the modeling of sun safe behaviours by teachers and parents through the provision of sun safety information and reminders about their importance as role models. Students were encouraged to act as advocates for sun safety within their family and school through the classroom and home-based activities. The program aimed to alter societal expectations about sun safety through its Sun Smart Awards scheme and policy and environmental adaptations in full intervention schools. Social inoculation, or rehearsal techniques, were incorporated into classroom and home activities to develop students' self -efficacy. Students were given the opportunity to practise assertive communication and decision-making skills in the classroom while acting out sun safety-related scenarios they may experience in everyday life. Practising these skills in a non-threatening setting was designed to help students become inoculated against pressure situations (eg. peer pressure to sunbathe) so they were more likely to respond assertively. The basis for this skills-based health promotion program was, therefore, that students who developed the appropriate knowledge, attitudes and skills would have stronger feelings of self efficacy for sun protection, and thus would be more likely to protect their skin, than those with fewer skills, less knowledge and poorer attitudes.

Health Belief Model

The Health Belief Model [108, 147, 187] was based on the notion that an individual was more likely to perform a particular health-related behaviour if they believed: they were susceptible to a severe health problem; they were capable of taking action to reduce the threat and; that the perceived benefits of taking this action outweighed the barriers to doing so. A significant cue to action was also required to make the health issue seem relevant. Skin cancer due to excessive sun exposure does not usually manifest until adulthood and thus may seem irrelevant to young children [100]. Thus, to increase students' feelings of susceptibility, the short term effects of sun exposure were emphasized [191], as was the fact that all skin types are susceptible to UV damage to a greater or lesser extent. Student activities also identified the benefits of protecting their skin and gave them the opportunity to devise methods of overcoming barriers to sun protection. Cues to action for students and parents were incorporated through the provision of classroom and home based activities during the school term and via the Totally Cool Summer Club during the Summer school holidays. Teachers were provided with cues to teach the Kidskin program via reminder phone calls, faxes and letters and through contact with program staff at lesson observations.

PRECEDE/PROCEED framework

The PRECEDE/PROCEED framework [64] was used to guide the application of the health behaviour theories [192]. This framework identifies three groups of factors that influence health behaviours. Predisposing factors, such as knowledge, beliefs, attitudes, cultural influences and existing skills, are forces that motivate an individual or group to take action. The Kidskin program aimed to increase the sun protection knowledge and beliefs of the school community via a number of methods previously described. Enabling factors assist in the performance of an action, making it possible for this action to occur [64]. Skill development for decision making, assertive communication and goal setting was included in the Kidskin program activities as these were identified as significant enablers in making health related behaviour changes. Support was provided to improve the capacity of schools to improve sun protection through policy and environmental adaptations. Sun protective swimwear was provided at cost price to high intervention group students and their siblings to facilitate their widespread use by families. Reinforcing factors provide incentives for the health actions or outcomes to be maintained [64]. Incorporating parental and family components in the program addressed

enabling and reinforcing factors as, particularly with younger children they serve as key facilitators for sun protection behaviours [17, 112, 193]. The program components previously discussed under Social Cognitive Theory highlight key reinforcing factors used in the Kidskin Program to support sun protective behaviours.

2.3.3 STRUCTURE AND CONTENT OF EFFECTIVE CURRICULA

A number of features of effective school-based health promotion curricula have been identified. For example, in a review by Dusenbury and Falco [186], effective drug education curricula were shown to have content that was developmentally appropriate, culturally sensitive and relevant to the students. They incorporated social-resistance skills training together with more comprehensive social and personal skills training [186] and included interactive, student-centred teaching techniques [194]. Effective curricula also tended to be more in-depth and had continuing follow-up. Additional components, such as policy and environmental adaptations, family and community involvement were recognised as being important. Teacher in-service training in program content and teaching techniques were incorporated and the importance of ongoing program evaluation was also highlighted [186].

Similarly, interventions most likely to be effective in achieving sun protection-related outcomes have been identified as those that utilised interactive programming for children, [22] presented cross-curricularly [60] using a developmentally appropriate, longitudinal curriculum incorporating a spiral approach to expand on information and skills developed in previous years [22, 27]. Clear behavioural messages addressing sun safety knowledge, affective and skills components were recommended [100].

As part of the formative evaluation, a review of related literature was conducted to obtain guidance on content areas to be addressed. Sun safety content followed guidelines set both nationally [195] and internationally [196]. These included behavioural recommendations to: use natural methods of sun protection including covering up with hats, clothing, sunglasses and using shade; limit sun exposure and particularly avoid exposure in the middle of the day and; use sunscreens with a high sun protection factor (SPF) as an adjunct protection measure when other measures are impractical [195, 196].

2.3.4 PROGRAM ELEMENTS INFLUENCING IMPLEMENTATION

The Diffusion of Innovations Theory [103] can be used to guide the development of strategies to maximise the implementation of school-based health promotion programs [197]. This theory is conceptualised as a staged process of uptake of an intervention (an innovation) over time by individuals or organisations [103]. The initial 'adoption' stage involves the target audience becoming aware of the program, how to use it and how it works. Rogers use of the term 'implementation' refers to the initial use of the program, while 'maintenance' describes the ongoing use of the program [103]. The process through these stages can be influenced by features of the intervention, or the individuals and organisations adopting the intervention [103].

The intervention

A new school-based health promotion intervention, such as that developed for Kidskin, can be described as an innovation [103, 198]. Features of an innovation can influence its adoption and implementation [103, 173]. Innovations are more likely to be used when they are easy to understand and use, and are consistent with the past experiences and current requirements of the target users [103, 197, 198]. Innovations which can be easily communicated to and observed by others and trialled on a short-term basis, rather than requiring long term commitment, may also be perceived more favourably [103, 197, 199]. The relative advantage of an innovation over the program it is replacing is also a factor influencing the likelihood of its uptake [103, 197, 200]. The amount of time and commitment required to implement the innovation tend to be inversely related to the likelihood of implementation [199] Additionally, innovations which can be modified, adapted or updated easily to meet the needs of the user are more likely to be implemented [103, 197].

Several specific key features of the Kidskin sun safety intervention that would facilitate implementation were identified by teachers during interviews conducted during the formative evaluation. These included linking program outcomes to the requirements of state syllabi and incorporating pre-prepared resource kits, incorporating all materials required to deliver the program [43].

Schools and teachers

Features of schools and teachers will influence their likelihood of adopting and implementing a new program [197]. A number of teacher characteristics and broader organisational and environmental features have been identified as influencing implementation [198, 201, 202]. Organisational factors include the provision of adequate planning and resources to facilitate implementation and parental, administrative and district support for the program [201, 203].

Teacher factors have been most commonly addressed through in-service training as part of an introduction to a new intervention. Teacher training has been shown to be an important factor in facilitating the effective implementation of school-based health innovations [153, 169, 178, 201, 204-208]. Studies of school-based health promotion programs have found that including pre-implementation training increases the likelihood that a program will be implemented [169, 205, 209] and that training can increase the completeness and fidelity of implementation [37, 151, 166, 175].

Further, teacher training seems to be more effective in ensuring implementation when it is when it is conducted with teachers present in a workshop setting, rather than via video training [37], or transmitted 'second hand' from other teachers [151]. Studies that offered funded teacher relief to facilitate attendance at teacher in-service tended to have higher participation in training [167, 210].

Teacher training can be used to plan implementation, address teacher attitudes to the intervention, increase familiarity with the concepts addressed in the intervention [163, 211] and provide practice for teachers in implementing skills-based activities [211]. Pre-implementation teacher training with funded teacher relief was included each year in the Kidskin intervention [43]. The features of the training teachers reported finding most useful were the guided 'walk though' of the materials for teachers and students that were provided in the intervention kit and the opportunity to see the core student activities demonstrated [43].

2.4 SUMMARY OF LITERATURE REVIEW

Skin cancer is an important public health issue in Australia. Programs reducing sun exposure are most likely to be effective if they involve children and their parents. Effective, adequately implemented programs addressing sun protection have been shown to positively affect sun related knowledge attitudes and behaviours. However, a number of program evaluations have relied on unvalidated self-reported behaviour, or have not addressed a wide range of behaviours. The level of implementation of sun protection programs has not been regularly reported.

Information on the implementation of interventions can help to explain their effect on study outcomes. If data on implementation are not collected, program evaluators run the risk of incorrectly attributing outcomes to the intervention, or what has been termed Type III error.

Process evaluation can be used within the larger evaluation plan to provide information on program implementation. The literature suggests the structure of a process evaluation be guided by the theory on which the intervention was based, by a detailed description of the structure and content of the intervention itself and by consideration of the data collection load to be placed on study participants. Methods used to assess quantity and quality of teacher implementation in school-based health promotion programs include: teacher self-report via checklists, logs, post-test questionnaires or interviews; student work sample collection; lesson observations; and ratings by other professionals. These assessment methods each have their own strengths and weaknesses in the extent to which they: are objective measures of implementation; can measure all elements of a program; may introduce testing bias; and place additional data collection burden on participants.

A number of previously reported process evaluation studies in sun safety and other health promotion programs have relied on self report, with fewer programs using an objective or validated measure of implementation.

Prompted by the lack of research using a multi-component approach to measuring implementation and by the importance of conducting such process evaluation on a newly developed intervention program, this study will assess the quality and quantity of

implementation of the Kidskin school- and home-based interventions. The association between level of implementation and student outcomes will be evaluated. This research will contribute to an understanding of how the intervention was used by the target population, how the program dose may have influenced sun protection and ways of ensuring the implementation of effective health programs for children and their families.

3. METHODS

The Kidskin study was conducted in Western Australian primary schools between 1995 and 1999. The process evaluation of the Kidskin Project described in this thesis was conducted as part of this larger study. Specifically, the objectives of this process evaluation were to:

1. Determine the dose of the Kidskin classroom and home intervention delivered to students.

2. Determine the association between the level of dose of the Kidskin classroom and home intervention and student sun-related behaviours, level of tanning and number of naevi at post-test in 1999.

This chapter describes the methods used in the process evaluation of the Kidskin project and is divided into sections addressing the following: study design; study sample; description of the intervention; instrumentation and data collection; analysis and treatment of data. The final section of this chapter is a summary of the methods used in this study.

3.1 STUDY DESIGN

The larger Kidskin study was a seven-year quasi-experimental intervention study involving a cohort of 1776 children, their parents and teachers from 33 primary schools in Perth, Western Australia. The aim of the study was to design, implement and evaluate a school- and home-based intervention to reduce sun exposure in primary school-aged children. Baseline data were collected from the student cohort in 1995 when they were in Year 1, aged 5 or 6 years. Student outcomes were assessed at three post-tests in 1997, 1999 and 2001 when students were in Years 3, 5 and 7 respectively. Process evaluation data were collected each year from 1995 to 1998.

There were three study groups: a ‘high intervention’ group, a ‘moderate intervention’ group and a control group. The two intervention groups received identical classroom

and home programs, but differed in the amount of student and parent contact outside the school environment and in the extent of support provided to schools to facilitate environmental and structural change (Table 3.1). Students at the eight schools assigned to the high intervention group received the Kidskin school- and home-based educational intervention in Years 1 to 4. A brief home-based sun safety education 'booster' package, the 'Totally Cool Summer Club' was also mailed to these students during the summer school holidays each year. Additionally, the high intervention group was offered low-cost sun-protective swimwear in October each year.

Students at the 11 moderate intervention schools received the Kidskin school- and home-based materials at the same time as the high intervention schools, however this group did not receive the 'booster' holiday intervention or the sun protective swimwear.

Students at the 14 comparison group schools received their school's usual sun safety program, based on the Western Australian Health Education K-10 Syllabus, which included several sun safety-related activities each year.

The larger Kidskin Project also incorporated interventions related to policy and environmental changes that began mid way through the third year of the study. Schools from both intervention groups were invited to participate in a sun safety award scheme and high intervention schools were given assistance in developing policies and structural changes related to sun protection. Evaluation of the school-based environmental intervention is reported elsewhere [70]. Table 3.1 outlines the interventions provided to each Kidskin study group.

Table 3.1 - Interventions delivered to schools in the three Kidskin study groups

High Intervention Group	**Moderate Intervention Group**	**Control Group**
Classroom- and home-based educational intervention, Years 1-4. Summer holiday 'booster' intervention, Years 1-4. Cost-price sun protective swimwear, Years 1-4. Schools invited to participate in sun safety award scheme. Support for school policy and environmental changes to facilitate sun protection.	Classroom- and home-based educational intervention, Years 1-4. Schools invited to participate in sun safety award scheme.	School's usual sun safety program.

Baseline testing of student outcomes was conducted in winter (June - September) 1995. The classroom intervention was implemented in spring / summer over four years (September to December 1995, August to November 1996-1998). The summer holiday booster intervention was implemented in December and January 1995-1999 during the six- to seven-week school summer vacation. Post-testing of student outcomes was conducted when students returned to school at the end of summer in February and early March in 1997, and again at the end of summer in mid-February 1999 (to assess tanning and behaviours) and in winter from June-August 1999 (to assess naevi). Table 3.2 illustrates the study design and timeline up to post-test 1999.

Table 3.2 - Kidskin study design and timeline

	1995			1996		1997			1998		1999	
Student intervention group	Jun - Sept (BL)	Sept-Dec	Dec-Jan	Aug-Nov	Dec-Jan	Feb - Mar (PT_{1997})	Aug-Nov	Dec-Jan	Aug-Nov	Dec-Jan	Feb (PT_{1999})	June - Aug (PT_{1999})
High	O_1	X_1	X_2	X_3	X_4	O_2	X_5	X_6	X_7	X_8	O_3	O_3
Moderate	O_1	X_9		X_{10}		O_2	X_{11}		X_{12}		O_3	O_3
Control	O_1	X_{13}		X_{14}		O_2	X_{15}		X_{16}		O_3	O_3

Where: O_x Observation
X_x Student intervention
X_{1-8} High intervention
X_{9-12} Moderate intervention
X_{13-16} Usual sun safety state curriculum
(BL) Baseline testing of student outcomes
(PT) Post test of student outcomes

A process evaluation of teacher and parent implementation of the Kidskin educational intervention was conducted from years one to four of the study. Students and their parents comprised a longitudinal cohort tracked through five years of the study, whereas four new cohorts of teachers were assessed, one in each year.

Table 3.3 and Table 3.4 illustrate the design of the process evaluation. Teachers implemented the classroom intervention from September to November each year and completed a pre-implementation instrument in August/September and post-implementation instruments in November/December.

Implementation of the summer holiday booster intervention was evaluated in March 1996 and February 1998 and 1999 at the beginning of the new school year.

Table 3.3 - Process evaluation study design - classroom intervention evaluation

	1995 cohort			**1996 cohort**			**1997 cohort**			**1998 cohort**		
Intervention group	Sept '95 (BL)	Oct-Dec '95	Dec '95 (PT)	Aug '96 (BL)	Sept-Nov '96	Nov '96 (PT)	Aug '97 (BL)	Sept-Nov '97	Nov '97 (PT)	Aug '98 (BL)	Sept-Nov '98	Nov '98 (PT)
High	O_1	X_1	O_2	O_3	X_2	O_4	O_5	X_3	O_6	O_7	X_4	O_8
Moderate	O_1	X_1	O_2	O_3	X_2	O_4	O_5	X_3	O_6	O_7	X_4	O_8
Control	O_1	X_5	O_2	O_3	X_6	O_4	O_5	X_7	O_6	O_7	X_8	O_8

Where:
O_{1-8} Observation – teacher self-report questionnaires, work sample assessment, lesson observations
X_{1-4} Kidskin student classroom- and home-intervention
X_{5-8} Usual sun safety state curriculum
BL Baseline
PT Post-test

Table 3.4 - Process evaluation study design - summer holiday booster intervention (Summer Club) evaluation

	1996 Dec-Jan	Mar	**1997** Dec-Jan	Feb	**1998** Dec-Jan	Feb	**1999** Dec-Jan	Feb
High intervention group	X_1	O_1[a]	X_2	-	X_3	O_2[a]	X_4	O_3[b]

Where:
O_{1-2}[a] Observation (parent questionnaire)
O_3[b] Observation (student telephone interview)
X_x Student summer holiday intervention (Summer Club)
- No observation

The analyses in this thesis address only the process evaluation of the Kidskin educational intervention. These analyses include data from the intervention groups' student cohort, their parents and teachers. Analyses examine the impact of level of

intervention dose on student outcomes at the end of the four years of program implementation, at post-test in 1999. Study outcomes comparing the intervention groups to the control group in terms of program efficacy are reported elsewhere [80, 81, 83-85, 91].

3.2 STUDY SAMPLE

3.2.1 SAMPLE SELECTION

The sample selection for the Kidskin study has been described by Milne [80]. The sampling pool for the Kidskin study comprised all primary schools in the Perth metropolitan area with at least 50 students enrolled in Year 1 at the end of 1994 (n=97). These schools were assigned a socio-economic status rating between 1 and 4, based on the Australian Bureau of Statistics SEIFA index of "social disadvantage" [212]. The location of these schools, and public swimming pools in the Perth metropolitan area, were geographically plotted. The schools were then clustered geographically, such that schools were allocated to the same cluster if located within 3km of each other, or if children attending them shared a local swimming pool or beach [80]. Schools were assigned to these clusters prior to their assignment to study groups to reduce contamination from two main sources. Firstly, from interaction between neighbouring schools if they were assigned to different study groups and secondly, through local swimming pools and beaches due to sun-protective swimwear provided to children at full intervention schools as part of the larger Kidskin study [80].

Fifteen geographical clusters were formed, with all schools in a cluster assigned to the same study group [80]. To minimise travel costs, clusters closest to the centre of Perth were assigned to the high intervention group, since schools in this group required more frequent visits from project staff. Clusters furthest from the centre of the metropolitan area were assigned to the control group.

All schools were weighted by the number of students in Year 1 to ensure each child had the same probability of being selected, then stratified by SES and proximity to the beach [80]. Thirty-three schools were randomly selected from the geographical clusters. Fourteen were selected for the control group, 11 for the moderate intervention group and

eight for the high intervention group. As the cost per subject in the control group was approximately one-third of that for the full intervention group, this unbalanced design was chosen to maximise power while minimising cost.

Of the 33 schools originally selected, five did not agree to participate. Five replacement schools were randomly chosen from the same clusters and SES strata as those that had declined to participate and all agreed to be involved [80]. All Year 1 students (5-6 year olds), their parents and teachers at participating schools were eligible to participate.

The sample for the process evaluation study was the same as for the larger Kidskin study. However, analyses assessing the effect of program dose on student outcomes included data from students, parents and teachers in the intervention conditions only. Subjects in the control group did not receive the Kidskin intervention, therefore no dose value for the Kidskin intervention could be calculated.

The sample for the process evaluation study was tracked as follows:

- Students and parents - five years (1995 – 1999)
- Year 1 teachers - one year (1995)
- Year 2 teachers - one year (1996)
- Year 3 teachers - one year (1997)
- Year 4 teachers - one year (1998)

Thus, students and their parents formed a longitudinal cohort, while a new cohort of teachers was recruited into the study each year as the student cohort progressed from Year 1 to Year 5. Schools assigned students to a new teacher at the commencement of each school year. In most classes the Kidskin program was taught by the classroom generalist teacher.

3.2.2 RECRUITMENT STRATEGY

The Curtin University Human Research Ethics Committee provided ethics approval for this project (Approval number HR 72/94) as did the University of Western Australia's Human Research Ethics Committee. Prior to the recruitment phase, approval was sought from the Education Department of Western Australia to conduct the study within

its schools. They supported the program in principle but advised that approval was required from each school individually.

A uniform recruitment strategy was used with all schools selected to participate. In May 1995, principals from the 33 selected schools were contacted by telephone and invited to participate in the study. School principals were told to which condition their school had been assigned ie. high or moderate intervention or control group. A letter describing the study was mailed to each principal (Appendix 1), followed within one week by a telephone call to determine whether the principal agreed for his/her school to participate. If so, Kidskin Project staff arranged to meet and discuss the project in more detail with the principal, senior school staff and teachers.

A letter describing the study, and parent and child consent forms, were sent home with each Year 1 child at the selected schools (see Appendix 2). Active consent was required from parents at the start of the study. Parents were asked to return their signed consent form via their child's teacher indicating whether or not they wished their child to participate in the study. Follow-up reminders were sent to non-respondents several weeks later. Students for whom no parental consent was received were classified as not consenting and no study data were collected from them. However, these students still received the classroom activities along with the rest of their class.

Since the intervention was implemented during four school years, new Year level teachers were recruited into the study each year. An information sheet outlining the Kidskin study, plus a teacher consent form with reply paid envelope, was sent to teachers of the appropriate year group at the start of each school year (see Appendix 3). In 1996, two Year 2 teachers refused to participate, however, other teachers were assigned by the school to teach the Kidskin program to their classes. One Year 3 (1997) and one Year 4 (1998) teacher refused to participate in the study and their classes did not receive the program. The Year 3 teacher refusal was due to lack of time to complete the program as she had arrived at the school in Term 4 only. The Year 4 teacher taught a split grade class and had only four Year 4 students in the class and was not willing to teach the Kidskin program for this small group.

During the initial two years of the study, teachers in Western Australian schools were involved in industrial action. To minimise the effect of this action on study recruitment, project staff were flexible when scheduling appointments at schools and met personally with teachers to explain the requirements of the study.

Students who arrived at study schools prior to September 1996, but after the initial recruitment phase, were also given the opportunity to participate in the study. Recruitment of these students followed a similar procedure to that used in 1995.

3.2.3 SAMPLE SIZE AND POWER

The sample used in the current study were the high and moderate intervention group students from the larger Kidskin sample. The sample size calculations for the larger Kidskin Project had been completed prior to the commencement of this doctoral study and have been described by Milne et al. [80] They will be reviewed here to provide background to the sample used in the current study.

The sample size was selected such that it would have 90% power to detect a change in number of naevi on the backs of participating children from 1995 to 1999, based on a 25% reduction in sun exposure to the back. The Kidskin pilot study conducted in 1993-94 (unpublished observations) suggested this was a realistic reduction to be expected in the intervention groups. As no published data were found that quantified the relationship between sun exposure and change in naevi numbers, unpublished cross-sectional data [44] were used to estimate the relationship between number of naevi, age and ambient sun exposure (based on where the child lived). This regression equation was then used to estimate that there would be an eight percent reduction in naevi on the backs of children aged 5 to 9 years in the Kidskin study assuming a 25 % reduction in sun exposure in the intervention groups [80]. These calculations assumed a two-year lag between the children receiving the Kidskin intervention and the development of naevi, therefore the last two years of exposure were not included in these calculations.

To account for the unit of randomization being the school rather than the individual, a consrvative intra-class correlation coefficient for the change in number of naevi within children attending the same school of 0.25 was assumed [80]. A 10% attrition rate was

allowed for each year of the study. Therefore, after adjusting for the study's design effects, a sample of 14 control schools, 11 moderate intervention schools and eight high intervention schools were required to be recruited.

As the current study uses the data from the 19 intervention schools only, the power will be less than the 90% power estimated for the larger Kidskin study.

3.3 DESCRIPTION OF THE INTERVENTION

The Kidskin educational intervention comprised two components - a classroom and home intervention (moderate and high intervention group) and a summer holiday booster intervention (high intervention group only). An overview of these interventions is provided in Figure 3.1. These intervention materials were developed by the author of this thesis.

The educational intervention used in this study was based on the materials developed for a pilot study conducted at two Perth primary schools in 1993/94. This pilot showed the feasibility of implementing a school- and home-based sun safety education program and a home-based holiday intervention with Year 1 children. These pilot interventions were further developed for Years 1 to 4 for use within the current study. A more detailed description of the Kidskin educational intervention follows.

Kidskin Educational Interventions

Classroom and Home Intervention	Summer Holiday Booster Intervention
Year 1 Sun Safety Education Program September-December 1995 • Teacher in-service training – half day. • Classroom-based activities – 6 themes, each comprising core, extension and processing activities. • Take-home activity sheets – 6 sheets for students to complete at home with their families.	**Year 1 Totally Cool Summer Club** December 1995 – January 1996 • Four issues – first issue given to students at school just prior to summer holidays. Next three issues mailed to students' homes during the summer school holidays.
Year 2 Sun Safety Education Program August – November 1996 • Teacher in-service training – half day. • Classroom-based activities – 6 themes, each comprising introduction, core, extension and processing activities. • Take-home activity sheets – 6 sheets for students to complete at home with their families.	**Year 2 Totally Cool Summer Club** December 1996 – January 1997 • Four issues – first issue given to students at school just prior to summer holidays. Next three issues mailed to students' homes during the summer school holidays.
Year 3 Sun Safety Education Program August – November 1997 • Teacher in-service training – half day. • Classroom-based activities – 6 themes, each comprising introduction, core, extension and processing activities. • Take-home activity sheets – 6 sheets for students to complete at home with their families.	**Year 3 Totally Cool Summer Club** December 1997 – January 1998 • Three issues – first issue given to students at school just prior to summer holidays. Next two issues mailed to students' homes during the summer school holidays.
Year 4 Sun Safety Education Program August – November 1998 • Teacher in-service training – half day. • Classroom-based activities – 4 themes, each comprising introduction, core, extension and processing activities, plus three processing activities to complete the program. • Take-home activity sheets – 4 sheets for students to complete at home with their families.	**Year 4 Totally Cool Summer Club** December 1998 – January 1999 • Three issues – first issue given to students at school just prior to summer holidays. Next two issues mailed to students' homes during the summer school holidays.

Figure 3.1 – Overview of the Kidskin educational interventions

3.3.1 KIDSKIN CLASSROOM AND HOME MATERIALS

Development of the classroom and home intervention

Several sources of information advised the development of the Kidskin classroom- and home-based educational intervention. The activities developed for the initial one-year pilot study (1994) were used as the basis of the Year 1 intervention. Further formative evaluation, literature reviews and pilot testing with teachers, students and parents occurred throughout the current study. Process evaluation data collected at the end of each year informed the development of the following year's classroom intervention.

The formative evaluation included several stages carried out annually. Firstly a review of the literature and current sun safety resources was conducted to determine the appropriate content and format for the intervention materials. Western Australian school curricula for the appropriate year level were reviewed for existing sun safety and related topics to facilitate cross-curricular programming.

Interviews were conducted with 18 Year 1 teachers in 1995 and 20 Year 2 teachers in 1996. All participants taught at pilot schools not involved in the study. Each interview lasted approximately 30 minutes and incorporated open-ended questions about the structure, organisation and content teachers would most like in a sun safety resource. Teachers who participated in the interview were acknowledged in the study materials and given a small gift (instant lottery ticket, a tea bag and a health food bar) as thanks for participating.

Draft copies of the materials were developed based on the information obtained in the formative evaluation. In June each year, approximately 15 teachers at the appropriate year level (i.e. Year 1 in 1995, Year 2 in 1996, Year 3 in 1997 and Year 4 in 1998), from non-study schools, piloted the draft materials for two weeks. Pilot teachers were then surveyed to determine their use of and satisfaction with the materials and their feedback was used to modify the draft materials as necessary. Pilot teachers were generally positive about the materials and their suitability for their class and reported their students enjoyed the activities.

In the second year of the project, lesson observations were used to assess teachers' use of the activities and teacher and student satisfaction with the materials. This measure

was originally designed to assess limitations in teacher self-report data and provide complementary evidence of the fidelity of implementation. However, the observations were conducted with Year 2 classes in the second year of the study only and not in other years due to budgetary and logistical constraints of the larger Kidskin study. The observations provided useful formative process information about the design, content and structure of the activities, which assisted in the development of the following years' Kidskin materials.

Structure and content of the classroom and home intervention

Teacher in-service training

In each year of the study, all teachers involved in teaching the Kidskin Program were invited to attend a three-hour in-service training session. The purpose of these sessions was to highlight the importance of sun protection for young children, familiarise teachers with the intervention materials and teaching strategies used within them, and to describe their role in the Kidskin study. Sessions were held at a central location in the Perth metropolitan area in September, 1995 and August, 1996 - 1998. All training sessions were conducted by the author of this thesis.

Teachers at high and moderate intervention group schools were trained separately. The content and structure of the two sessions were kept as similar as possible and teachers in both groups received the same classroom materials and take-home activities. The trainings differed only in that high intervention teachers also received information about the holiday booster intervention (the Totally Cool Summer Club) and the Kidskin sun protective swimwear.

Each training session included a welcome and introduction (5 minutes); background information about the project, skin cancer and sun safety (10 minutes); an introduction to the Kidskin materials for that year and an opportunity for teachers to check they had sufficient resources for their class (20 minutes); a short break (15 minutes); a guided 'walk-through' of the structure of the materials (20 minutes); time for teachers to review the Kidskin activities and discuss them with their peers (60 minutes); planning for implementation, where teachers had the opportunity to schedule their teaching of each theme (15 minutes). The author also described the evaluations teachers would be asked to complete as part of the Kidskin study ie. pre- and post implementation questionnaires,

program checklists and providing student work samples (15 minutes). The training finished with a teacher evaluation of the session (5 minutes).

At the training, teachers were provided with the materials required to implement the Kidskin program with their class. Teachers were asked to commence teaching the Kidskin intervention approximately two weeks after attending the training.

Teacher relief funding was provided by the Kidskin project to increase the likelihood of teacher attendance at the training. Teachers who were unable to attend the training sessions were offered training at their school, also with funded teacher relief provided. One extra training session was conducted for four Year 1 teachers during the first year of the study and four extra trainings were conducted at four schools in the second year. Where possible these trainings followed the format of the main training and provided similar information, although they tended to be approximately one hour shorter as fewer group activities were used. All sessions were conducted by the author to minimise variability in each presentation. Of these latter trainings, two were conducted with one teacher each, and were more highly modified, lasting only 30 minutes.

Teacher satisfaction with the training was assessed immediately after the training sessions and also on completion of implementation of the intervention each year. Satisfaction with the training was high each year (unpublished data) and following their implementation of the program at post-test, with over 85% of teachers each year reporting they found the training useful [43].

Classroom and home intervention materials

The intervention materials were provided at the training in a Teacher's Kit. This kit comprised a Teacher's Guide and accompanying teacher and student resources required to teach the program. Table 3.6 lists the contents of the kits.

The Teacher's Guide contained: a description of activities to be completed with students; reproducible teacher and student resource sheets; take-home activities for students to complete with their parents; and background information about sun protection and the Kidskin project.

The formative evaluation with pilot teachers indicated that teachers were more likely to implement a program that was self contained and required little time to prepare and obtain additional resources [43]. In response to this finding, all the necessary resources required to teach the Kidskin activities were provided in the kit. These contents are described in Table 3.5.

Table 3.5- Contents of Kidskin teacher's kits

Year 1 Kidskin Teacher's Kit	**Year 2 Kidskin Teacher's Kit**
• Kidskin Year 1 sun safety education program teachers' guide • Kidskin Year 1 passports (x30) • teachers' passport stamp • audio tape, sun safety songs • story book, "A Hat so Simple" • stimulus pictures (set of three A3 sheets) • samples of high SPF fabric • a ream of photocopy paper • posters and pamphlets • stickers (x30)	• Kidskin Year 2 sun safety education program teachers' guide • Kidskin Year 2 passports (x30) • teachers' passport stamp • audio tape, sun safety song • stimulus pictures (set of four A3 sheets) • calendar sheets (x30) • fabric crayons (1 packet) • student scrap books (x30) • a ream of photocopy paper • posters and pamphlets • stickers (x30) • teacher's Kidskin pen
Year 3 Kidskin Teacher's Kit	**Year 4 Kidskin Teacher's Kit**
• Kidskin Year 3 sun safety education program teachers' guide • Kidskin Year 3 passports (x30) • teachers' passport stamp • audio tape, sun safety songs • student scrap books (x30) • samples of high SPF fabric • a ream of photocopy paper • posters and pamphlets • stickers (x30) • teacher's Kidskin pen	• Kidskin Year 4 sun safety education program teachers' guide • Kidskin Year 4 passports (x30) • teachers' passport stamp • student scrap books (x30) • a ream of photocopy paper • posters and pamphlets • stickers (x30) • teacher's Kidskin pen

Formative discussion with pilot teachers revealed limited resources for photocopying in schools. Therefore, in each year a ream of photocopy paper was provided for each class to facilitate the reproduction of Kidskin activity sheets. Scrapbooks were provided in Years 2-4 to store students' activity sheets and other Kidskin work and these also facilitated the evaluation of student work samples.

A stamp and class set of student checklist 'Passports' were provided each year and teachers were asked to stamp students' passports each time they returned a completed home activity to encourage children to complete the home activities with their parents

and return them to school. Incentives such as posters, pamphlets, stickers and pens were also provided as cues to remind teachers and students to be sun safe.

The Kidskin materials were divided into six themes in Years 1-3 and four themes in Year 4 (Table 3.6). Each theme addressed different issues associated with sun protection, such as the importance of sun protection and sun protection methods. Skills training in assertive communication, decision-making and goal-setting were also integrated through each theme.

Most themes were structured to include: an introductory activity; a core activity; extension activities; processing questions and a home activity (Table 3.6). During the teacher training session, teachers were encouraged to teach at least the core, home and processing activities from each theme as described in the Teacher's Guide. They were asked to teach the optional introductory and extension activities if time permitted. The four-year Kidskin program incorporated 22 classroom-based core activities plus accompanying extension activities and 22 home activity sheets with teacher-led follow-up activities. The core program activities were designed to be taught by teachers as six, 40 minute lessons in each of Years 1 to 3 and as four, 60 minute activities in Year 4. The home activities were designed to be completed in 10 or less minutes by students and their families. The whole program was estimated to require about eight hours to complete each year. Teachers were encouraged to incorporate the program into their classroom teaching over a twelve-week period, timetabling activities in a manner that best suited them. Previous research has shown that such flexibility is likely to increase implementation [199].

Table 3.6 - Number of themes and activities in the Kidskin curriculum for Years 1-4

Year	**Number of themes**	**Title of themes**	**Number of each activity type per theme** (I=introduction; C=core; H=home; E=extension; P=processing)				
			I	**C**	**H**	**E**	**P**
1	6	Theme 1 – Protect Yourself	-	1	1	5	1
		Theme 2 – Shade	-	1	1	4	1
		Theme 3 – Hats	-	1	1	4	1
		Theme 4 – Sun Screening	-	1	1	4	1
		Theme 5 – Speaking Out	-	1	1	4	1
		Theme 6 – Planning for a Safe Summer	-	1	1	4	1
2	6	Theme 1 – Why Protect Yourself	1	1	1	1	1
		Theme 2 – Ways to Protect Yourself	1	1	1	2	1
		Theme 3 – Speaking Out for Sun Safety	1	1	1	1	1
		Theme 4 – Sun Protection at School	1	1	1	1	1
		Theme 5 – Shady Places	1	1	1	1	1
		Theme 6 – Sunsafe Summer Planning	1	1	1	1	1
3	6	Theme 1 – Protecting Your Skin	1	1	1	1	1
		Theme 2 – Sunsafe Planning Time	1	1	1	1	1
		Theme 3 – Thinking Straight & Speaking Out	1	1	1	1	1
		Theme 4 – Past, Present Future Sun Protection	1	1	1	1	1
		Theme 5 – Sun Protection at School	1	1	1	1	1
		Theme 6 – Your Skin in Australia	1	1	1	1	1
4	4	Theme 1 – The Sun and the Earth	1	1	1	-	1
		Theme 2 – A Sporting Chance	1	1	1	1	1
		Theme 3 – Three Degrees of Protection (Place, Time, Behaviour)	1	1	1	1	1
		Theme 4 - Sun Safe Policies	1	1	1	1	1
		Kidskin Closure Activities	-	-	-	2	1

In Year 1, the program emphasised the various actions students could take to protect themselves from the sun via hats, clothing, use of shade and avoiding the midday sun. Sun screen use was recommended as an adjunct to other sun protection measures, rather than a method to be relied on alone, due to the difficulties in attaining complete coverage [195, 213]. Children were given the opportunity to practise correct application of sunscreen. Activities addressing group norms encouraged students to remind their friends to be sun protected. Role-play activities, for students to practise asking adults for help with sun protection, were included, as were activities in which children planned for sun protection on the summer holidays.

The Year 2 program encouraged students to study their skin and its importance, and revised the key methods of sun protection for children as per Year 1. Role-play and decision making activities incorporated opportunities for students to practise assertive communication in sun protection dilemma situations and asking for increased shade at school. Students were given the opportunity to find shady areas around their school and

community, and to set goals for sun protection over summer for themselves and their family.

The Year 3 and 4 programs addressed students' personal sun protection, but also encouraged students to consider provision of sun protection by their school and community. The Year 3 program highlighted using shade and avoiding the sun during the middle of the day, as well as revising the other personal sun protection measures covered in Years 1 and 2. Using assertive communication skills to counter peer pressure to not protect themselves from the sun was also included. The availability of sun protection at school was assessed by students who were encouraged to use assertive communication to suggest ways to increase shade provision. Students were encouraged to design effective sun protection methods for the future and to set goals for sun protection over the holidays.

In Year 4, students discussed the position of the sun and the earth in space and the effect of seasonal change on sun exposure. The issue of sun exposure in organised sport was examined by students and they were asked to use assertive communication to write letters requesting improvements in sun protection at sporting events. Dilemma situations involving sun protection were incorporated to allow students to practise decision making to maintain or increase their sun protection. School policies and practices regarding sun protection were explored and students were given the opportunity to advocate for improved sun protection at school.

Copies of the final versions of the Year 1 to 4 Teacher's Guides used in the study are included in Appendices 4 to 7.

3.3.2 KIDSKIN SUMMER HOLIDAY BOOSTER INTERVENTION: THE 'TOTALLY COOL SUMMER CLUB'

Development of the holiday booster intervention (Totally Cool Summer Club)

The 'Totally Cool Summer Club' developed for the initial pilot program in 1994 was used as the basis for the intervention in the current study. Parent focus groups were also used to obtain information to guide the development of the Summer Club materials. Parents were asked about the types of activities their children liked doing on the

holidays, and the sorts of sun safe activities they thought their children would enjoy. The focus groups involved 13 parents of Year 1 children in 1995 and 12 parents of Year 2 children in 1996. Parents suggested a variety of types of activities their children enjoyed completing by themselves or with their families. These suggestions were adapted where possible to incorporate sun protection issues or themes for use in the intervention.

A draft version of the Summer Club was then pilot tested with a convenience sample of 10 students not involved in the study to determine the appropriateness of content, style and structure. In 1995 and 1996, parents of these students were interviewed about their child's use and enjoyment of the Summer Club materials. Most requested changes to the materials related to font size, layout and illustrations. Based on this feedback the draft materials were revised, where necessary, for use within the study.

Structure and content of the summer holiday booster intervention

A home-based intervention, the 'Totally Cool Summer Club', including activity sheets for children and their parents to complete, was incorporated in the high intervention.

The Totally Cool Summer Club comprised activity packs sent to students over the summer school holidays. Students received four packs in 1996 and 1997 and three packs in 1998 and 1999. The first pack each year was delivered to schools by project staff and distributed to students by teachers during the last week of the school year in December. The following packs were mailed to students at their home address, approximately every ten days during January. Addresses had been obtained via the consent forms at the start of the study. Change of address forms were included with the distribution from school to assist in follow up of students who moved during the holiday period.

The Totally Cool Summer Club mailouts were designed to act as cues to encourage sun protection in the home environment [107, 147] and to provide a booster to the school-based program. Each mailed pack reinforced similar issues to the classroom materials, such as the importance of and methods for sun protection, and encouraged children to be advocates for sun protection within their family. Summer Club mailouts contained a series of games, puzzles, stories and activities related to sun safety for students to

complete with their family [107]. Incentives such as stickers, fridge magnets, pens, posters and postcards were included with each pack. Parent information sheets describing the Totally Cool Summer Club and providing information on sun protection were also included.

In Year 1, students were asked to paste their completed Summer Club activities into a scrapbook provided for this purpose with the first mail-out. They were asked to bring these back to school with them at the end of the holidays. Year 2 teachers were also asked to remind students to return their scrapbooks. The scrapbooks were collected from Year 2 classrooms in early February, and assessed by the author to determine how many Summer Club activities had been completed by students and their families. Scrapbooks were returned to students during April.

In Years 2 and 3, in an effort to increase response rates, students were asked to return a Checklist from each mail-out indicating which Summer Club activities they had completed. Students who returned their Checklist were entered into a draw for a small weekly prize. Students were also asked to return all their Summer Club materials at the end of the holidays. As an incentive, all students who submitted their work at the end of the holidays were entered into a draw for one of eight sets of family movie tickets. Students' work was returned approximately one month later after being assessed to determine the number of activities they had completed.

No work samples were collected in Year 4 as the Summer Club activities in that year were not designed to provide work sample evidence.

3.4 INSTRUMENTATION AND DATA COLLECTION

The process evaluation of the Kidskin educational interventions was based on information collected from intervention group students, their parents/guardians and teachers. Table 3.7 lists the instruments and measures used to obtain this information.

The first objective of this study was to determine the dose of the intervention delivered to students. Teacher implementation (dose) of the classroom and home intervention was measured using two data collection methods:

- teacher self-report **program checklists** completed after each lesson and returned to project staff at the mid-point and end of the implementation period each year;
- student **work sample** analysis completed at the end of implementation each year.

The student work samples were used to assess the validity of the teacher program checklists. Both the program checklist and work sample data were used to create a combined measure of Kidskin dose, and weightings were applied to the dose scores dependent on which activities teachers completed. The development of the dose scores for each year is described in Section 3.5.

Dose of the summer holiday booster intervention the Totally Cool Summer Club was assessed via a **Summer Club implementation questionnaire** completed by parents (Years 1 and 3) or students (Year 4).

The second objective was to determine the association between level of dose and sun-related student outcomes. The student outcomes were assessed via school-based skin characteristic measurements and a parent questionnaire about their child's sun-related behaviours. These measures were developed by Milne [80] and are described in Section 3.4.1. The associations between the teacher implementation measures listed above (independent variables) and student outcomes (dependent variables) were examined using methods described in Section 3.5.

Student / parent demographic data were collected at the commencement of the study in winter 1995 via a school-based parents' self-complete questionnaire and baseline student skin characteristics by school-based measurements [80]. Demographic characteristics of participating teachers were collected via a **teacher pre-implementation questionnaire** administered each year.

Table 3.7 - Summary of instruments used

Data type	Data Collection Instrument					
	Parent Qr.	School-based skin assessment measures	Teacher Qr. Pre-implementation	Teacher program checklist	Student work samples	Summer Club Qr.
Demographic data - parents / students	√					
Naevi Skin tanning Student sun-related behaviours	 √	√ √				
Demographic data - teachers			√			
Teacher implementation (dose)				√	√	
Summer Club dose						√

3.4.1 STUDENT OUTCOME INSTRUMENTATION AND DATA COLLECTION

A variety of methods were used to measure the student outcomes targeted by the intervention. These methods were primarily developed to assess differences in outcomes between the control and intervention groups for the larger Kidskin study and have been described previously [80, 81, 83-85, 91]. To maintain a consistency of results with the larger Kidskin study, and to provide data to help explain these results, these same outcome measures have been used to assess the effect of level of intervention dose in this process evaluation and will be described briefly below.

The number of benign melanocytic naevi on the back was the main outcome measure [80]. This was assessed by counting naevi from photographic slides taken of the student cohort. Boys had their chest and back photographed, while girls had their back photographed only, so naevi could be counted later. The number of naevi on the face and arms was counted directly by trained observers. The level of suntanning on the forearms and back were derived from skin reflectance measured with a spectrophotometer. The degree of freckling on the face and arms was assessed directly by trained observers. Students' sun-related behaviours were measured using a parents' self-administered questionnaire. Table 3.8 summarises the student outcomes measured, the methods used to collect these data and the schedule for data collection in the larger Kidskin study as described by Milne [80]. The baseline (1995) and post-test two (1999) data were analysed in this process evaluation study.

Table 3.8 - Outcome data collection methods and timeline for the Kidskin study [80] (Table 1, pg 166)

Outcome measure	Method or instrument	Schedule		
		Baseline (1995)	**Midterm (1997)**	**End of study (1999)**
Naevi on back	Counting from slides	Winter		Winter
Naevi on chest and abdomen (boys only)	Counting from slides	Winter		Winter
Naevi on the face and arms	Direct counting	Winter		Winter
Tanning on forearms and back	Spectrophotometer		End of summer	End of summer
Constitutional skin reflectance (inner arm)	Spectrophotometer	Winter		Winter
Freckling on face and arms	Direct assessment	Winter		Winter & end summer
Sun-related behaviour	Parent questionnaire	Winter[a]	End of summer	End of summer

[a] The questionnaire was administered at the end of winter but referred to exposure during the previous summer.

Student skin characteristic measurements

The assessment of student skin characteristics in the Kidskin study has been described previously [80, 81, 85, 91]. A brief description of these methods is as follows.

Naevi counting

Naevi, were chosen as an objective outcome measure because they are commonly found on children and are highly associated with sun exposure [87] and melanoma risk [86]. Naevi are frequently found on the back and are not difficult to count in this location [44, 93]. Melanoma were not used as the outcome measure because they are uncommon in children and take longer to appear than naevi [80].

A naevus was defined as 'a brown-to-black pigmented macule or papule of any size that was darker in size than the surrounding skin' [80]. Trained observers counted all naevi on face and arm areas as defined by anatomic landmarks. Slide photographs were taken of the backs of girls and chest/abdomen and backs of boys to allow naevi on these sites to be counted later. After data collection at post-test two, slides of the trunk from 1995 and 1999 were assessed side-by-side to allow any changes in number of moles for each child to be identified [91]. All naevi counting from slide photographs was conducted by one trained observer. Previous research [93] has shown that counts made from photographs of the back were the same as those from direct counting. Direct counting was used for the face and arms as their curved surfaces make counting from photographs difficult [93].

Skin colour testing

A reflectance spectrophotometer (Model 99, Diffusion Systems, London, United Kingdom) was used to measure skin reflectance (at 425 nm) on the inner surface of the upper arm in winter 1995 [80, 83, 84]. This was classified as 'constitutional skin colour' [91] as it was an area that received little sun exposure. The same procedure was used to measure level of tanning on the forearm and upper back (mid scapula) in February (end of summer) 1999. These measurements were taken using a Minolta CM 500d spectrophotometer [85]. This machine was used in 1999 due to breakages in the original machine and unavailability of a replacement of the same model.

Two measurements were taken at each site in rotation for each child. Measurements were taken on unblemished skin at these sites and note was made of any children with freckling, moles or other markings on these sites that may have affected skin colour readings. For the 1995 measurements, taken using the reflectance spectrophotometer, reflectance is inversely related to the level of skin pigmentation, (ie. paler skin will give a higher reflectance score than more tanned skin). The 1999 measurements, taken using the different spectrophotometer indicate melanin density [214] and higher scores indicate greater levels of tanning.

Other measures

Students' hair colour, eye colour and degree of freckling were also assessed during the school-based testing [80]. These measures were used as covariates in the outcome analyses. Degree of freckling was assessed by comparing each student's face and forearms against a 10-point scale of freckle density. Hair colour was graded against hairdressers' colour samples and eye colour against a set of artificial irises of different colours.

Reliability of the measures

Inter- and intra-rater reliability testing was conducted for naevus counts, reflectance measures, freckling assessment and hair and eye colour rating [80, 84]. At baseline in 1995, 10% of students were randomly selected and assessed twice by the same observer. Another 10% of students were randomly selected for assessment by two different observers. The first observer was not informed that the child would be assessed twice and the second observer was blind to the results of the first assessment [80].

Skin reflectance inter-rater reliability was assessed by having all five raters measure the skin reflectance of 20 children randomly selected from one school. To assess intra-rater reliability, 7% of all students were randomly selected to have their skin reflectance measured twice by the same observer approximately 15 minutes apart [84].

Intra-rater reliability for naevi counts on the trunk were assessed [80] in 1995 and 1999. A randomly selected group of slides were examined for naevi twice by the same trained observer two weeks apart. In 1999, a specialist dermatologist also counted naevi on randomly selected slides and the inter-rater agreement between the usual trained observer and a specialist was examined.

Both intra- and inter-rater reliability were generally high for all measures. Intra-rater reliability coefficients ranged from 0.95 to 0.98 for naevi measurements at baseline [80], and from 0.93 to 1.00 for naevi measurements at post-test in 1999 [91]. Inter-rater reliability coefficients of 0.86 were obtained for naevus counts on the face and arms in 1995 [80] and ranged from 0.82 to 0.89 for naevus counts on the face, arms and back in 1999 [91]. The intra- and inter-rater reliability coefficients for inner arm skin reflectance were 0.95 and 0.86 respectively at baseline [80]. Kappa statistics for the intra-rater reliability of eye and hair colour measures at baseline were 0.95 and 0.84 respectively. Inter-rater assessment produced Kappa statistics of 0.89 and 0.52 for eye and hair measures respectively [80].

Administration of school-based testing

The Kidskin coordinators (one of whom is the author of this thesis) contacted schools to schedule testing dates and to arrange a testing venue within the school. Two days were allowed per school to complete the skin characteristic measurements. Repeat visits were made to schools to follow up students who had been absent on previous testing days.

On the day prior to the testing students were given notes advising their parents the measurements would be occurring on the next day and asking them to dress their children appropriately (ie. long hair tied up). A second note was given to students at the end of the testing to inform their parents that the testing had taken place. Male and

female students were tested separately and each student was away from his/her classroom for approximately 15 minutes. All data collection and testing procedures were carried out by trained female project staff members.

Parent questionnaire about student sun related behaviours

A self-administered parent questionnaire was developed by Milne to obtain data about students' sun related behaviours [80]. Specifically it asked parents about their child's sun exposure at different venues during the previous summer, including use of hats, clothing, sunscreen and shade and times of the day the child was outside. The child's ethnicity and skin sensitivity to sunlight as well as parents' educational levels were also recorded at the first administration of the instrument. Questions were based on the key behaviours addressed in the intervention and factors identified *a priori* as influencing the development of naevi.

A parent questionnaire was considered the most appropriate method to obtain this information about the study cohort due to the young age (5 to 6 years) and limited reading and writing skills of the student cohort at the commencement of the study.

Reliability and validity of the measures

Test-retest reliability of a whole body sun exposure index, combining data from questions on individual sun-related behaviours from the baseline questionnaire, was assessed by Milne et al. [84] An intraclass correlation coefficient of 0.79 (0.68-0.87) was attained indicating good stability of this measure. The validity of the measures of sun exposure developed from the questionnaire were examined by assessing their agreement with skin reflectance. The correlation between a forearm sun exposure index, combining individual sun protection and exposure measures, and forearm skin reflectance was –0.17 ($p<0.001$) [83]. This indicated that children with higher levels of sun exposure reported in the questionnaire, were more tanned (ie. had lower reflectance scores). Additionally, children with no reported sun exposure for the back had a higher mean skin reflectance for that site (39.1, CI: 38.2 – 39.9) than those with some reported exposure (34.6, CI: 33.6 – 35.5) [83]. This further indicated that parent report of the child's sun exposure was positively related to level of tan [83].

Administration of the parent questionnaire

The parent questionnaire was administered at the end of winter (September) 1995, the end of summer (February) 1997 (not included in this thesis) and the end of summer (February) 1999 [80].

In 1995, the questionnaires were distributed by teachers in class for children to take home to their parents. A pre-addressed reply paid envelope was provided for return of the questionnaire. In 1999, to reduce teacher workload, questionnaires were mailed to parents' home addresses, together with a pre-addressed reply paid envelope. A reminder letter and second copy of the questionnaire were sent to parents who had not returned their questionnaire three weeks after the due date.

3.4.2 PROCESS DATA INSTRUMENTATION AND DATA COLLECTION

The development and administration of the process data collection instruments is described below. These measures provided information on teacher demographics, teacher implementation of the classroom intervention and the dose of the classroom and holiday interventions received by students in the intervention groups of the Kidskin study. Each of the following data collection instruments will be discussed in this section:

Process Evaluation Instruments	
Classroom intervention	***Holiday intervention***
Teacher pre-implementation questionnaire	Summer Club implementation questionnaire
Program checklist	Summer Club work sample checklist
Student work sample checklist	

Teacher pre-implementation questionnaire

A self-report, pre-implementation questionnaire was completed by intervention teachers in August/September each year. The questionnaire assessed demographic characteristics and sun safety and teaching attitudes and practices.

Self-complete, mailed questionnaires were used as a cost and time-effective method of obtaining information from teachers who, as a group, have high literacy levels and are relatively likely to remain at the one school until the end of the year [45].

Instrument development and validity

The development of this instrument began with a review of the related literature to identify reliable and valid instruments and to determine factors that may influence teacher implementation of the curriculum. Appropriate questions were adapted from prior school health studies [146, 168, 175, 202]. Similar instruments used in the study conducted by Hall [146] were found to be reliable and valid when used with teachers from the same population as those in the current study (30 Year 2 teachers from primary schools in Perth, Western Australia).

The final version of the instrument assessed teachers' demographic characteristics, teaching experience, amount of sun safety teaching and attitudes about the importance of sun safety education. Three indices assessing teacher innovativeness, need for collegial support and conservatism were adapted from Gingiss et al, [202] and addressed Roger's [103] description of adopter characteristics.

Prior to administering this instrument to study teachers, it was assessed for face and content validity by the Kidskin advisory committee. Based on these pilot data and feedback from teachers and the advisory committee, several changes were made to the wording of the questionnaire. A copy of the final version of the questionnaire for each year can be found in Appendices 8 to 11.

Administration of the teacher pre-implementation questionnaire

Pre-implementation questionnaires were mailed directly to teachers in September 1995, August 1996, August 1997 and August 1998. To maximise response rates, a covering letter describing the questionnaire and how it should be completed, a pre-addressed reply paid envelope and a teabag were included with the mailout. As an incentive for teachers to respond, the cover letter informed them that when they returned their questionnaire they would be entered into a draw for a $50.00 gift voucher for a local department store.

Non-respondents were sent a follow-up letter and a second copy of the questionnaire three weeks after the due date. Teachers who had not responded prior to the Kidskin in-service training (mid September 1995 and mid August 1996-1998) were asked to complete a copy of the questionnaire immediately on arrival at the training session.

Teacher program checklist

The program checklist was used to document the quantity (completeness) and the quality (fidelity) of implementation of the classroom intervention by teachers. This teacher self-report instrument was modeled on logbook or checklist-style instruments used in previous school health studies [34, 38, 152, 153, 168, 169, 215] and was kept brief and simple to maximise teacher compliance. A copy of the program checklists for each year's intervention are provided in Appendices 12 to 15.

The program checklist comprised two one-page, self-report logs that listed all Kidskin program activities. Teachers checked boxes indicating whether they had completed as planned, modified, or not completed each activity with their class. If they had not completed an activity they were asked to indicate their reasons for not doing so by selecting from a categorical list of responses. Space was provided for teachers to explain the type of modifications they made to the program and what they liked or disliked about each activity.

The number of activities completed by teachers (indicated by a 'Yes' response) was used as a measure of completeness or quantity of implementation. Modified activities were assessed by the author of this thesis and were recoded 'Yes' if the modification described by the teacher still met the theme objectives. Modified activities were recoded 'No' (did not complete the activity) if the assessor judged that the modification did not meet the theme objectives. If the boxes for any activities were left blank, it was conservatively assumed that the activity had not been completed. If the program checklist was not returned, student work samples (see below) were used, where available, to determine whether the teacher taught the activity.

Instrument development, reliability and validity

The format of the teacher program checklist was based upon similar implementation measures for use in primary schools, developed for the Western Australian Centre for

Health Promotion Research's Child Pedestrian Injury Prevention Project [216]. The assessment of the construct validity of this instrument is described in Chapter 4 of this thesis.

Program checklist data collection

The program checklist was included as the final pages in the Kidskin teachers' guide and teachers were shown how to complete the checklist at the Kidskin teacher training. To reduce the likelihood of recall bias and teacher attrition, teachers were asked to complete the checklists after each lesson and return the first checklist half-way through the program and the second immediately on completing the program. Details of where to fax or mail the completed checklist were provided on each page.

All teachers were faxed a reminder to return their checklist at the end of the program each year and halfway through the program in Years 2-4. Program staff telephoned non-respondents during the last week of school to ask them to return their checklists.

Student work sample checklist

Student work samples were assessed to provide a measure of the completeness of implementation of the Kidskin activities that incorporated work sheets. These data were used to verify teacher self-report of activities containing work sheets within the Kidskin curriculum. The development of this instrument was based on methods used by Resnicow et al. to assess implementation of a school-based health education program for Grades 1-4 [152].

As part of the program materials provided at the teacher training, teachers were given a class set of blank scrapbooks for their students to paste in their completed activity sheets. A checklist was developed listing all Kidskin activities that produced work sample evidence (eg. an activity sheet or child's drawing). Forty percent of all Year 1 activities, 58% of all Year 2 activities, 57% of all Year 3 activities and 54% of all Year 4 activities provided evaluable work samples, that demonstrated the materials were implemented as planned. Student scrapbooks were examined for evidence of Kidskin work samples and results were scored on the student work sample checklist. A copy of the student work sample checklist sheets for each year's implementation can be found in Appendices 16 to 19.

Student work sample data collection

Seven students were randomly selected from each class and their work samples were collected and assessed. Students were randomly selected to minimise bias due to teachers selecting student work. At the end of the program implementation each year, Kidskin project staff visited all study schools and collected all available Kidskin work samples from five of these students in each class. If any of these five students had left the school, or had been a long-term absentee, the next student on the list of seven was substituted in his/her place.

One trained rater (the author), familiar with the contents of the intervention, assessed all work samples in all years of the study by identifying evidence of an activity being completed by the students. The activity was considered completed if the activity sheet had been attempted, either partially or wholly, by the student. If there was evidence that an activity had been completed in a modified format, an 'M' was placed on the checklist and the activity was considered completed. If one or more children from a classroom had evidence of completing an activity (either as planned, or in a modified format), then it was considered the teacher had implemented that activity with his/her class. All student work samples were returned to children approximately two weeks after collection.

Summer Club implementation parent/student questionnaire

The Summer Club implementation questionnaire assessed how much of the Summer Club intervention was received by students and whether activities were completed. Satisfaction with the intervention was also evaluated.

Instrument development

Prior to administering this instrument to study parents, it was assessed for face and content validity by the Kidskin project staff. It was then pilot tested with a convenience sample of 19 parents of Year 1 students in one class at a school not involved in the Kidskin study to determine the suitability of its layout and wording. Minor adaptations were made to the draft version based on feedback from these groups. The student instrument used in the final year of the study was pilot tested with a convenience sample of eight children aged 8 to 10 years to determine the suitability of its structure and

wording and to check for comprehension of the questions in a group of similar age to the target population. A copy of the final versions of the parent and student questionnaires can be found in Appendices 20 to 22.

While the Summer Club materials were designed for students, it was felt a more valid and reliable response about the use of the materials would be obtained by surveying parents, due to the young age of the students. This was felt to be particularly so in Year 1 when, due to students' limited reading skills, parents often completed the activities with their child.

In 1999, Summer Club implementation was assessed via a structured telephone interview with students rather than with parents. Formative evaluation for the Summer Club materials indicated that children at this age (9-10 years) were more independent and likely to have had less parental input into their use of the holiday activities. Therefore it was decided that it would be more valid to ask students about how much of the Summer Club materials they had used, rather than their parents.

Data collection procedures

The parents' Summer Club implementation questionnaire was administered in March 1996 to a random sample of 200 parents whose children attended high intervention schools and had been sent Summer Club materials. In 1998 it was administered to all parents of children who had received the Summer Club. Questionnaires were mailed to the participants' homes, addressed 'to the parents of' the child participating in the study. The instructions requested the questionnaire be completed by the person who usually helped their child with the Summer Club materials.

The self-complete questionnaire asked parents about their child's use of and satisfaction with the Summer Club materials. Parents were also asked about the effect the materials had on their family's sun protection attitudes and behaviours. A reply paid envelope was provided to facilitate return of the questionnaire. Non-respondents were sent a follow-up letter and second copy of the questionnaire and reply paid envelope three weeks after initial administration.

A telephone interview format was used in February 1999 to contact children directly about their recollection of the Summer Club materials received over the 1998/99 summer holidays. The interview asked whether students: remembered receiving each mailout; used or read each mailout; and enjoyed receiving the Summer Club materials. Trained interviewers asked to speak to the parent to obtain permission to conduct the interview with the child. If the parent gave his/her consent, the interviewer asked if the student agreed to participate before commencing with the interview.

Summer Club work sample checklist

Students' Summer Club work samples were assessed to provide a measure of the completeness of implementation of the Summer Club activities that incorporated written/drawn work. These data were collected to assist in the validation of parent report of Summer Club activity completion.

Instrument development

In Year 1 of the study, students were asked to place all their Kidskin Summer Club materials into a scrapbook and to return this scrapbook at the end of the school holidays. Students could return their scrapbook using either the reply paid envelope provided for them, or by giving it to their classroom teacher on returning to school at the end of the holidays. Teachers were asked to remind students to return their materials at the commencement of the school year, and scrapbooks were collected from Year 2 teachers in February 1996 by Kidskin staff and returned approximately two weeks later.

In Years 2 and 3 of the study a slightly different approach was used in an attempt to increase return rates. A checklist was included with each mailout and students were asked to tick the activities they completed, answer several questions about the activities, then tear off the checklist and mail it back to the Kidskin office in the reply paid envelope provided. To check the validity of this student self-report data, students were asked to hand in all their Kidskin Summer Club materials at the end of the holidays, as per Year 1. When this second method was piloted at two pilot schools over the two-week long spring school holidays, higher rates (75%) of return of student work samples were obtained.

Methods used to enhance response rates included asking teachers to remind students to return their materials and conducting a raffle where the names of all students who returned work samples were entered into a small prize draw.

A summary of the strengths and weaknesses of each implementation measure is provided in Table 3.9.

Table 3.9 - Advantages and disadvantages of Kidskin implementation measures

Implementation Measure	**Strengths**	**Weaknesses**
Teacher program checklist	Comprehensive – asks about every activity in the program Minimises recall bias by being returned at mid-point and end-point of program each year High response rate	Self-report Social desirability bias may lead to overestimation Slightly lower response rate than student work samples Incomplete return may lead to underestimation of implementation e.g. teacher may have returned first but not second checklist, but may have taught all the activities
Student work sample checklist	High response rate Objective, does not rely on teacher-report of implementation	Not a comprehensive assessment of the program. Only measures activities with paper evidence
Summer Club implementation questionnaire	Comprehensive – asks about every activity in the program (Years 3 and 4 only)	Relies on parent report of the student's completion of activities in Years 1 and 3 Recall bias – completed at the end of the summer holidays Social desirability bias may lead to more favourable responses being given Lower response rates Not administered in Year 2 of the study and only administered to a sub-sample of participants in Year 1 Structure of instrument varies – parent responses in Years 1 and 3, student responses in Year 4
Summer Club work sample assessment	Objective, does not rely on parent or student report of implementation	Response rates lower as Summer Club is used informally over the holidays and work samples not always kept Not a comprehensive assessment of the program -only measures activities with paper evidence

3.4.3 DATA COLLECTION SUMMARY

This process evaluation study analysed data from cohort students, their parents and teachers during the four years of Kidskin intervention implementation. These data were collected via student interview, parent-report and teacher-report questionnaires and student work samples as described previously. Data on student skin colour, number of naevi and sun-related behaviours were collected via direct skin observation and parent s questionnaire at baseline and then again in the fifth year of the study following four years of intervention [80]. Data on student skin colour and behaviours were also collected in Year 3 of the Kidskin study, however the analysis of the effect of intervention dose on these data is beyond the scope of this thesis. A timeline of the Kidskin study's recruitment procedures, intervention delivery and data collection to February 2000 is shown in Figure 3.2.

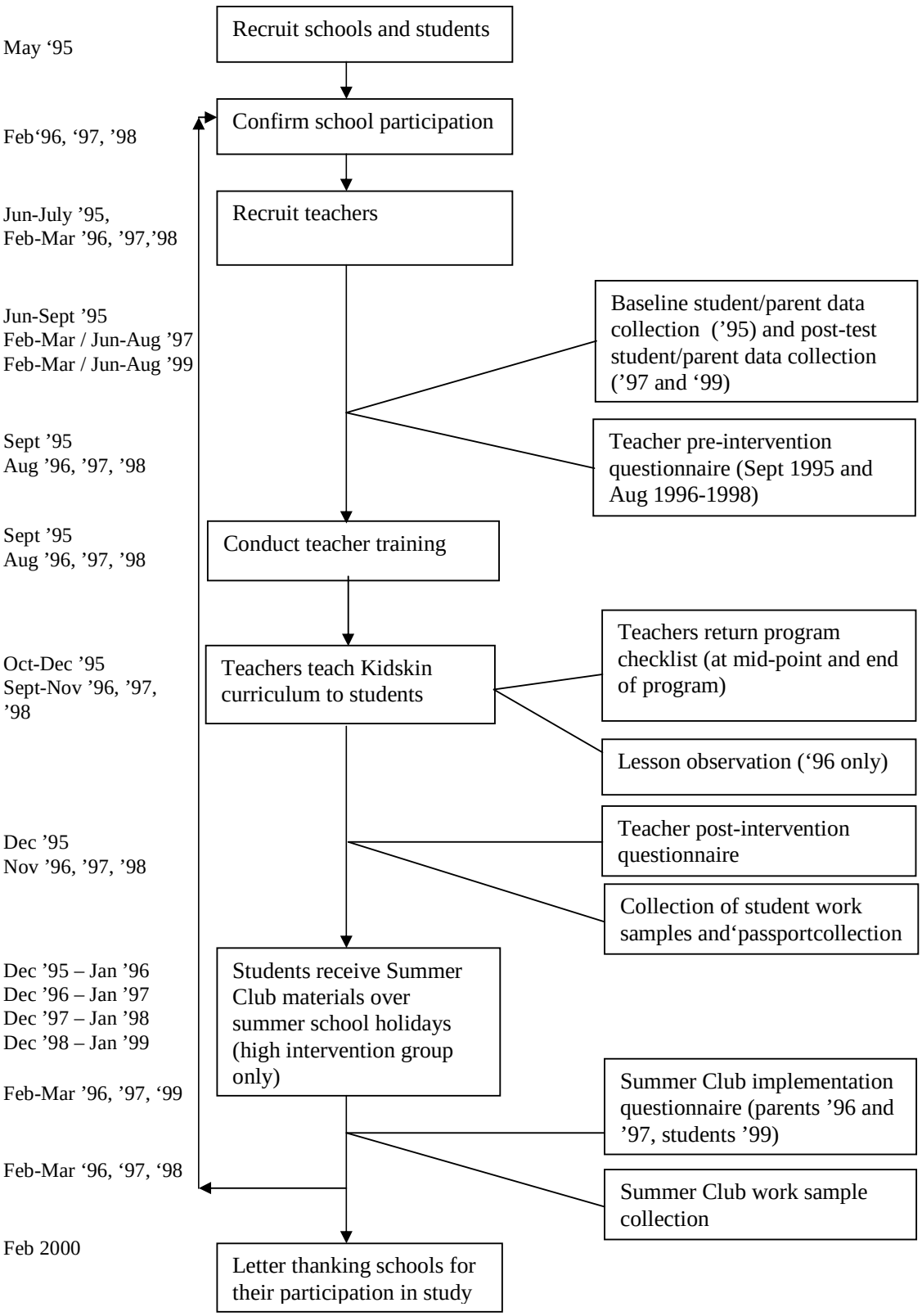

Figure 3.2 - Timeline of Kidskin school-based intervention and data collection procedures conducted each year.

3.5 ANALYSIS AND TREATMENT OF DATA

Data analysis was performed using the Statistical Package for the Social Sciences (SPSS) for Windows software, Version 11.5 [217] and Stata for Windows, Version 8.2 [218].

3.5.1 UNIVARIATE AND BIVARIATE ANALYSES

Descriptive univariate statistics were calculated for each data set. Percentages are presented for categorical variables, means and standard deviations for symmetric continuous variables and means, medians and standard deviations for skewed continuous variables. Baseline differences between teachers were assessed using chi-square tests and one-way ANOVA's. Respondents' and non-respondents' baseline values were compared to test for selective attrition using chi-square tests, t-tests and Mann-Whitney's test. Chi-squared tests were used to test for differences between teachers in the high and moderate groups in terms of their categorised dose scores.

3.5.2 MULTIVARIATE ANALYSES

Separate binary logistic regression analyses were conducted to assess dose effects on each of the binary, dependent sun-related behaviour variables (bathers type worn, hat wearing, back coverage, sunscreen use, shade use). Multiple linear regression analyses were conducted for the continuous, dependent sun-related behaviour variable (hours spent outside between 11am and 2pm) against the dose variables. Multiple linear regression was also used to assess the four naevi variables (naevi on the back, face, arms and chest) and the two suntanning variables (tanning on the forearm and back) against the dose variables. Each of these analyses used random coefficients models (random intercepts only) to control for clustering at the school level. Continuous dependent variables were tested for normality prior to analysis. Non-normal variables were transformed using the natural logarithm to achieve normality. A value of one was added to the naevi variables since zero values were possible.

ANCOVA-type analyses were chosen in preference to repeated measures analyses since the latter methods are not clearly established for clustered binary repeated measures data and differing results can be obtained using different approaches [219]. Some advantages

to this approach above repeated measures analyses have been identified by Murray [97] and Janega [220].

The model-fitting process was conducted in a number of phases. Firstly possible confounders were assessed for significant confounding effects in order to control for these effects when modeling program dose. Secondly the various dose measures were assessed separately to test for impact.

A two-stage process was followed to determine which potentially confounding variables to retain in the model, for each dependent variable. Firstly, each was assessed individually for significance. Secondly all significant variables were included in the model and using a backward elimination strategy, non-significant variables were removed one by one until the most parsimonious model was achieved. In all instances where they were available, the baseline values of the dependent variable were included in the model as a predictor to adjust for possible baseline differences.

Each of the dose measures were then added to these models individually to test for their effects after adjusting for the value of the dependent variable at baseline and any significant confounding variables. As the dose measures consisted of three levels, the models were refitted to obtain all possible comparisons between the different levels of dose.

3.5.3 THEORETICAL MODEL FOR THE DOSE-RESPONSE ANALYSIS

A number of variables were identified as being associated with the student outcomes. The model for the dose-response analyses is shown in Figure 3.3.

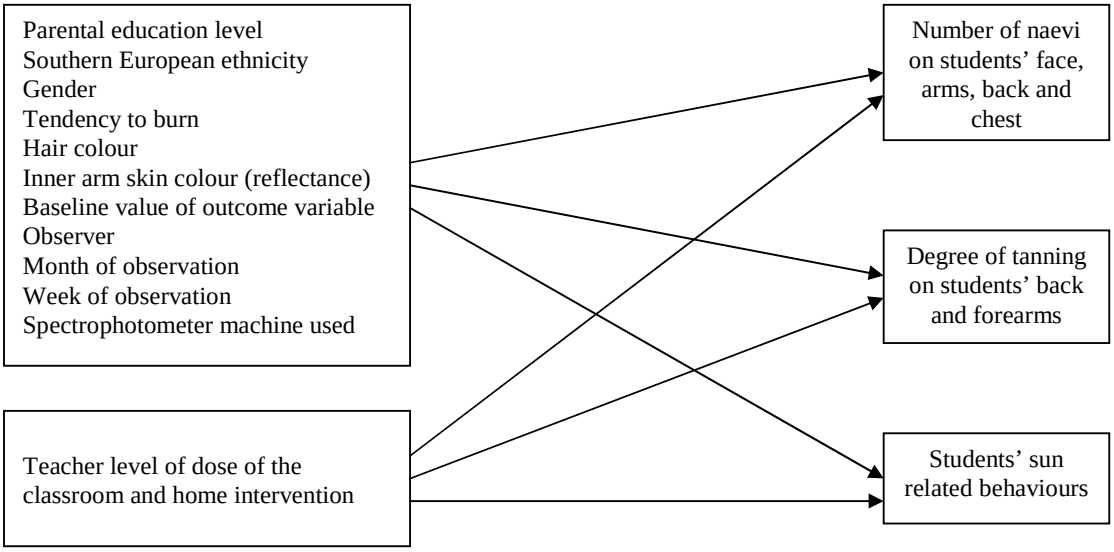

Figure 3.3 – Theoretical model for the dose-response analyses

3.5.4 DESCRIPTION OF THE INDEPENDENT VARIABLES

To account for missing data, both teacher program checklist and student work sample data were used to describe the dose of the classroom and home intervention implemented by teachers. The Summer Club intervention dose was not included in the program dose used in the dose-response analyses. The Totally Cool Summer Club was designed as a cue to remind students about sun protection during the holidays and its level of use was difficult to assess accurately. The Summer Club implementation questionnaire was not administered in all years of the program and furthermore there were low response rates for work samples (See Chapter 4). Student study group was included as a covariate in all analyses to account for the effect of receiving the Summer Club intervention as there was not detailed information on students' completion of individual Summer Club activities each year. Following is a description of the independent variables used in the dose-response analyses. The dose measures assess teacher implementation of the classroom and home intervention only.

Creation of the combined teacher implementation variable

The teacher self-report program checklists were the primary source of information about teacher implementation of the classroom activities each year. They provided the most complete overview of all program activities (see Table 3.9). Student work sample

evidence of teacher completion of an activity was used to provide more complete data where teacher program checklist data were missing. Where program checklist and student work sample data were both missing, teachers were assumed to have not completed the activity (ie. given a score of zero for that activity). This is a conservative measure as it may underestimate the number of activities a teacher completed.

Creation of the weighted classroom dose scores

For all four years of the Kidskin program, each of the classroom and home activities were assigned a weighting based on the extent to which they met the Kidskin Program Outcomes. These Program Outcomes are listed below in Table 3.10 and describe the outcomes students should have achieved by the end of the Kidskin program. The twelve Program Outcomes were divided into three groups: knowledge-based outcomes (four); affective or attitude-based outcomes (two); and skills-based outcomes (six).

Table 3.10 - Kidskin outcomes

OUTCOMES *After completing this program, children will be able to:*
Knowledge • **K1** - Identify and demonstrate actions they can take to protect their skin from the sun. • **K2** - Identify and describe the best types of clothing to protect their skin from the sun. • **K3** - Discuss the period of the day when they should avoid playing in the sun. • **K4** - Describe the games and activities they can play in the shade during the middle of the day.
Affective • **A1** - Describe why they believe it is important to protect themselves and others from the sun. • **A2** - Describe why they need to take responsibility for protecting themselves from the sun.
Skills • **S1** - In a variety of situations, decide what actions they can take to protect themselves from the sun. • **S2** - Explain to their parents and others why they need to play under the shade or (and) wear protective clothing when outside. • **S3** - Demonstrate how they can encourage their family and friends to protect their skin from the sun. • **S4** - Respond assertively to someone who is encouraging them to be in the sun without protection. • **S5** - Set a goal to reduce sun exposure for themselves, their families and friends. • **S6** - Use assertive communication to request that school and community play areas be more sun safe.

Development of the activity weightings proceeded via several steps. Firstly each Kidskin activity was assigned a score for each of the twelve outcomes based on a Likert-type scale of how well the activity met that outcome. Possible scores were: 0 = the activity would not achieve this outcome; 0.25 = activity would achieve this outcome a little; 0.5 = activity would achieve some/half of the outcome; 0.75 = activity would achieve most of the outcome; 1 = activity would achieve all of the outcome. The face and content validity of these weightings was assessed via a panel of three experts in health and education using a modified Delphi process [138] to reach consensus [221].

These weightings per outcome for each activity were then averaged over the weightings per outcome group so that each activity obtained a mean weighting for each group (ie. knowledge, affective and skills). These mean weightings were then averaged to give the overall weighting across the three outcome types for each activity. This overall weighting for each activity ranged between zero and one. Activities with a low weighting met few of the Program Outcomes while those with a higher weighting met more of the Program Outcomes.

Based on their program checklist and work sample data, teachers received a score of 'one' for an activity if it was taught to their class and a score of zero if they did not teach it. The implementation score for each activity was then multiplied by the weighting (described above) for that activity to create a weighted dose score between zero and one for each activity. For each theme, the weighted dose scores were summed to create dose scores. An 'all activities' dose score was calculated for each year of the intervention as the sum of all the possible program activities teachers could have taught in each year and was based on: introduction activities for Years 2 to 4 (introduction activities were not included in the Year 1 program); core activities for Years 1-4; extension activities for Years 1-4; home activities for Years 1-4 and; closure activities for Year 4 (these activities were included in Year 4 only).

Table 3.11 shows the classroom activity weightings for Year 4. The last column of Table 3.11 and Table 3.12 provide examples of the method of calculation of the classroom weighted dose scores for a hypothetical Year 4 teacher. The weighting for each activity is multiplied by a one if the activity was completed, as is the case for all

activities in Theme 1 in this example (Table 3.12). In the example in Theme 2 the extension activity was not completed, therefore, that activity's weighting is multiplied by zero. The scores are all summed to give each teacher an overall weighted score based on their implementation for that year. The possible ranges of these dose scores differed each year depending on the weightings for each activity.

Table 3.11 - Example of classroom activity weightings for Year 4.

Year 4	**Activity type**	**Weighting**	**Example program checklist /work sample score (1= completed; 0=did not complete)**
Theme 1	Introduction activity	0.54	1
	Core activity	0.47	1
	Home activity	0.46	1
Theme 2	Introduction activity	0.44	1
	Core activity	0.73	1
	Extension activity	0.26	0
	Home activity	0.53	1
Theme 3	Introduction activity	0.23	0
	Core activity	0.72	1
	Extension activity	0.23	1
	Home activity	0.23	1
Theme 4	Introduction activity	0.15	0
	Core activity	0.67	1
	Extension activity	0.67	0
	Home activity	0.66	0
Closure activities	Closure extension activity 1	0.47	0
	Closure extension activity 2	0.25	0
	Closure processing activity	0.47	1

Table 3.12 - Example of the calculation of components of classroom weighted dose scores for a Year 4 teacher

Classroom 'all activities' weighted dose score for Year 4	= (0.54x1) + (0.47x1) + (0.46x1) + (0.44x1) + (0.73x1) + (0.26x0) + (0.53x1) + (0.23x0) + (0.72x1) + (0.23x1) + (0.23x1) + (0.15x0) + (0.67x1) + (0.67x0) + (0.66x0) + (0.47x0) + (0.25x0) + (0.47x1) = 0.54 +0.47 + 0.46 + 0.44 + 0.73 + 0 + 0.53 + 0 + 0.72 + 0.23 + 0.23 + 0 + 0.67 + 0 + 0 + 0 + 0 + 0.47 = 5.49

For the purposes of the dose analyses, cumulative dose scores were calculated to determine the effects of, firstly, dose in Year 1, then the combined dose in Years 1 and 2, the combined dose in Years 1 to 3 and finally the combined dose for all four years.

Maximum possible cumulative dose scores for the dose variables are detailed in Table 3.13.

Table 3.13 - Maximum scores for the dose variables

Dose Score Variables	Maximum dose scores [a]
Classroom 'all activities' cumulative dose score for Year 1	9.08
Classroom 'all activities' cumulative dose score for Years 1and 2	18.48
Classroom 'all activities' cumulative dose score for Years 1, 2 and 3	26.16
Classroom 'all activities' cumulative dose score for Years 1, 2, 3 and 4	34.34

[a] The minimum possible dose score is zero

Within each year, teacher dose scores varied based on which activities they taught their class, however all children within that class in that year were assigned the same weighted dose scores. Students at high and moderate intervention schools could both achieve this maximum dose score. Tertiles of these weighted dose scores were calculated for each year to create categorical dose variables for use in the analyses.

3.5.5 DESCRIPTION OF THE DEPENDENT VARIABLES

The student outcomes selected as dependent variables in the multivariate analyses for this process evaluation were based on those used by Milne et al. [(80)] in their outcome evaluation of the Kidskin program. These variables provided both behavioural and biomedical measures of children's sun exposure and addressed the key messages of the educational intervention. The student outcomes measured at the end of program implementation (1999) were analysed as the dependent variables in this thesis and the models included the corresponding baseline (1995) measurements as covariates. The multivariate analyses were conducted to examine the association between implementation (dose) and student outcomes at post-test in 1999. Midterm data was not assessed in the dose-response analyses as data on naevi were not collected at this time point. Further, assessment using 1999 outcomes allowed the effect of dose of the whole program over the four years of the intervention to be assessed. The dependent variables for the analyses at post-test are described in Table 3.14.

Behavioural outcomes were assessed via parent report of their child's sun-related behaviours during the previous summer. Data on these variables were available at

baseline and post-test in 1999. The variables assessed included: amount of time exposed to the sun; use of hats, sunscreen, shade, clothing covering the back; and type of swimwear worn during the last summer.

The amount of time exposed to the sun included a continuous variable that assessed the time spent in the sun between 11am and 2pm. This was developed from parent questionnaire items asking about how many days were spent at the pool, the beach and outside around the home and multiplying these by the hours usually spent at each location [85]. The amount of time was log transformed to obtain a normally distributed variable.

Use of hats, sunscreen, shade and back cover were binary measures of the proportion of time each measure was used across all venues (ie. beach, pool and at home) weighted by amount of time spent outside at each venue [83]. The two response categories for the binary hat wearing, sunscreen use and back coverage variables were either the student used the sun protection measure 'all of the time' when in the sun, or the student performed the activity 'less than all the time' when in the sun [83, pg 482]. For the binary shade use variable, the two response categories were either the student was in the shade for 'at least half the time', or the student was in the shade 'less than half the time' when outside [83, pg 482].

The binary measure of the type of swimwear worn classified students as having worn either the 'gold standard' swimwear (covered the trunk, had sleeves covering at least the upper arms and covered the upper legs) or not 'gold standard' swimwear (provided less sun protection) [80].

Degree of tanning was assessed by measuring skin reflectance at the end of summer (February) in 1999 [85]. Melanin density was calculated [85, 214] from skin reflectance measured on the dorsal surface of the forearm and mid-scapular region of the back.

Number of naevi was assessed in 1995 and 1999 by counting the naevi on the trunk from slide photographs of the back and chest (boys only) and via direct counting of the naevi on the face and arms. These variables were log-normally distributed after a constant (1.0) was added to allow for students with no naevi [84]. Therefore the

dependent variables for naevi were the natural logarithm of the number of naevi plus one for naevi on the back, chest (boys only), face and arms, which were continuous variables.

3.5.6 COVARIATES USED IN THE MULTIVARIATE ANALYSES

Adjustments to control for potential confounding were based on those used by Milne et al [80, 83, 84] in the analysis of between groups data from the Kidskin study. All variables on which the the study groups differed at baseline and that were considered, *a priori*, to be predictive of the outcomes were included as covariates in the analyses [80, 85]. In the analyses of the students' sun-related behaviours, the following potential confounders were included: parents' education level, southern European ethnicity, gender tendency to sunburn and study group. Degree of freckling did not differ between groups at baseline, so was not included as a covariate. Analyses of behavioural data were also adjusted for the baseline values of the dependent variables, except in the analyses of time spent outside in the middle of the day. Baseline values for this dependent variable were not available due to differences in the questions about time spent outside between baseline and post-test 1999 questionnaires.

Analyses using the reflectance spectrophotometer data were adjusted for parents' education level, southern European ethnicity, gender, tendency to sunburn, study group, plus the spectrophotometer machine used, the observer, the week of observation and inner arm melanin density score. Students' inner arm melanin density was used to determine 'constitutional' [85] or base skin colour as the inside surface of the upper arm is a body site that receives little sun exposure [85]. These measurements were conducted during winter 1999 when the likelihood of sun exposure inducing tanning in this area was low. Baseline (1995) inner arm skin colour measurements were not used as they were assessed using a different reflectance spectrophotometer [85].

Multivariate analyses using the naevi outcome data were adjusted for parental education, southern European ethnicity, gender, tendency to sunburn and study group, as well as hair colour, inner arm reflectance score, the baseline naevus count (log transformed), the observer in each year and the month of observation in each year. These factors have

been found to be associated with the development of naevi in children [44] and to influence their assessment [93].

Study group was included in all analyses as an indicator variable for high versus moderate intervention group. This controlled for the possible effect of receiving the Totally Cool Summer Club intervention, the sun protective swimwear, and school support for policy and environmental change, which were part of the 'high' intervention. This was necessary as these intervention components were not included in the measure of program dose.

The dependent, independent and covariate variables used in the multivariate analyses are described in Table 3.14, Table 3.15 and Table 3.16 .

Table 3.14 - Dependent variables used in the multivariate analyses

Variable – Dependent variables	**Variable type**
Log of (time in minutes exposed between 11 am and 2 pm +1)	Continuous
Hat use (all the time v's less than all the time)	Binary
Sunscreen use on back (all the time v's less than all the time)	Binary
Sunscreen use on face (all the time v's less than all the time)	Binary
Sunscreen use on arms (all the time v's less than all the time)	Binary
Shade use (at least half the time v's less than half the time)	Binary
Clothing covering back (all the time v's less than all the time)	Binary
Bathers type worn (gold standard v's other)	Binary
Degree of tan	
Back	Continuous
Dorsal surface of forearm	Continuous
Log of (number of naevi + 1)	
Back	Continuous
Chest (boys only)	Continuous
Face	Continuous
Arms	Continuous

Table 3.15 - Dose variables used in the multivariate analyses

Variable – Dose variables	Variable type
Classroom and home dose 'all' activities Year 1 [a]	Categorical
Classroom and home dose 'all' activities for Years 1 and 2 [a]	Categorical
Classroom and home dose 'all' activities for Years 1, 2 and 3 [a]	Categorical
Classroom and home dose 'all' activities for Years 1, 2, 3 and 4 [a]	Categorical

[a] Cumulative score divided into tertiles

Table 3.16- Covariates used in the multivariate analyses

Variable - Covariates	Variable type
Covariates for analyses using behavioural variables	
Parental education	Binary
Southern European ethnicity	Binary
Gender	Binary
Tendency to sunburn	Binary
Study group	Binary
Baseline value of same outcome variable	Continuous or binary
Covariates for analyses using spectrophotometer data	
Parental education	Binary
Southern European ethnicity	Binary
Sex	Binary
Tendency to sunburn	Binary
Spectrophotometer used	Binary
Observer	Categorical
Week of observation	Categorical
Study group	Binary
Inner arm reflectance winter 1999	Continuous
Covariates for analyses using naevi data	
Parental education	Binary
Southern European ethnicity	Binary
Sex	Binary
Tendency to sunburn	Binary
Hair colour	Continuous
Inner arm reflectance	Continuous
Observer in each year	Categorical
Month of observation in each year	Categorical
Study group	Binary
Logged baseline naevus count	Continuous

3.6 SUMMARY OF METHODS

This chapter has described the methodology used to conduct the process evaluation of the Kidskin project. After formulating the research design and sample selection for a multi-component sun safety education intervention trial in Western Australia, survey instruments to examine the impact of the interventions were developed and pilot tested along with procedures for collecting these data. School- and home-based interventions were developed, targeting the sun-related knowledge, attitudes and behaviours of the Kidskin cohort. Classroom-based curricula with take-home components were developed and piloted for Years 1, 2, 3 and 4 students and teachers. Strategies to support and enhance their implementation included the provision of in-service training each year with funded teacher relief, and the provision of all materials required to teach the Kidskin activities each year in a Teacher's Kit. A 'booster' holiday intervention was also developed in each of these years to be mailed to students and their families during the summer school holidays. Thirdly, survey instruments were developed to assess the process of implementation delivery of the school- and home-based intervention and the holiday intervention. Finally, data collection procedures were established and data analyses for the process evaluation were planned.

The information provided in the teacher instruments allowed the level of program implementation to be assessed. The effect of this dose on the student outcomes of sun-related behaviors, suntanning and development of naevi was evaluated. The results of this process evaluation are described in Chapter 4.

4. RESULTS

4.1 INTRODUCTION

This chapter describes the results of the process evaluation of the Kidskin intervention trial. As described in the introduction to this thesis, the objectives of this process evaluation study were to:

1. Determine the dose of the Kidskin classroom and home intervention delivered to students.
2. Determine the association between the level of dose of the Kidskin classroom and home intervention and student sun-related behaviours, level of tanning and number of naevi at post-test in 1999.

As well as providing data to address these objectives and the study hypotheses listed in Chapter 1, this chapter describes: the demographic characteristics of the student and teacher samples; the representativeness of the sample; and response rates to the evaluation measures.

4.2 RESPONSE RATES FOR STUDENT AND TEACHER CHARACTERISTICS DATA

The sample for the process evaluation study described in this thesis comprised the cohort of students of European origin and their parents at the 19 high and moderate intervention group schools who took part in the Kidskin project between 1995 and 1999, and the teachers of these students in 1995 to 1998. Students and their parents formed a longitudinal cohort and were tracked over five years. A new cohort of teachers was recruited into the study each year as these cohort students progressed from Year 1 in 1995 to Year 4 in 1998. The assignment of students to teachers each year was coordinated by the school and unrelated to this study. While most teachers taught the Kidskin classroom intervention only to their own class, several teachers took more than one class for the program (Table 4.1).

Table 4.1 - Number of classes (and teachers [a]) participating in Kidskin process evaluation study 1995 – 1998

Study Condition	1995	1996	1997	1998
High Intervention Group (8 schools)	21 (21)	23 (23)	23 (23)	23 (22)[b]
Moderate Intervention Group (11 schools)	31 (29)[b]	33 (33)	34 (34)	32 (31)[b]
Total	52 (50)	56 (56)	57 (57)	55 (53)

[a] Includes only the main Kidskin/health teacher for each class, not tandem teachers
[b] One teacher taught health to more than one class

4.2.1 STUDENT OUTCOME DATA RESPONSE RATES

Response rates and participation in each round of outcome data collection in the larger Kidskin study were described by Milne [80, 83-85, 91]. The relevant sections of these data that relate to students in the intervention group will be reviewed in this section to provide details of the student cohort to be linked to teacher data in the current process evaluation.

For the larger Kidskin study all 2,529 Year 1 children at the 33 study schools were invited to participate. Parental consent was obtained for 1,776 children (70%). Of these children, 1,623 were of European ethnicity as determined from information given by parents in the baseline outcome data questionnaire and obtained from data collected at the baseline skin survey. Non-European children, were excluded from further analyses as they were found to have darker skin and fewer naevi at baseline than other children in the study [80]. Most were of Asian descent, and skin cancers, including melanoma, are uncommon in individuals from this ethnic group [80, 222].

Ninety-one children whose parents were uncertain of their ethnic origin, were included in the sample of 1623 'European' children as their naevus counts and skin reflectance were almost the same as this group, indicating their ancestors were likely to have been European [80].

The current process evaluation includes only the data collected from the high and moderate intervention groups. Therefore, of the 1,282 children at the 19 high and moderate intervention schools who were invited to participate, parental consent was obtained for 960 children (75%). Of these children 875 were of European ethnicity and were included in the analyses. Combined high and moderate intervention group response fractions for study recruitment and outcome data collection at each time point are listed in Table 4.2. The 875 children with European ethnicity constitute the denominator for all follow-up response fractions.

Table 4.2 - Response fractions for recruitment and data collection for high and moderate intervention groups

Instrument	Total respondents n (%)
Invited to participate	1282
Parental consent given	960 (74.8)
European origin [a]	875
1995 (W) skin reflectance, naevi, pigmentary factors	873 (99.8)
1995 sun-related behaviour parents' questionnaire	865 (98.8)
1999 (S) skin reflectance	711 (81.4)
1999 sun-related behaviour parents' questionnaire	723 (82.6)
1999 (W) naevi, skin reflectance	794 (90.8)

W Data collected at end of winter
S Data collected at end of summer
[a] Percentages not available for European origin, as data on the ethnicity of all invitees were unknown.

All but two children in the moderate and high intervention groups were tested at baseline in winter 1995. At the end of the Kidskin study in October 1999, 90% of the 875 students in the high and moderate groups at baseline remained in the Perth metropolitan area and were eligible for follow up [(42)]. Children who moved schools were followed up at post-test wherever possible, even if they moved to non-study schools.

Most parents returned the sun-related behaviour parent questionnaire at baseline (99%), with response rates remaining high (83%) at post test in 1999. At least 81% of children were followed up for skin measurements at post test in 1999 (Table 4.2). Of the 794

students who had naevi assessed in winter 1999 all had naevi on the face assessed, one student was missing arm naevi data and 17 were missing data on naevi on the back.

The high response rates attained suggest that the sample available for analysis is representative of all European children eligible and invited to participate in the study at baseline in 1995.

4.2.2 TEACHER CHARACTERISTICS DATA RESPONSE RATES

Information on teacher attendance at the Kidskin in-service trainings was recorded for each year of the program. The self-complete teacher pre-implementation questionnaire was used to obtain teacher demographic and teaching characteristics data each year. The proportion of classes where the teacher attended the training and completed the questionnaire prior to implementing the Kidskin program are reported in this section.

Teacher in-service attendance

All classroom and health teachers of Year 1 classes in 1995, Year 2 classes in 1996, Year 3 classes in 1997 and Year 4 classes in 1998 were invited to attend the Kidskin program in-service training. In several cases more than one teacher attended per class, to allow teachers to make a decision on program delivery once they were familiar with the requirements of the program. However, the program was only taught by one teacher per class and in 1995 and 1998 several teachers taught the program to more than one class (Table 4.3).

The percentage of intervention classes who were taught the Kidskin intervention by a teacher who had attended the Kidskin teacher inservice training was 86% in Year 1 (1995), 92% in Year 2 (1996), 88% in Year 3 (1997) and 94% in Year 4 (1998) (Table 4.3).

Table 4.3 - Intervention teacher attendance at Kidskin in-service training

Total number of classes:	**Year 1 1995** n=52	**Year 2 1996** n=56	**Year 3 1997** n=57	**Year 4 1998** n=55
	n (%)	n (%)	n (%)	n (%)
Teachers at training (attendance)	46[a]	56[a]	53[a]	51
Classes taught Kidskin program by teacher who participated in the training	45 (86)	51 (92)	50 (88)	52 (94)
Classes taught Kidskin program by teacher who did not participate in the training	7 (14)	5 (8)	6 (11)[b]	2 (4)[b]

[a] Inservice attendance is higher than number of classes/number of classes taught by a trained teacher because both tandem teachers attended training but subsequently only one taught Kidskin program.
[b] One class was not taught the Kidskin program.

Teacher pre-implementation questionnaire

This questionnaire was mailed to teachers prior to the commencement of the intervention each year. It assessed teachers' demographic characteristics, teaching experience, amount of sun safety teaching and attitudes about the importance of sun safety education. In 1995 and 1996, 100% of teachers of eligible classes completed the pre-implementation questionnaire. In 1997 and 1998, 95% and 98% of classes had teachers who returned this questionnaire. These data are shown in Table 4.4.

Table 4.4 - Response rates for teacher pre-implementation questionnaire

Instrument Number of Eligible classes:	**Year 1 1995** 52 *n (%)*	**Year 2 1996** 56 *n (%)*	**Year 3 1997** 57 *n (%)*	**Year 4 1998** 55 *n (%)*
Teacher pre-implementation questionnaire	52 (100)	56 (100)	54 (95)	54 (98)

4.3 SAMPLE CHARACTERISTICS

4.3.1 STUDENT SAMPLE CHARACTERISTICS

Baseline analyses were conducted on all students of European origin from the 19 high and moderate intervention group schools in the Kidskin study who had data collected

via the parent sun-related behaviour questionnaire or student skin testing. At both subsequent post-tests all available students were sampled and data from students of European origin were included in the analyses. Baseline data for all study groups in the larger Kidskin study has been presented previously by Milne et al [80]. The data for the intervention group students included in the current study are described below.

The characteristics of the 865 eligible students with data from the parent sun-related behaviour questionnaire and the 873 eligible students with naevi and tanning data at baseline are summarised in Table 4.5.

Forty six percent (n=399) of the students were in the high intervention group and 52% (n=453) were male. Twelve percent (n=101) were of southern European ethnicity. Just under half of the students had parents who were educated to tertiary level. When asked about how tanned their child's skin would look by the end of summer if they spent short periods in the sun each day without sunscreen, 33% of parents said their child would be very tanned, 43% moderately tanned, 21% lightly tanned and 3% said their child would have no tan by the end of summer. Parents were also asked to rate their child's skin's tendency to burn based on imagining its reaction to 30 minutes in the sun in the middle of the day at the start of summer without sunscreen. Five percent replied their child would have no burn at all, 39% said their child would have a mild burn, 46% a painful burn and 11% replied their child would be likely to have severe burn with blisters.

Fifteen percent of students at baseline wore hats all the time when outside and 51% had their back covered all the time when outside over summer. Thirty percent used shade half the time or more often when they were outside, and 18% used sunscreen on exposed skin not covered by clothing when outside. Sixty four percent of respondents at baseline wore swimwear with sleeves and that covered the trunk. At baseline students spent a median of 22.5 hours outdoors across all venues (beach, pool and around neighbourhood) in the middle of the day over the seven-week summer vacation period. This is equivalent to about 27.5 minutes per day.

At baseline, children in the study sample had a median of three naevi on the back, three on the chest (boys only), four on the face and a median of nine naevi on the arms. The median skin reflectance on the inner arm was 50%.

Table 4.5 - Baseline student characteristics (European origin students only)

Baseline student characteristic	**n (%)**
Responses from baseline parent questionnaire	***Total n=865***
Intervention group	
High	399 (46.1)
Moderate	466 (53.9)
Gender	
Male	453 (52.4)
Female	412 (47.6)
Southern European ethnicity	
Yes	101 (11.7)
No	764 (88.3)
Maximum education level of parents	missing =9
Non-tertiary	458 (53.5)
Tertiary	398 (46.5)
Skin reaction to frequent brief exposure	missing = 7
Very tanned	281 (32.8)
Moderately tanned	372 (43.4)
Lightly tanned	180 (21.0)
No tan	25 (2.9)
Skin reaction to 30 minutes midday sun	missing = 8
Severe burn with blisters	91 (10.6)
Painful burn	395 (46.1)
Mild burn	331 (38.6)
No sunburn at all	40 (4.7)
Time spent outside between 11am-2pm (hours)	Mean=28.49 Median=22.50 sd=22.93 n=836
Proportion of time hat worn when outside	Missing = 41
All the time	124 (15.0)
Less than all the time	700 (85.0)
Proportion of time back covered when outside	Missing = 38
All the time	418 (50.5)
Less than all the time	409 (49.5)
Proportion of time shade used when outside	Missing = 61
Half the time or more	235 (29.2)
Less than half the time	569 (70.8)
Proportion of time sunscreen used when outside	Missing = 37
All the time	146 (17.6)
Less than all the time	682 (82.4)
Baseline bathers type worn	Missing = 12
'Gold standard'	549 (64.4)
Other	304 (35.6)
Responses from baseline student skin testing	***Total n= 873***
Eye Colour	missing = 20
Brown	189 (22.2)
Hazel	189 (22.2)
Blue	457 (53.6)
Green	18 (2.0)
Hair Colour	missing = 68
Dark brown/black	301 (34.5)
Light brown	267 (31.2)
Blonde/fair	205 (23.8)
Red/auburn	24 (2.7)
Inner arm percent reflectance at baseline (%)	Raw Mean=49.86 Median=50.30 sd =6.08 n=873
Baseline naevi on back	Raw Mean=3.76 Median=3.00 sd=3.50 n=778
Baseline naevi on face	Raw Mean=4.51 Median=4.00 sd=3.43 n=873
Baseline naevi on arms	Raw Mean=11.06 Median=9.00 sd=7.96 n=873
Baseline naevi on chest (boys only)	Raw Mean=3.23 Median=3.00 sd=2.82 n=407

4.3.2 TEACHER SAMPLE CHARACTERISTICS

Characteristics of teachers of the student cohort were assessed each year via a self-complete questionnaire administered prior to commencement of the Kidskin classroom program. The intervention groups were collapsed to allow a comparison of teacher characteristics by study year. While most teachers taught Kidskin for only one year, 15% (n=33) of intervention group teachers taught Kidskin in two years of the study. This occurred when teachers changed the year groups they taught during the course of the study, or when teachers taught students in multi-age groupings and thus had the same group of students for more than one school year. These 33 teachers who taught the program for more than one year were only included in the analyses of teacher characteristics for their first year of teaching Kidskin. Another four teachers taught Kidskin to more than one classroom within a year group and these teachers were only included once each in these analyses. Therefore, the sample size for these anlyses were 50 teachers in 1995, 44 teachers in 1996, 45 teachers in 1997 and 44 teachers in 1998.

Significant differences between study years/year levels were found for five of the baseline teacher characteristics assessed – academic qualifications, teaching status, amount of health education training in the last five years, amount of sun safety training in the last two years, and frequency of giving incidental sun safety messages (Table 4.6). In addition gender differences were assumed.

Although the majority of teachers were female in each year of the study, there were 12 male teachers in 1998 (27%) compared to no male teachers in 1995 and 1996 and one in 1997 (2.2%). Chi square analyses were not conducted due to the small number of male teachers (Table 4.6). There was an association between study year and teaching status, with significantly fewer tandem teachers in 1995 (8%) than other years, particularly in 1997 (34%) ($\chi^2 = 9.87$; df = 3; p=0.020) (Table 4.6).

Year 1 teachers in 1995 tended to have had less health education or sun safety training in recent years than teachers in other years of the study. Sixty four percent of teachers in 1995 and 57% in 1996 had received no health education training in the last five years, compared to 37% of teachers in 1997 and 1998 who had received health education

training (χ^2 = 12.91; df = 6; p=0.045). None of the teachers in 1995 and 2.3% of teachers in 1996 had received sun safety training in the last two years whereas about 10% of teachers in 1997 and 1998 had received such training. Chi square analyses were not conducted due to low cell numbers. Teachers in 1995 were also more likely to have completed only three years of university training (69%) than teachers in 1996 (57%), 1997 (43%) and 1998 (40% were three year university trained) (χ^2 = 16.58; df = 6; p=0.011). These data are shown in Table 4.6.

The frequency with which teachers gave students incidental sun safety messages in Term 1 (autumn term - February to April) also differed across Year levels, with the prevalence of teachers reminding students about sun safety decreasing with increasing year level. In Year 2, 51% of teachers gave incidental sun safety messages every day, while 35% of Year 3 and 15% of Year 4 teachers did so (χ^2 = 17.04; df = 6; p=0.009) However, in all three years, less than 5% of teachers reported never giving incidental sun safety messages (Table 4.6). Data from Year 1 was not included in this analysis as the question in that year differed in that it did not specify at what time of year incidental messages were given.

Table 4.6 - Teacher sample characteristics by study year (high & mod. intervention groups combined) [c]

Variable	**Year 1 1995** (n=50)	**Year 2 1996** (n=44)	**Year 3 1997** (n=45)	**Year 4 1998** (n=44)	**F (df)**	***p***
Age (years) Mean (sd)	40.3 (8.7)	40.1 (9.2)	42.5 (7.3)	43.0 (7.0)	1.44 (3)	0.233
Teaching experience (years) Mean (sd)	14.5 (7.8)	16.3 (8.3)	16.7 (7.6)	18.4 (7.0)	1.89 (3)	0.133
Experience teaching Year (yrs) Mean (sd)	7.7 (6.3)	6.3 (4.2)	6.0 (5.3)	7.6 (5.7)	1.11 (3)	0.346
Minutes per week teaching health Mean (sd)	47.1 (16.2)	54.7 (16.3)	53.4 (16.1)	52.7 (17.9)	1.90 (3)	0.131
No. of sun safety lessons (lessons) Mean (sd)	2.2 (2.3)	2.3 (3.3)	1.9 (2.3)	1.4 (2.1)	1.03 (3)	0.380
Total minutes teaching sun safety Mean (sd)	82.2 (99.0)	71.6 (82.8)	68.7(103.1)	62.5 (95.3)	0.33 (3)	0.804
	n (%)	**n (%)**	**n (%)**	**n (%)**	**χ^2 (df)**	***p***
Gender [b]						
Female	50 (100.0)	44 (100.0)	44 (97.8)	32 (72.7)		-
Male	0	0	1 (2.2)	12 (27.3)		
Academic qualifications						
Diploma of teaching (3 yrs univ.)	34 (69.4)	22 (57.1)	20 (42.6)	16 (40.4)	16.58 (6)	0.011*
Bachelors degree (4 yrs university)	12 (24.5)	17 (33.9)	18 (44.4)	15 (36.5)		
Post graduate degree (5+ yrs univ.)	3 (6.1)	5 (8.9)	4 (13.0)	12 (23.1)		
.missing	1	0	3	1		
Teaching status						
Full time	46 (92.0)	36 (81.8)	27 (65.9)	35 (79.5)	9.87 (3)	0.020*
Tandem / part time / other	4 (8.0)	8 (18.2)	14 (34.1)	9 (20.5)		
.missing	0	0	4	0		
Health education specialist [b]						
Yes	0	0	1 (2.4)	0		-
No	50 (100.0)	44 (100.0)	41 (97.6)	43 (100.0)		
.missing	0	0	3	1		
Health educ. training, last 5 yrs						
0 hours	32 (64.0)	25 (56.8)	16 (37.2)	16 (37.2)	12.91 (6)	0.045*
1-3 hours	12 (24.0)	9 (20.5)	17 (39.5)	19 (44.2)		
4-6 hours	4 (8.0)	5 (11.4)	4 (9.3)	5 (11.6)		
> 6 hours	2 (4.0)	5 (11.4)	6 (14.0)	3 (7.0)		
.missing	0	0	2	1		
Sun safety training in last 2 years[b]						
Yes	0	1 (2.3)	4 (9.3)	5 (11.6)		-
No/ Can't remember	50 (100.0)	43 (97.7)	39 (90.7)	38 (88.4)		
.missing	0	0	2	1		
Time spent on sun safety last year						
Did not teach grade level	12 (25.5)	17 (38.6)	19 (45.2)	17 (40.5)	4.38 (6)	0.625
0-79 minutes	16 (34.0)	14 (31.8)	11 (26.2)	12 (28.6)		
80+ minutes	19 (40.4)	13 (29.5)	12 (28.6)	13 (30.1)		
.missing	3	0	3	2		
Importance of sun safety as a health topic for students[a]						
Most important health topic	-	10 (24.4)	11 (22.9)	13 (31.7)	2.40 (4)	0.663
Second most important health topic	-	18 (43.9)	24 (50.0)	14 (34.1)		
Third most important health topic	-	13 (31.7)	11 (22.9)	11 (26.8)		
Fourth/fifth most important topic	-	0	2 (4.2)	3 (7.3)		
.missing	-	1	4	2		
How often gave students incidental sun safety messages in term one[a]						
Everyday	-	21 (51.2)	16 (34.8)	6 (14.6)	17.04 (6)	0.009*
Most days	-	12 (29.3)	17 (37.0)	18 (43.9)		
Some days	-	6 (14.6)	11 (23.9)	17 (41.5)		
Never	-	2 (4.9)	2 (4.3)	0		
.missing	-	1	6	2		

* $p<0.05$

[a] Data not assessed in 1995

[b] Chi square analysis not conducted due to low cell numbers

[c] Thirty-three teachers taught the program in more than one year of the study. These data include teachers only in their first year of teaching the program.

4.3.3 STUDENT SAMPLE REPRESENTATION

Selective attrition between students in the longitudinal cohort and those lost to follow up was assessed by comparing the baseline demographic and skin characteristic variables of students for whom post-test data were obtained and those who were non-respondents. Separate analyses were conducted to compare baseline data for students for whom:

- a post-test parent questionnaire was received and those who were non-respondents;
- post-test moles/reflectance data (winter 1999) were obtained and those who were non-respondents and ;
- post-test (summer 1999) skin reflectance data were obtained and those who were non-respondents.

Assessment of differential attrition between study groups was not conducted, as only intervention group data was included in this study and data from the high and moderate intervention groups were combined for all analyses.

Selective attrition: parent questionnaire data

The denominator for the parent questionnaire attrition calculations is the 865 students of European origin who returned a questionnaire at baseline. Of the 865 students for whom a completed parent questionnaire was received at baseline in 1995, 723 (83.6%) also had a completed parent questionnaire at post-test in 1999. Eight students who returned post-test questionnaires in 1999 did not have baseline parent questionnaire data and were excluded from the parent questionnaire selective attrition analyses. However, these students did have baseline moles and spectrophotometer data and were included in the selective attrition analyses for those instruments.

At follow-up in 1999, students in the sample who returned a parent questionnaire and those lost to follow-up differed significantly on only one variable, namely gender ($p=0.02$) (Table 4.7). A greater proportion of respondents (49.4%, n=357) than non-respondents (38.8%, n=55) were female.

Table 4.7 - Selective attrition: parent questionnaire (n=865)

Baseline student characteristic variables	**Respondents (PT '99) n=723**	**Non-respondents (PT '99) n=142**	
Gender	**n (%)**	**n (%)**	**χ^2 (df) *p***
Male	366 (50.6)	87 (61.3)	5.39 (1) 0.020*
Female	357 (49.4)	55 (38.7)	
Southern European ethnicity			
Yes	82 (11.3)	19 (13.4)	0.48 (1) 0.489
No	641 (88.7)	123 (86.6)	
Maximum parent education level			
Non-tertiary	379 (52.8)	79 (57.2)	0.93 (1) 0.336
Tertiary	339 (47.2)	59 (42.8)	
Eye colour			
Brown	159 (22.4)	29 (21.8)	0.37 (3) 0.946
Hazel	159 (22.4)	27 (20.3)	
Blue	378 (53.2)	74 (55.6)	
Green	15 (2.1)	3 (2.3)	
Hair colour			
Dark brown/black	273 (37.8)	28 (37.8)	1.40 (3) 0.706
Light brown	244 (33.7)	23 (31.1)	
Blonde/fair	183 (25.3)	22 (29.7)	
Red/auburn	23 (3.2)	1 (1.4)	
Ability to tan			
Very tanned	225 (31.4)	56 (39.4)	3.92 (3) 0.270
Moderately tanned	314 (43.9)	58 (40.8)	
Lightly tanned	156 (21.8)	24 (16.9)	
No tan	21 (2.9)	4 (2.8)	
Tendency to burn			
Severe burn with blisters	74 (10.3)	17 (12.0)	3.10 (3) 0.377
Painful burn	339 (47.4)	56 (39.4)	
Mild burn	270 (37.8)	61 (43.0)	
No sunburn at all	32 (4.5)	8 (5.6)	
Proportion of time hat worn when outside			
All the time	101 (14.6)	23 (17.3)	0.62 (1) 0.429
Less than all the time	590 (85.4)	110 (82.7)	
Proportion of time back covered when outside			
All the time	352 (50.8)	66 (49.3)	0.11 (1) 0.744
Less than all the time	341 (49.2)	68 (50.7)	
Proportion of time shade used when outside			
Half the time or more	199 (29.6)	36 (27.5)	0.23 (1) 0.631
Less than half the time	474 (70.4)	95 (72.5)	
Proportion of time sunscreen used when outside			
All the time	124 (17.9)	22 (16.3)	0.20 (1) 0.656
Less than all the time	569 (82.1)	113 (83.7)	
Baseline bathers type worn			
Gold standard	469 (65.7)	80 (57.6)	3.36 (1) 0.067
Other	245 (34.3)	59 (42.4)	
Time (hours) spent outside between 11am-2pm [a]	**Mean (sd)** 2.94 (1.11) n=702	**Mean (sd)** 3.04 (1.01) n=134	**t (df) *p*** 1.06 (200) 0.292
Inner arm reflectance at baseline (%)	49.89 (5.99) n=730	49.69 (6.52) n=143	-0.39 (871) 0.697
Baseline naevi on back [a]	1.34 (0.69) n=695	1.22 (0.73) n=73	-1.46 (776) 0.144
Baseline naevi on face [a]	1.48 (0.72) n=722	1.51 (0.70) n=141	0.44 (861) 0.675
Baseline naevi on arms [a]	2.27 (0.71) n=722	2.22 (0.85) n=141	-0.77 (182) 0.488
Baseline naevi on chest (boys only) [a]	1.24 (0.68) n=352	1.10 (0.61) n=49	-1.44 (399) 0.151

* $p < 0.05$

[a] Log transformed data used after adding a constant value of one

Selective attrition: winter naevi/reflectance data

The denominator for the naevi/reflectance attrition calculations is the 873 students of European origin who had naevi and reflectance data collected at baseline. Of the 873 students for whom naevi and reflectance data were collected at baseline in 1995, 792 (90.7%) also had naevi/ reflectance data at post-test in 1999. Two students for whom naevi data were collected in winter 1999 did not have baseline naevi data and were excluded from the naevi/reflectance selective attrition analyses.

Respondents in the sample with winter 1999 naevi data differed significantly to those lost to follow-up on two variables (Table 4.8). These were southern European ethnicity ($p=0.050$) and baseline logged number of naevi on the arms ($p=0.020$). A greater proportion of respondents (12.2%, n=97) than non-respondents (4.9%, n=4) were of southern European ethnicity and respondents had fewer naevi on their arms at baseline (log of (naevi+1) on arms: mean = 2.24, SD=0.73) than non-respondents (log of (naevi+1) on arms: mean = 2.44, SD=0.76).

Table 4.8 - Selective attrition: winter naevi/spectrophotometer data (n=873)

Baseline student characteristic variables	**Respondents (PT '99) n=792**	**Non-respondents (PT '99) n=81**	
Gender	**n (%)**	**n (%)**	**χ^2 (df) *p***
Male	418 (52.8)	40 (49.4)	0.34 (1) 0.560
Female	374 (47.2)	41 (50.6)	
Southern European ethnicity			
Yes	97 (12.2)	4 (4.9)	8.84 (1) 0.050
No	695 (87.8)	77 (95.1)	
Maximum education level of parents			
Non-tertiary	419 (53.3)	43 (55.1)	0.10 (1) 0.759
Tertiary	367 (46.7)	35 (44.9)	
Eye colour			
Brown	179 (23.0)	10 (13.5)	3.56 (3) 0.313
Hazel	171 (22.0)	18 (24.3)	
Blue	413 (53.0)	44 (59.5)	
Green	16 (2.1)	2 (2.7)	
Hair colour			
Dark brown/black	296 (37.4)	6 (42.9)	0.70 (3) 0.873
Light brown	269 (34.0)	4 (28.6)	
Blonde/fair	203 (25.6)	4 (28.6)	
Red/auburn	24 (3.0)	0 (0.0)	
Ability to tan			
Very tanned	249 (32.1)	31 (38.3)	2.98 (3) 0.394
Moderately tanned	344 (44.4)	28 (34.6)	
Lightly tanned	161 (20.8	19 (23.5)	
No tan	21 (2.7)	3 (3.7)	
Tendency to burn			
Severe burn with blisters	83 (10.7)	7 (8.6)	0.70 (3) 0.874
Painful burn	358 (46.3)	37 (45.7)	
Mild burn	297 (38.4)	34 (42.0)	
No sun burn at all	36 (4.7)	3 (3.7)	
Proportion of time hat worn when outside			
All the time	111 (14.9)	13 (17.3)	0.33 (1) 0.568
Less than all the time	636 (85.1)	62 (82.7)	
Proportion of time back covered when outside			
All the time	384 (51.2)	32 (42.7)	1.99 (1) 0.159
Less than all the time	366 (48.8)	43 (57.3)	
Proportion of time shade used when outside			
Half the time or more	219 (30.1)	16 (21.6)	2.32 (1) 0.128
Less than half the time	509 (69.9)	58 (78.4)	
Proportion of time sunscreen used when outside			
All the time	129 (17.2)	16 (21.1)	0.71 (1) 0.400
Less than all the time	621 (82.8)	60 (78.9)	
Baseline bathers type worn			
Gold standard	501 (65.0)	47 (58.8)	1.23 (1) 0.268
Other	270 (35.0)	33 (41.3)	
Time (hours) spent outside between 11am-2pm [a]	**Mean (sd)** 2.95 (1.10) n=757	**Mean (sd)** 2.93 (1.08) n=77	**t (df) *p*** -0.18 (832) 0.861
Inner arm reflectance at baseline (%)	49.76 (6.10) n=792	50.83 (5.79) n=81	1.51 (871) 0.132
Baseline naevi on back [a]	1.33 (0.69) n=777	2.48 - n=1	1.67 (776) 0.095
Baseline naevi on face [a]	1.48 (0.72) n=792	1.4 (0.73) n=81	-0.03 (871) 0.979
Baseline naevi on arms [a]	2.24 (0.73) n=792	2.4 (0.76) n=81	2.33 (871)0.020*
Baseline naevi on chest (boys only) [a]	1.23 (0.67) n=407	-	- [b]

* $p < 0.05$

[a] Log transformed data used after adding a constant value of one

[b] All boys with baseline chest moles data had post-test chest moles data

Selective attrition: summer reflectance data

The denominator for the summer reflectance attrition calculations is the 873 students of European origin who had reflectance data collected at baseline. Of the 873 students for whom reflectance data were collected at baseline in 1995, 709 (81.2%) also had a reflectance data at post-test in 1999. Two students for whom reflectance data were collected in summer 1999 did not have baseline reflectance data and were excluded from the summer 1999 reflectance selective attrition analyses.

Respondents in the sample with summer 1999 reflectance data were not significantly different at baseline to those lost to follow up on any of the constitutional or outcome variables (Table 4.9).

Therefore, across all student outcome instruments respondents and non-respondents were similar on most variables, providing little evidence of selective attrition. The exception is naevi on the arms which were lower for respondents than non-respondents to the post-test naevi data collection.

Table 4.9 - Selective attrition: reflectance spectrophotometer data (n=873)

Baseline student characteristic variables	**Respondents (PT '99) n = 709**	**Non-respondents (PT '99) n = 164**	
Gender	**n (%)**	**n (%)**	**χ^2 (df) *p***
Male	370 (52.2)	88 (53.7)	0.12 (1) 0.734
Female	339 (47.9)	76 (46.3)	
Southern European ethnicity			
Yes	87 (12.3)	14 (8.5)	1.82 (1) 0.178
No	622 (87.7)	150 (91.5)	
Maximum education level of parents			
Non-tertiary	368 (52.1)	94 (59.5)	2.82 (1) 0.093
Tertiary	338 (47.9)	64 (40.5)	
Eye colour			
Brown	164 (23.3)	25 (17.2)	2.87 (3) 0.412
Hazel	157 (22.2)	32 (22.1)	
Blue	373 (52.7)	84 (57.9)	
Green	14 (2.0)	4 (2.8)	
Hair colour			
Dark brown/black	269 (37.9)	33 (34.0)	1.14 (3) 0.767
Light brown	241 (34.0)	32 (33.0)	
Blonde/fair	178 (25.1)	29 (29.9)	
Red/auburn	21 (3.0)	3 (3.1)	
Ability to tan			
Very tanned	225 (32.3)	55 (34.4)	5.12 (3) 0.163
Moderately tanned	314 (45.1)	58 (36.3)	
Lightly tanned	139 (20.0)	41 (25.6)	
No tan	18 (2.6)	6 (3.8)	
Tendency to burn			
Severe burn with blisters	74 (10.6)	16 (10.0)	0.14 (3) 0.987
Painful burn	321 (46.2)	74 (46.3)	
Mild burn	269 (38.7)	62 (38.8)	
No sun burn at all	31 (4.5)	8 (5.0)	
Baseline proportion of time hat worn when outside			
All the time	98 (14.6)	26 (17.4)	0.79 (1) 0.373
Less than all the time	575 (85.4)	123 (82.6)	
Baseline proportion of time back covered when outside			
All the time	346 (51.3)	70 (46.7)	1.04 (1) 0.309
Less than all the time	329 (48.7)	80 (53.3)	
Baseline proportion of time shade used when outside			
Half the time or more	192 (29.3)	43 (29.3)	0.00 (1) 0.988
Less than half the time	463 (70.7)	104 (70.7)	
Baseline proportion of time sunscreen used when outside			
All the time	117 (17.3)	28 (18.5)	0.12 (1) 0.724
Less than all the time	558 (82.7)	123 (81.5)	
Baseline bathers type worn			
Gold standard	451 (65.0)	97 (61.8)	0.57 (1) 0.449
Other	243 (35.0)	60 (38.2)	
Baseline time (hours) spent outside between 11am-2pm [a]	**Mean (sd)** 2.92 (1.11) n=682	**Mean (sd)** 3.06 (1.02) n=152	**t (df) *p*** 1.44 (239) 0.150
Inner arm reflectance baseline (%)	49.76 (6.06) n=709	50.29 (6.17) n=164	1.02 (871) 0.310
Baseline naevi on back [a]	1.32 (0.70) n=693	1.40 (0.62) n=85	0.97 (776) 0.331
Baseline naevi on face [a]	1.49 (0.71) n=709	1.46 (0.76) n=164	-0.39 (871) 0.697
Baseline naevi on arms [a]	2.25 (0.72) n=709	2.29 (0.77) n=164	0.66 (871) 0.509
Baseline naevi on chest (boys only) [a]	1.23 (0.67) n=360	1.25 (0.66) n=47	0.26 (405) 0.797

* $p < 0.05$

[a] Log transformed data used after adding a constant value of one

4.3.4 TEACHER SAMPLE REPRESENTATION

Instruments used to collect data from teachers each year included the following:

- Teacher pre-implementation questionnaire;
- Teacher program checklist;
- Student work sample data.

Only two teachers (one in Year 3 and one in Year 4) were non-respondent to *all* process evaluation measures. In each year of process data collection, all teachers who completed the pre-intervention teacher self-report questionnaire returned at least one other measure of implementation. As none of the teachers were lost to follow-up, differential and selective attrition have not been reported as measures of sample representativeness. Instead, baseline demographic data for the following groups were compared to determine teacher representativeness:

- teachers who returned at least one program checklist with those who did not return any;
- teachers who returned student work samples and those who did not return them.

Teachers' demographic data were obtained from the pre-implementation teacher self-report questionnaire. School principals were contacted to provide gender and teaching status data for the three teachers who did not respond to this questionnaire. Two of these three teachers did not complete any of the Kidskin evaluation instruments, however, had children participating in Kidskin in their classes. They have been classified as non-respondents for these sample representation analyses. Additionally, 33 teachers taught the program for more than one year, however were only included in the analyses of teacher representation for their first year of teaching Kidskin.

Gender and years of university education were the only demographic characteristics that differed between teachers who returned their program checklists and teachers who did not return their program checklists. There were 12.6% more females in the group of teachers who returned their program checklists than in the group who did not do so (χ^2 = 4.6, df = 1, p = 0.031, see Table 4.10). Non-respondents were also more likely to have completed a post-graduate university degree than respondents (χ^2=15.0, df=2, p=0.001). The only significant difference in demographic characteristics between teachers who

returned student work samples and those who did not was that non-respondents reported spending more time teaching sun safety at the start of the year, prior to implementing Kidskin, than respondents (Mann Whitney U=66.5, p=0.023, see Table 4.11). However, it should be noted that this between groups difference may be due to limited responses in one group as it is based on information from only three of the teachers who were non-respondent to work samples. Chi-square analyses were not conducted for university education, health education or sun safety training, importance of sun safety or incidental sun safety messages due to low cell numbers.

As few differences were found between teacher respondents and non-respondents, the respondent teachers seem to be representative of the broader teacher group.

Table 4.10 - Comparison of demographic characteristics of respondents and non-respondents to teacher program checklist [a]

Variable	**Respondents**	**Non-respondents**		
Teacher program checklist	**n = 161**	**n = 22**	**t (df)**	***p***
Age (yrs) Mean (sd)	41.1 (8.2)	44.2 (7.5)	1.5 (172)	0.128
Teaching experience (yrs) Mean (sd)	16.1 (7.4)	18.8 (9.7)	1.5 (175)	0.143
Experience teaching Year (yrs) Mean (sd)	6.9 (5.5)	7.7 (5.6)	0.6 (177)	0.541
Mins. / week teaching health Mean (sd)	51.9 (16.5)	51.6 (19.3)	-0.1 (173)	0.945
Total mins. teaching sun safety Mean (sd)	70.6 (94.0)	80.5 (103.2)	1355 [c]	0.586
	n (%)	**n (%)**	**χ^2 (df)**	***p***
Gender				
Female	152 (94.4)	18 (81.8)	4.6 (1)	0.031*
Male	9 (5.6)	4 (18.2)		
Teaching status				
Full time	127 (79.9)	17 (85.0)	0.3 (1)	0.586
Tandem / part time / other	32 (20.1)	3 (15.0)		
University education				
Diploma of teaching (3 yrs univ.)	85 (53.5)	7 (36.8)	15.0 (2)	0.001*
Bachelors degree (4 yrs university)	58 (36.5)	4 (21.1)		
Post graduate degree (5+ yrs univ.)	16 (10.1)	8 (42.1)		
Health educ. training, last 5 yrs				
0 hours	81 (50.3)	8 (42.1)	2.7 (2)	0.263
1-3 hours	48 (29.8)	9 (47.4)		
4+ hours	32 (19.9)	2 (10.5)		
Sun safety training in last 2 years				
Yes	8 (5.0)	2 (10.5)	1.0 (1)	0.317
No/ Can't remember	153 (95.0)	17 (89.5)		
Importance of sun safety as a health topic [b]				
Most important health topic	31 (27.4)	3 (17.6)	2.0 (2)	0.368
Second most important health topic	46 (40.7)	10 (58.8)		
Third most important health topic	32 (28.3)	3 (17.6)		
Fourth/fifth most important topic	4 (3.5)	1 (5.9)		
How often gave students incidental sun safety messages in term one [b]				
Everyday	41 (36.6)	2 (12.5)	5.0 (3)	0.169
Most days	38 (33.9)	9 (56.3)		
Some days	29 (25.9)	5 (31.3)		
Never	4 (3.6)	0 (0.0)		

* Significant difference between groups ($p<0.05$).

[a] Thirty-three teachers taught the program in more than one year of the study. These data include teachers only in their first year of teaching the program.

[b] Data not collected in 1995.

[c] Mann Whitney U-test conducted due to skewed data

Table 4.11 - Comparison of demographic characteristics of respondents and non-respondents to student work sample assessment [a]

Variable	**Respondents**	**Non-respondents**		
Student Work Samples	**n = 177**	**n = 6**	**t (df)**	***p***
Age (yrs) Mean (sd)	41.4 (8.1)	45.5 (10.5)	1.0 (172)	0.317
Teaching experience (yrs) Mean (sd)	16.4 (7.7)	15.5 (8.7)	-0.2 (175)	0.818
Experience teaching Year (yrs) Mean (sd)	6.9 (5.4)	9.8 (9.3)	0.6 (3)	0.584
Mins. / week teaching health Mean (sd)	51.8 (16.8)	55.0 (12.9)	0.4 (173)	0.703
Total mins. teaching sun safety Mean (sd)	68.8 (91.3)	233.3 (166.5)	66.5 [c]	0.023*
	n (%)	**n (%)**	**χ^2 (df)**	***p***
Gender				
Female	165 (93.2)	5 (83.3)	0.9 (1)	0.354
Male	12 (6.8)	1 (16.7)		
Teaching status				
Full time	140 (80.5)	4 (80.0)	0.0 (1)	0.980
Tandem / part time / other	34 (19.5)	1 (20.0)		
University education				
Diploma of teaching (3 yrs univ.)	91 (52.3)	1 (25.0)	-	-[d]
Bachelors degree (4 yrs university)	60 (34.5)	2 (50.0)		
Post graduate degree (5+ yrs univ.)	23 (13.2)	1 (25.0)		
Health educ. training, last 5 yrs				
0 hours	88 (50.0)	1 (25.0)	-	-[d]
1-3 hours	55 (31.3)	2 (50.0)		
4+ hours	33 (18.8)	1 (25.0)		
Sun safety training in last 2 years				
Yes	9 (5.1)	1 (25.0)	-	-[d]
No/ Can't remember	167 (94.9)	3 (75.0)		
Importance of sun safety as a health topic[b]				
Most important health topic	33 (25.8)	1 (50.0)	-	-[d]
Second most important health topic	55 (43.0)	1 (50.0)		
Third most important health topic	35 (27.3)	0 (0.0)		
Fourth/fifth most important topic	5 (3.9)	0 (0.0)		
How often gave students incidental sun safety messages in term one[b]				
Everyday	43 (33.9)	0 (0.0)	-	-[d]
Most days	46 (36.2)	1 (100.0)		
Some days	34 (26.8)	0 (0.0)		
Never	4 (3.1)	0 (0.0)		

* Significant difference between groups ($p<0.05$).

[a] Thirty-three teachers taught the program in more than one year of the study. These data include teachers only in their first year of teaching the program

[b] Data not collected in 1995

[c] Mann Whitney U-test conducted due to skewed data

[d] Chi-square not conducted due to low cell numbers

4.4 RESPONSE RATES FOR PROCESS EVALUATION MEASURES

4.4.1 RESPONSE RATES FOR CLASSROOM INTERVENTION MEASURES

Two instruments were used to collect process data from intervention group teachers and students. Response rates to each of the teacher instruments are reported as follows:

- **Program checklists** – the proportion of classes where the teacher completed program checklist 1 (mid-way through the program), program checklist 2 (at the end of the program) and both program checklists 1 and 2, indicating which activities were taught to students;
- **Student work samples** – the proportion of classes where the teacher provided a random sample of five student 'Kidskin' work books.

Program checklists

At least one program checklist was received for 96% of classes in 1995, 93% of classes in 1996 and 91% of classes in 1997. Response rates were lower in 1998 with 78% of classroom teachers returning at least one program checklist. Both checklists were received for 90%, 86%, 86% and 78% of classes in 1995, 1996, 1997 and 1998 respectively. Thus, apart from 1998, data for activities taught was available for 86% or more of classes. Teacher response rates for program checklists are shown in Table 4.12.

Student work samples

In 1995, 96% of classes provided a random sample of five student work books at program completion. Two teachers in this year provided no work samples while five provided student passports only, or incomplete work samples, as workbooks had been sent home prior to work sample collection. In 1996, all classes provided student work books for evaluation, while in 1997 and 1998 work sample response rates were 98% and 95% respectively (Table 4.12). Reasons for not returning work samples were either that the class had not been taught the program, or that the workbooks had already been sent home by teachers.

Table 4.12 - Response rates for classroom- and home-intervention measures

Instrument Number of eligible classes:	**Year 1** **1995** 52 *n (%)*	**Year 2** **1996** 56 *n (%)*	**Year 3** **1997** 57 *n (%)*	**Year 4** **1998** 55 *n (%)*
Program Checklists				
Program checklist 1	50 (96)	51 (91)	51 (89)	43 (78)
Program checklist 2	47 (90)	49 (88)	50 (88)	43 (78)
Program checklist 1 & 2	47 (90)	48 (86)	49 (86)	43 (78)
Program checklist 1 or 2	50 (96)	52 (93)	52 (91)	43 (78)
Student Work Samples	50 (96)[a]	56 (100)	56 (98)	52 (95)
Either Program Checklist or Work Samples	52 (100)	56 (100)	56 (98)	52 (95)

[a] Five classes gave passports only as the rest of the work had been sent home

Of the 33 classes where teachers were non-respondents for one or both program checklists, only four did not return work samples (Table 4.12). Three of these non-respondent teachers taught Year 4 and one taught Year 3. Therefore, 100% of Year 1 and 2 classes, 98% of Year 3 classes and 95% of Year 4 classes returned at least one of the forms of measurement of activities taught.

4.4.2 HOLIDAY INTERVENTION EVALUATION RESPONSE RATES: PARENTS AND STUDENTS (HIGH INTERVENTION GROUP ONLY)

Summer Club implementation questionnaire

As mentioned in Chapter 3, the Summer Club was only disseminated to the high intervention group. In 1996 the Summer Club implementation questionnaire was administered to a randomly selected sample of 200 parents of high intervention group students. A subsample of the high intervention group was used due to concerns that being asked to complete too many data collection instruments may lead to increased dropout in this group. This questionnaire was sent at the end of the 1995/96 summer holidays after all issues of the Totally Cool Summer Club had been sent to students. Eighty percent of parents returned their questionnaire (Table 4.13). The questionnaire was not administered in 1997 due to other components of the Kidskin project taking place at this time. There was an ongoing concern among project staff that sending high intervention group parents another questionnaire at this time may lead to fatigue with the project that could increase attrition. In 1998, 72% of high intervention group parents responded to the questionnaire sent at the end of the school holidays.

In 1999 a different format was used to obtain process information about the 1998/1999 Summer Club. Students were interviewed directly using a telephone interview. It was felt this would be a more valid measure than a parent questionnaire as the students were now more independent and parents may be less likely to be aware of their child's use of the Summer Club materials. Eighty three percent of high intervention students were contacted via telephone interview at the end of the 1998/1999 summer school holidays (Table 4.13).

Table 4.13 - Parent and student response to Summer Club implementation questionnaire (high intervention group only)

	Year 1 **1996** n=200[a]	**Year 2** **1997** n=399	**Year 3** **1998** n=381	**Year 4** **1999** n= 327
Respondents (%)	161 (80)	- [b]	275 (72)	271 (83)

[a] Sample from high intervention group only
[b] Not assessed in this year

Summer Club activity samples

Summer Club activity samples were collected at the end of the first, second and third years of the project. Rates of return of these samples were low in each year, with response rates of 32% in 1995, 29% in 1996 and 23% in 1997 (Table 4.14).

Table 4.14 - Summer Club activity sample response rates[a]

	Year 1 **1996** n=409	**Year 2** **1997** n=399	**Year 3** **1998** n=381	**Year 4** **1999** n=327
Respondents[a] (%)	132 (32)	114 (29)	87 (23)	- [b]

[a] Sample from high intervention group only
[b] Work samples not collected in Year 4. Style of intervention generated no evidence

Due to incomplete data, it was not possible to include the Summer Club component of the intervention in the dose scores calculated for use in the dose analyses conducted to meet Objective Two of this thesis. However, results from as much data as is available are presented below to assess implementation of the home-based component as a part of meeting study Objective One.

4.5 STUDY OBJECTIVE ONE: IMPLEMENTATION OF THE KIDSKIN INTERVENTION

Study Objective One assesses implementation of the intervention in terms of:

- How many of the activities were taught by teachers (completeness);
- Which activities were taught in each theme;
- How much time was spent teaching the activities;
- The dose of the classroom and home activities taught by teachers;
- How much of the Summer Club intervention was received by high intervention group students.

Measures of implementation of the classroom and home intervention were the same for the high and moderate intervention group. The high intervention group also completed measures assessing implementation of the Summer Club, however, as described above these data were not incorporated into the dose scores used in the dose-response analyses. Therefore, data from high and moderate intervention group teachers was combined for these analyses.

4.5.1 COMPLETENESS OF CLASSROOM IMPLEMENTATION: COMBINED TEACHER IMPLEMENTATION SCORE

The completeness of the classroom intervention implementation was assessed as the percentage of the total activities taught according to the following instruments:

- A teacher self-report program checklist or log of the activities they taught. Teachers were asked to complete this self-report checklist at the end of each activity and return it to Kidskin staff at the midpoint (checklist 1) and end (checklist 2) of the program. The program checklist assessed implementation of all classroom and home activities;
- A checklist used by project staff to assess student work samples. Student work samples indicated teacher implementation of activities which provided 'pen and paper' evidence, such as a work sheet. In 1995, paper evidence was included for only three of the six core activities. In all other years, all core activities could generate work samples. Therefore, this measure provided assessment of whether or not an activity was taught for the 40% to 58% of all activities each year that provided evaluable work samples.

Teacher implementation or dose scores were calculated using data primarily from the teacher program checklist. Where there were missing data due to teachers not completing all boxes in the program checklist, or teachers not returning one checklist each year (n=11), the missing data were conservatively coded as 'uncompleted' or zero implementation. If a teacher returned neither of the two parts of the program checklist (n = 23) student work sample data were used to 'fill in any gaps' in the program checklist data. Therefore, if the student work sample data indicated evidence of an activity being completed, the teacher was assumed to have taught the activity and was coded 'completed' for that activity. Where there was no student work sample evidence available, teachers non-respondent to the teacher program checklist were conservatively coded as 'uncompleted' or zero implementation for that activity.

Part of, or all program checklist data were missing for five teachers in 1995 (Year 1), eight teachers in 1996 (Year 2), eight teachers in 1997 (Year 3) and 12 teachers in 1998 (Year 4) (Table 4.12). For all but four of these teachers, work sample data were available to use as a measure indicating whether or not the activities were taught. The four teachers who submitted no checklists or work sample data were assumed not to have taught any of the activities and their missing data was coded with a zero.

Each Kidskin theme comprised a core, optional extension, processing and home activity. Introduction activities were also included in Years 2 to 4 (1996 – 1998). The percentages of each type of activity taught were averaged over all teachers to obtain mean implementation rates. Combined program checklist and student work sample measures of teacher implementation dose, as described above, are shown in Table 4.15.

Table 4.15 - Mean percent (unweighted) of Kidskin classroom activities delivered by teachers each year as measured by teacher program checklist and work sample data combined [a]

Activity type **Eligible classes:**	**Year 1** **1995** n = 52	**Year 2** **1996** n=56	**Year 3** **1997** n=57	**Year 4** **1998** n=55
	Mean % n=52	Mean % n=56	Mean % n=57	Mean % n=55
Introduction activities	-[b]	78	77	70
Core activities	79	92	91	90
Home activities	89	92	91	87
Optional extension activities	57	52	52	31
Processing	-[b]	73	66	55
Core and home activities	84	92	91	89
All activities[c]	65	76	76	64

[a] Non-respondents to program checklist *and* student work samples recoded as zero implementation
[b] Activity not included/data not collected in 1995
[c] In 1995, 'all activities' comprised all core, extension and home activities. In all other years, 'all activities' comprised all introduction, core, home, extension and processing activities in the program.

Implementation levels were generally high in all years, particularly for core and home activities which study staff had emphasized to teachers at the training as being the most important components to teach their class. Teachers taught a mean of 84% of the 12 core and home activities in Year 1 (1995), 92% of the 12 core and home activities in Year 2 (1996), 91% of the 12 core and home activities in Year 3 (1997) and 89% of the 8 core and home activities in Year 4 (1998). When all program activities were included in the measurement of implementation (ie. core, home, introduction, extension and processing), teachers were found on average to have implemented 65% of all 37 possible program activities in Year 1, 76% of 31 activities in Year 2 and 30 activities in Year 3, and 64% of all 22 activities in Year 4 (Table 4.15).

4.5.2 ASSOCIATION BETWEEN TEACHER IMPLEMENTATION MEASURES

The percent agreement between teacher self-report of an activity being taught and work sample evidence of its implementation was assessed and the results are presented in Table 4.16. These analyses were conducted only for activities that could potentially generate work sample evidence. The percent agreement for activities ranged from 48% to 98% in Year 1, 39% to 98% in Year 2, 65% to 100% in Year 3 and 47% to 100% in Year 4. The mean percent agreement between the two implementation measures was higher each year for core and home activities (76% to 98% each year) than for introductory and extension activities (59% to 82% each year). The lower agreement for the latter activities was most often due to teachers indicating they taught the activity

when there was no work sample evidence (Table 4.16). This occurred approximately 30% of the time each year and may indicate social desirability bias influencing teacher responses, or, due to a lack of time or teaching style, teachers teaching the activity without using the written components. Disagreement between the two measures due to work samples being present but the teacher indicating they had not taught the activity occurred less than 5% of the time each year. The percent agreement between the two measures was higher in Years 3 and 4 than in Years 1 and 2. This is likely to have been due to the greater number of pen and paper activities in these higher year levels than in the younger year levels. Alternatively, teachers of the lower year levels, who were more likely to have been involved in the school's decision to participate in the Kidskin study may, have been more influenced by social desirability bias to report they had completed activities.

The program checklist provided the most complete coverage of classroom program activities and the moderate to high agreement between work samples and teacher self report data suggest the validity of the teacher program checklist as a measure of classroom program implementation. However, this measure tended to have higher concurrent validity for core and home activities, particularly in the higher grades. The percent agreement data also support the use of student work sample data to complete missing program checklist data where possible.

Table 4.16 - Percent agreement between teacher report and work sample evidence

Activities with work sample evidence	**% agreement between work samples and teacher self report**	**% disagreement (teacher report 'yes', work samples 'no')**	**% disagreement (work samples 'yes', teacher report 'no')**
Year 1 (1995)			
Theme 1 extension	64.6	10.4	25.0
Theme 1 core	56.2	39.6	4.2
Theme 1 home	97.9	0.0	2.1
Theme 2 home	91.7	8.3	0.0
Theme 3 extension	47.9	43.8	8.3
Theme 3 home	91.6	4.2	4.2
Theme 4 home	84.4	11.1	4.4
Theme 5 home	73.3	24.4	2.2
Theme 6 extension 1	51.1	40.0	8.9
Theme 6 core	51.1	48.9	0.0
Theme 6 extension 2	73.3	26.7	0.0
Theme 6 home	62.2	37.8	0.0
Mean Yr 1 core & home	76.0	21.8	2.1
Mean Year 1 extension activities	59.2	30.2	10.6
Mean Yr 1 all activities with evidence	70.4	24.6	4.9

Table continued overleaf

Table 4.16 (continued) - Percent agreement between teacher report and work sample evidence

Activities with work sample evidence	% agreement between work samples and teacher self report	% disagreement (teacher report 'yes', work samples 'no')	% disagreement (work samples 'yes', teacher report 'no')
Year 2 (1996)			
Theme 1 introduction	84.3	13.7	2.0
Theme 1 core	94.1	5.9	0.0
Theme 1 extension	68.6	11.8	19.6
Theme 1 home	98.0	2.0	0.0
Theme 2 core	74.5	23.5	2.0
Theme 2 home	94.1	3.9	2.0
Theme 3 core	60.0	40.0	0.0
Theme 3 extension	38.8	59.2	2.0
Theme 3 home	92.0	8.0	0.0
Theme 4 core	91.8	8.2	0.0
Theme 4 home	91.8	4.1	4.1
Theme 5 core	51.0	42.9	6.1
Theme 5 home	98.0	0.0	2.0
Theme 6 core	67.3	32.7	0.0
Theme 6 home	91.8	0.0	8.2
Mean Yr 2 core & home	83.7	14.3	2.0
Mean Yr 2 intro/extension activities	63.9	28.2	7.9
Mean Yr 2 all activities with evidence	79.7	17.1	3.2
Year 3 (1997)			
Theme 1 introduction	90.2	7.8	2.0
Theme 1 core	94.1	2.0	3.9
Theme 1 home	100.0	0.0	0.0
Theme 2 core	86.3	0.0	13.7
Theme 2 extension	64.7	35.3	0.0
Theme 2 home	92.2	3.9	3.9
Theme 3 core	92.2	7.8	0.0
Theme 3 extension	90.2	7.8	2.0
Theme 3 home	98.0	0.0	2.0
Theme 4 core	98.0	0.0	2.0
Theme 4 home	92.0	0.0	8.0
Theme 5 core	94.0	2.0	4.0
Theme 5 home	94.0	2.0	4.0
Theme 6 core	90.0	8.0	2.0
Theme 6 home	86.0	6.0	8.0
Mean Yr 3 core & home	93.1	2.6	4.3
Mean Year 3 intro/extension activities	81.7	17.0	1.3
Mean Yr 3 all activities with evidence	90.7	5.5	3.7
Year 4 (1998)			
Theme 1 core	100.0	0.0	0.0
Theme 1 home	97.6	2.3	0.0
Theme 2 core	100.0	0.0	0.0
Theme 2 extension	69.8	27.9	2.3
Theme 2 home	96.7	2.3	0.0
Theme 3 core	100.0	0.0	0.0
Theme 3 extension	46.5	53.5	0.0
Theme 3 home	97.7	2.3	0.0
Theme 4 core	95.3	2.3	2.3
Theme 4 extension	55.8	44.2	0.0
Theme 4 home	95.3	4.7	0.0
Final processing activity	69.8	16.3	13.9
Mean Yr 4 core & home	97.8	1.7	0.3
Mean Yr 4 intro/extension activities	60.5	35.5	4.0
Mean Yr 4 all activities with evidence	85.5	13.0	1.5

Weighted combined teacher dose scores

Each Kidskin program activity was pre-assigned a weighting based on the extent to which it met program outcomes. These weightings were multiplied by the teacher implementation score (0 or 1) for each activity (as described in Chapter 3) and the weighted score for all activities each year summed to give a teacher weighted dose for each class, each year. The total possible weighted score varied in each year of the program. In Year 1 (1995) the total possible weighted summed score teachers could obtain, if they taught all activities, was 9.08, in Year 2 (1996) 9.40, in Year 3 (1997) 7.68, and in Year 4 (1998) the total possible weighted score was 8.18. In Years 1 and 2 all teachers implemented at least part of the program, and dose scores ranged from 0.89 to 9.08 and 3.21 to 9.40 respectively. In Year 3 dose ranged from 0 to 7.68 while in Year 4 it ranged from 0 to 8.18. The zero scores reflect the fact that several teachers in Years 3 and 4 returned none of the implementation measures, so were assigned a zero dose for that year. The median weighted dose score was 6.08, in Year 1, 7.72 in Year 2, 6.36 in Year 3 and 6.43 in Year 4. On average, teachers were found to have implemented 66% of the total possible weighted score in Year 1, 78% in Year 2, 79% in Year 3 and 71% in Year 4 (Table 4.17). Over 78% of teachers each year scored more than 50% of the total possible weighted score, and in Years 2 to 4 between 61% and 74% each year scored more than 75% of the total possible weighted score. In Year 1, the percentage of teachers who scored more than 75% of the total weighted score was lower, at 29%.

Table 4.17 - Weighted teacher implementation scores for each year (as measured by teacher program checklist and work sample data combined) [a]

Activity type Eligible classes:	**Year 1 1995** n = 52	**Year 2 1996** n=56	**Year 3 1997** n=57	**Year 4 1998** n=55
Weighted 'all activities' dose score [b] Mean, median (sd)	 5.95, 6.08 (1.79)	 7.34, 7.72 (1.51)	 6.04, 6.36 (1.25)	 5.81, 6.43 (1.97)
Range of weighted 'all activities' dose score	0.89 – 9.08	3.21 – 9.40	0 – 7.68	0 – 8.18
Mean % of total possible weighted score	66	78	79	71
% teachers who scored >50% of total possible weighted score	79	91	95	82
% teachers who scored > 75% of total possible weighted score	29	61	74	66

[a] Non-respondents to program checklist *and* student work samples recoded as zero implementation

[b] Comprises all classroom activities – introductory, core, extension, processing and home activities in 1996-1998. In 1995 this comprises core, extension and home activities only, as introduction and processing activity data were not collected.

Between groups differences in weighted combined teacher implementation/dose scores

The classroom and home intervention delivered by teachers was the same for the high and moderate intervention groups each year. While the teacher dose was not expected to differ between the study groups it is possible that the additional interventions received by high intervention schools may have led to teachers at these schools teaching a greater dose of the intervention. Bivariate analyses were used to assess differences in categorical dose scores between teachers in moderate and high intervention groups each year. Due to skewed data, the continuous weighted teacher dose scores were divided into tertiles to convert them to categorical scores of low, medium and high dose. The results of these analyses are shown in Table 4.18.

Table 4.18 - Between groups' differences in weighted combined teacher implementation scores

		High intervention group **n (%)**	Moderate intervention group **n (%)**	χ^2 **(df)** ***p***
Year 1 weighted dose	High	8 (38)	9 (29)	0.69 (2) 0.708
	Medium	6 (29)	12 (39)	
	Low	7 (33)	10 (32)	
Year 2 weighted dose	High	5 (22)	13 (39)	6.04 (2) 0.049*
	Medium	13 (56)	8 (24)	
	Low	5 (22)	12 (36)	
Year 3 weighted dose	High	11 (48)	8 (24)	4.47 (2) 0.107
	Medium	8 (35)	13 (38)	
	Low	4 (17)	13 (38)	
Year 4 weighted dose	High	9 (39)	9 (28)	2.19 (2) 0.334
	Medium	9 (39)	10 (31)	
	Low	5 (22)	13 (41)	

*$p<0.05$

There was no difference in weighted dose of the classroom and home intervention delivered between teachers in the high and moderate intervention groups in Years 1, 3 and 4. In Year 2 the p value reached borderline significance (p=0.049), with more moderate intervention group teachers implementing a high or low weighted dose of the intervention and more high intervention teachers implementing a medium dose (Table 4.18).

Based on these findings indicating little difference between groups, the dose-response analyses were conducted using the high and moderate intervention group data collapsed into one group.

Activities delivered per theme

As well as assessing the completion of all activities in total, the percentage of activities completed within each theme was also evaluated. In each year teachers were more likely to deliver more of the initial part of the program with implementation tending to taper off as the program progressed (Table 4.19). This was most noticeable in Year 1 where teachers delivered 74% of Theme 1, but only 47% of the final Theme (Theme 6). This may have been because the Year 1 curriculum contained more activities than the other years even though these activities tended to be shorter. Additionally, in the first year of implementation teachers were asked to teach the whole program in Term 4, whereas in Years 2 to 4 teachers began implementing the curriculum midway through Term 3 and thus had more available teaching time. In Year 2 teachers taught 85% of activities in Theme 1 and only 68% in Theme 6. Year 3 teachers tended to be more consistent across the whole program, with 75% of Theme 1 activities taught compared to 70% in Themes 5 and 6. In Year 4, implementation ranged from 80% in Theme 1 to 63% in Theme 4. Implementation of the closure activities in Year 4 was low, reflecting the fact that these were listed as optional activities.

There was little difference in the percent of activities completed and the percent of the total possible weighted score attained per theme, indicating that teachers maintained program fidelity and did not just complete the more lightly weighted, less complex activities. In Year 3, the mean percent of the weighted dose score completed for Theme 6 was higher than for Theme 1, indicating teachers taught fewer but more heavily weighted activities.

Table 4.19 - Teacher implementation of classroom and home intervention by theme

Year	Theme No.	Topic	Activities per theme	Mean % activities taught per theme	Mean % of total possible weighted dose score per theme
1	1	Importance of sun protection (mm)	8	74	74
	2	Shade	7	71	75
	3	Hats	7	69	79
	4	Sunscreen	7	65	63
	5	Assertive communication (mm)	7	65	64
	6	Goal setting for holiday sun protection (mm)	7	47	48
2	1	Importance of sun protection (mm; clothing)	5	85	90
	2	Sun protection methods (mm)	6	75	73
	3	Assertive communication for sun protectn. (mm)	5	81	83
	4	Sun protection at school (shade; sunscreen)	5	78	84
	5	Shade (shade; avoiding midday sun)	5	72	71
	6	Goal setting for holiday sun protection (mm)	5	68	68
3	1	Importance of sun protection (shade)	5	75	70
	2	Goal setting (avoiding midday sun; mm)	5	81	84
	3	Decision making/assertive communication (mm)	5	85	93
	4	Hats (hats; shade; mm)	5	72	76
	5	Shade at school (Shade)	5	70	73
	6	Goal setting for holiday sun protection (mm)	5	70	78
4	1	Importance of sun protection (mm)	4	80	86
	2	Assertive communication (mm)	5	71	81
	3	Decision making/assertive communication (mm)	5	68	80
	4	Goal setting and assertive communication (mm)	5	63	69
		Closure activities–summarise learning (mm)	3	28	30

(mm) = multiple methods of sun protection addressed.

Time spent on the Kidskin activities

Program checklists were also used to collect information on the amount of time teachers spent teaching the Kidskin activities each year. This information is presented in (Table 4.20). In all years, teachers spent the most time teaching Theme 1 (approximately one-and-a-half hours) and then the time spent on each theme tended to decrease. In 1996 and 1997 time spent teaching Kidskin increased slightly again for Theme 6 after decreasing to a low in Theme 5. The decrease over time in median time spent on the program was greatest in Year 1 (80 minutes to 32 minutes) and Year 4 (90 minutes to 30 minutes). However, in Year 4, the final theme included only two extension activities and one processing activity, and therefore would not have been expected to take as long as the other activities. Year 4 teachers spent a median of 70 minutes on Theme 4, the last major theme that year. Overall, teachers spent a median of 4 hours and 50 minutes teaching the program in Year 1, 7 hours and 20 minutes in Year 2, 8 hours and 40 minutes in Year 3 and 6 hours in Year 4.

The number of teachers who completed this section of the program checklist sheet tended to be lower in 1995 than in other years. Response rates for this question in 1995 ranged from a high of 60% for Theme 1 to a low of 42% for Theme 5. Response rates for this component of the program checklist were higher for other years, ranging from 79-86% in Year 2, 83-94% in Year 3 and 77-93% in Year 4.

Table 4.20 - Teacher self-report of time (minutes) spent teaching Kidskin activities (from program checklist)

	1995 Mean (sd) Median	1996 Mean (sd) Median	1997 Mean (sd) Median	1998 Mean (sd) Median
Theme 1 (mins)	121 (87) 80	106 (61) 90	110 (43) 115	99 (43) 90
Theme 2 (mins)	102 (81) 60	89 (42) 90	103 (63) 90	105 (53) 90
Theme 3 (mins)	89 (55) 60	87 (36) 80	99 (46) 95	92 (44) 80
Theme 4 (mins)	81 (47) 60	80 (33) 70	107 (48) 90	85 (45) 70
Theme 5 (mins)	76 (51) 60	71 (36) 60	83 (39) 70	42 (27) 30[a]
Theme 6 (mins)	48 (60) 32	81 (41) 70	88 (45) 90	-[a]

[a] In 1998 the curriculum included only four themes. Theme 5 in 1998 included optional closure activities and a final processing activity.

4.5.3 STUDENT CUMULATIVE DOSE

Each year, each teacher's weighted combined dose score was assigned to all students in his/her class. Students therefore received a different weighted dose score for each of the four years the program was implemented. These dose scores varied for each student depending on the teacher they were assigned to by their school each year. The annual weighted dose scores for each student were summed to give individual cumulative dose scores for:

- Year 1;
- Years 1 and 2;
- Years 1, 2 and 3, and;
- Years 1, 2, 3 and 4.

In each case, about 83% of students scored more than half of the total possible cumulative score, while 36% scored more than three quarters of the total possible cumulative dose.

These continuous cumulative dose scores were divided into tertiles to convert them to categorical scores of low, middle and high dose. The percentage of the program

completed by students within each tertile of cumulative dose is shown in Table 4.21. Students categorised to the 'low dose' tertile had cumulative dose scores ranging from almost none of the program (1%) up to about 65% of the program cumulatively each year, with a median score of between 46% and 53%. Students in the 'medium dose' tertile had cumulative dose scores ranging from about 65% to about 75% with a median score between 67% and 73% over the four years. 'High dose' tertile students' scores ranged from about 75% of the program to all or almost all of the program each year, with a median percent dose score of between 81% and 84% over the four years (Table 4.21). Therefore, due to high teacher implementation overall, assignment of students to dose categories was skewed towards higher levels of implementation of the intervention. For example, even students in the low dose group, on average, had teachers who delivered about half of the total program dose.

Table 4.21 - Students cumulative dose scores (n=858)

Cumulative dose score	**Year 1**	**Years 1 and 2**	**Years 1, 2 and 3**	**Years 1, 2, 3 and 4**
Mean (sd)	5.9 (1.8)	12.6 (3.1)	17.6 (4.8)	22.3 (6.7)
Median	6.1	13.1	19.0	24.4
Range	0.89 – 9.08	0.89 – 18.20	0.89 – 25.88	0.89 – 31.53
% students scoring >50% of total possible cumulative dose score	80	87	85	82
% students scoring > 75% of total possible cumulative dose score	31	39	39	37
Median score for dose tertile (% of total possible cumulative dose score)				
Low dose score (median %)	46	52	53	47
Medium dose score (median %)	67	71	73	71
High dose score (median %)	84	83	82	81
Range for dose tertile (% of total possible cumulative dose score)				
Low dose score (%)	1 – 63	5 - 65	3 - 65	3 - 65
Medium dose score (%)	64 – 71	66 - 75	66 - 77	66 - 76
High dose score (%)	72 – 100	76 - 98	78 - 99	77 - 92

4.5.4 IMPLEMENTATION OF THE HOLIDAY INTERVENTION (HIGH INTERVENTION GROUP ONLY)

Summer Club implementation questionnaire

The Summer Club intervention was disseminated over the summer holidays each year to high intervention group students only. Receipt and use of the Year 1, Year 3 and Year 4 'Totally Cool Summer Club' materials was evaluated at the end of the school summer holidays in March 1996, 1998 and 1999 respectively. Most commonly, respondents to the parent surveys in 1996 and 1998 were children's mothers, while in 1999 students responded to questions via a telephone interview (Table 4.22). The Year 2 Summer Club materials were not evaluated in February 1997, as discussed previously, due to concerns over the number of questionnaires parents in this group were asked to complete for the Kidskin project at this point in time.

Evaluation of the Year 1 (1995/1996) Summer Club was conducted in March 1996. The Summer Club questionnaire was sent to a random sample of 200 high intervention group parents and 161 (80%) parents returned the questionnaire. Only one parent (1%) said his/her child did not receive any of the Summer Club materials. All other respondents (99.4%) indicated their child received some or all of the Summer Club. Approximately two-thirds of respondents remembered their child receiving each issue, while 20% were unsure which issues their child received. Fifty-six percent of respondents remembered their child receiving all four issues. Of those who indicated their child received the Summer Club materials in Year 1, 96% reported their child used at least some of the activities. Most children (57%) spent less than an hour completing the activities from each mailout, although about one-third of respondents said their child spent between one and two hours on each mailout (Table 4.22). Eighty five percent of parents indicated their child was very interested or interested in receiving the Summer Club materials. The involvement of other family members in using the Year 1 materials was moderate, with respondents indicating 38% of children used the activities alone, while 15% of children were helped by their mother, 22% by their father and 43% by other siblings.

Evaluation of the use of the Year 3 (1996/1997) Summer Club materials was conducted in February 1997. Seventy-two percent (n=275) of high intervention group parents

returned their questionnaire. The Year 3 materials comprised 3 issues and only nine parents (3%) indicated their child did not receive any issues of the Summer Club in Year 3. Sixty-six percent of parents remembered their child receiving issue one, 65% issue two and 59% remembered their child receiving issue three in the 1997/98 summer holidays. Fifty percent remembered their child receiving all three issues. Of those parents who reported their child received the materials, 71% indicated their child used at least some of the activities. Most children (83%) spent less than an hour on each issue, with 48% spending less than 30 minutes on each of the three issues. Interest in the materials was lower than in Year 1, with only 55% of parents reporting their child was very interested or interested in the Year 3 Summer Club materials. Twenty-one percent of respondents indicated their child completed the Year 3 activities on their own, while 51% were helped by their mother, 11% by their father and 21% by other siblings.

In February 1998, the Year 4 Summer Club materials were assessed by student telephone interview. Of the 271 children (82.9%) who were interviewed, 248 (92%) said they remember receiving any of the Summer Club materials and only 8% did not remember receiving any of the materials. Over 80% remembered receiving issues one and two, while only 40% remembered issue three (Table 4.22). Thirty-three percent remembered receiving all three issues. Of those children who reported receiving the Year 4 Summer Club materials, all reported reading or using at least part of them. The Year 4 materials differed from those in other years in that they included fewer activities for children to complete, but included items to serve as cues to action, such as drink bottles with sun safety messages, stickers, reminder postcards etc. Therefore, no measure was made of time spent using the materials in this year. Ninety-seven percent of children reported being interested or very interested in receiving the Year 4 Summer Club materials in 1999. Only 14% of children reported they used the materials on their own, while 51% said their mother, 15% said their father and 36% said their siblings used the materials with them. Twenty four percent said ‘others’ used/read the materials with them and in most cases these were friends of the child (Table 4.22).

Table 4.22 - Implementation of the Totally Cool Summer Club by students as reported in the Years 1 and 3 parent Summer Club questionnaires and the Year 4 student interview

Variable	**Year 1 1996** n=161	**Year 2 1997** [a] -	**Year 3 1998** n=275	**Year 4 1999** n=271
	n (%)	**n (%)**	**n (%)**	**n (%)**
Questionnaire respondent				
Mother	147 (94)		250 (93)	0
Father	9 (6)		16 (6)	0
Child	0		0	271 (100)
Other	1 (1)		1 (1)	0
.missing	4		8	
Summer Club issues received by child				
Issue 1 (distributed at school)	106 (66)		182 (66)	235 (87)
Issue 2 (mailout)	102 (63)		178 (65)	229 (84)
Issue 3 (mailout)	104 (65)		162 (59)	107 (40)
Issue 4 (mailout, 1996 only)	102 (63)		-[a]	-[a]
Unsure which issues received	33 (20)		56 (20)	0
Didn't receive/don't remember receiving any issues	1 (1)		9 (3)	23 (8)
Remember receiving all issues	90 (56)		137 (50)	88 (33)
Remember receiving any issue	159 (99)		267 (97)	248 (92)
Child's use of Summer Club materials				
Received but didn't use materials	7 (4)		74 (29)	0
Received and used materials	153 (96)		184 (71)	248 (100)
Missing	-		9	
Child's interest in receiving Summer Club				
Very interested	53 (34)		22 (9)	133 (51)
Interested	79 (51)		118 (46)	121 (46)
Uninterested	18 (12)		81 (32)	7 (3)
Very Uninterested	5 (3)		31 (12)	1 (1)
Don't know	0		3 (1)	-
.missing	6		20	9
Time spent on each Summer Club mailout				
< 30 minutes (1998 only)	-		99 (48)	-[a]
30minutes-1 hour (1998 only)	-		73 (35)	
< 1 hour	92 (57)		172 (83)	
1-2 hours	57 (35)		13 (6)	
2-3 hours	9 (6)		3 (1)	
. missing	3		67	
Who else helped child use the activities				
No one else	61 (38)		59 (21)	37 (14)
Mother	24 (15)		141 (51)	139 (51)
Father	36 (22)		29 (11)	42 (15)
Other siblings	70 (43)		57 (21)	97 (36)
Other	20 (12)		6 (2)	64 (24)
Unsure	0		0	19 (7)

[a] These data were not assessed in this year

These results indicate that the reach of the Summer Club program was high with the majority of the high intervention group families receiving at least some of the program materials. Over two thirds of children had help using the materials each year, mostly

from mothers, fathers (Year 1) and siblings. Most children enjoyed receiving the Summer Club, although reported satisfaction with the materials was lowest in Year 3. Of those who reported receiving the materials each year, over three-quarters reported using at least some of them. However, the actual dose provided by this intervention may have been fairly low, especially after Year 1, based on time spent on the materials.

4.6 STUDY OBJECTIVE TWO: ASSOCIATION BETWEEN IMPLEMENTATION MEASURES AND STUDENT OUTCOMES

The dose of the intervention implemented by teachers, as assessed using the students' cumulative dose score, has been described previously in this chapter. This dose measure was used to conduct the dose-response analyses for student behavioural, skin colour and naevi data, the results of which are described below. The results in this section address the second objective of this process evaluation, namely to:

- Determine the association between the dose of the Kidskin classroom and home intervention and student sun-related behavioural and biomedical outcomes.

4.6.1 MULTIVARIATE ANALYSES OF ASSOCIATIONS BETWEEN LEVEL OF PROGRAM DOSE AND STUDENT SUN-RELATED BEHAVIOURAL OUTCOMES

Separate logistic regression analyses were conducted for each of the seven binary, dependent sun-related behaviour variables (type of bathers worn, hat wearing, back coverage, shade use, sunscreen use on face, arms and back) and multiple linear regression analyses for the continuous, dependent sun-related behaviour variable (natural log of hours spent outside between 11am and 2pm). The effect of each of the cumulative dose variables (Year 1, Year 1 and 2, Year 1, 2 and 3 and Year 1, 2, 3 and 4) on each of the above dependent variables were tested in separate models. These analyses addressed research Hypotheses One to Four, listed on page 5 in Chapter One of this thesis.

Back coverage when outside

The impact of level of intervention dose on back coverage (back covered by clothing all the time v's less than all the time when outside) at the end of the study is presented in Table 4.23. When the cumulative program dose variables were assessed, only the dose received in Year 1 (1995) was associated with significantly increased likelihood that the back was covered all the time when outside (Year 1: chi-square=8.63, df=2, p=0.013). Students in the high dose category in Year 1 were 1.8 times more likely to have their back covered when outside at post-test (1999) than those in the low dose category [OR=1.8, 95% CI=(1.19 2.68)] and 1.6 times more likely than those in the medium dose category [OR=1.6, 95% CI=(1.05 2.33)]. The other cumulative program dose scores did not have a significant impact on whether the back was covered all the time when outside (Table 4.23).

Table 4.23 - Logistic regression results for whether back covered when outside (all the time or less than all the time) [a] (n=671)

Back coverage (all the time v less than all the time) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	8.63	2	0.013*	Med v Low	1.14	0.228	0.66	0.509	(0.771, 1.690)
				High v Low	1.79	0.369	2.81	0.005*	(1.192, 2.678)*
				High v Med	1.56	0.130	-2.20	0.028*	(1.050, 2.333)*
Sum of all Yr 1 & 2 activities	2.09	2	0.351	Med v Low	1.11	0.228	0.53	0.597	(0.746, 1.664)
				High v Low	1.34	0.278	1.41	0.157	(0.893, 2.014)
				High v Med	1.20	0.162	-0.95	0.342	(0.821, 1.764)
Sum of all Yr 1, 2 & 3 activities	1.39	2	0.498	Med v Low	0.93	0.193	-0.35	0.727	(0.619, 1.396)
				High v Low	1.16	0.239	0.74	0.456	(0.779, 1.743)
				High v Med	1.25	0.155	-1.16	0.247	(0.855, 1.835)
Sum of all Yr 1, 2, 3 & 4 activities	0.23	2	0.891	Med v Low	1.08	0.227	0.37	0.714	(0.715, 1.631)
				High v Low	0.99	0.207	-0.04	0.969	(0.659, 1.493)
				High v Med	0.92	0.208	0.45	0.656	(0.631, 1.336)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for value of dependent variable at baseline and gender

Bathers type worn

Results of the analyses investigating possible dose effects on the type of bathers/swimwear worn indicated there was no significant association between any of the cumulative program dose scores and whether students wore the 'gold standard' sun

protective bathers (ie. bathers that covered shoulders, trunk and upper legs), or less protective swimwear at post-test in 1999 (Table 4.24).

Table 4.24 - Logistic regression results for type of bathers worn ('gold standard' or less than 'gold standard') [a] (n=702)

Bathers type worn (gold standard v other) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	0.40	2	0.819	Med v Low	1.01	0.214	0.07	0.946	(0.671, 1.532)
				High v Low	1.13	0.241	0.58	0.564	(0.745, 1.715)
				High v Med	1.11	0.189	-0.51	0.608	(0.737, 1.686)
Sum of all Yr 1 & 2 activities	2.76	2	0.252	Med v Low	1.41	0.299	1.63	0.103	(0.932, 2.140)
				High v Low	1.13	0.241	0.56	0.575	(0.742, 1.713)
				High v Med	0.80	0.262	1.08	0.281	(0.530, 1.203)
Sum of all Yr 1,2 & 3 activities	1.14	2	0.565	Med v Low	1.03	0.218	0.12	0.906	(0.676, 1.556)
				High v Low	1.23	0.263	0.96	0.335	(0.808, 1.869)
				High v Med	1.20	0.173	-0.87	0.382	(0.798, 1.800)
Sum of all Yr 1, 2, 3 & 4 activities	1.67	2	0.434	Med v Low	1.30	0.280	1.21	0.228	(0.850, 1.980)
				High v Low	1.25	0.267	1.04	0.298	(0.822, 1.898)
				High v Med	0.96	0.214	0.18	0.854	(0.643, 1.441)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for value of dependent variable at baseline, student gender and parent education level

Hat wearing when outside

The results of the analyses assessing the impact of program dose on hat wearing all the time versus less than all the time when outside are presented in Table 4.25. The likelihood of wearing a hat all the time while outside was similar, regardless of dose received, over the four years.

Table 4.25 - Logistic regression results for whether hat worn when outside (all the time v less than all the time) [a] (n=670)

Hat wearing (all the time v less than all the time) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	0.64	2	0.726	Med v Low	0.85	0.216	-0.64	0.525	(0.517, 1.400)
				High v Low	0.83	0.215	-0.73	0.464	(0.496, 1.377)
				High v Med	0.97	0.271	0.11	0.912	(0.580, 1.626)
Sum of all Yr 1 & 2 activities	0.20	2	0.907	Med v Low	0.94	0.247	-0.25	0.802	(0.558, 1.569)
				High v Low	1.04	0.275	0.17	0.866	(0.624, 1.750)
				High v Med	1.12	0.225	-0.44	0.660	(0.682, 1.828)
Sum of all Yr 1,2 & 3 activities	0.63	2	0.731	Med v Low	0.86	0.230	-0.57	0.568	(0.508, 1.450)
				High v Low	1.04	0.271	0.14	0.885	(0.622, 1.733)
				High v Med	1.21	0.208	-0.76	0.448	(0.740, 1.980)
Sum of all Yr 1, 2, 3 & 4 activities	2.19	2	0.334	Med v Low	0.76	0.199	-1.06	0.287	(0.452, 1.265)
				High v Low	0.68	0.180	-1.44	0.150	(0.409, 1.147)
				High v Med	0.91	0.279	0.39	0.695	(0.552, 1.486)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for value of dependent variable at baseline and student gender

Shade use when outside

The results of the analyses examining the impact of program dose on students' shade use when outside are presented in Table 4.26. Shade use was categorised as whether children spent at least half the time in the shade when outside, versus less than half the time in the shade when outside [(85)]. The association between the cumulative dose of the intervention delivered by teachers in Years 1 and 2 and the proportion of time spent in the shade when outside approached statistical significance (chi-square=5.80, df=2 p=0.055). Students in the high cumulative program dose group in Years 1 and 2 had significantly higher odds of reporting staying in the shade at least half the time they were outside in 1999 than those who received a low [OR=1.7, 95% CI=(1.03, 2.91)], or a medium cumulative dose [OR=1.7, 95% CI=(1.03, 2.66)] in Years 1 and 2. Differences in shade use between dose levels for other years were not statistically significant (Table 4.26).

Table 4.26 - Logistic regression results for time spent in the shade when outside (at least half the time v less than half the time) [a] (n=621)

Shade use (at least half the time v less than half the time) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	2.63	2	0.269	Med v Low	1.43	0.376	1.37	0.170	(0.857, 0. 240)
				High v Low	1.45	0.381	1.41	0.157	(0.866, 2.426)
				High v Med	1.01	0.265	-0.04	0.967	(0.598, 1.710)
Sum of all Yr 1 & 2 activities	5.80	2	0.055	Med v Low	1.05	0.272	0.18	0.861	(0.629, 1.743)
				High v Low	1.73	0.459	2.07	0.039*	(1.029, 2.910)
				High v Med	1.65	0.147	-2.07	0.038*	(1.028, 2.658)
Sum of all Yr 1, 2 & 3 activities	1.94	2	0.380	Med v Low	1.19	0.305	0.69	0.487	(0.724, 1.970)
				High v Low	1.44	0.378	1.38	0.167	(0.859, 2.408)
				High v Med	1.20	0.193	-0.80	0.424	(0.764, 1.899)
Sum of all Yr 1, 2, 3 & 4 activities	0.93	2	0.628	Med v Low	1.05	0.258	0.21	0.835	(0.651, 1.701)
				High v Low	1.26	0.329	0.89	0.371	(0.758, 2.102)
				High v Med	1.20	0.196	-0.77	0.440	(0.756, 1.902)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for value of dependent variable at baseline and parent education level

Sunscreen use when outside

The results of the logistic regression analyses of level of program dose on sunscreen use on the face, arms and back when outside are presented in Table 4.27 to Table 4.29. Sunscreen use was a binary measure categorised as 'worn all the time when outside' or 'worn less than all the time when outside'.

Sunscreen on the face

There was a weak effect for the cumulative Years 1-3 program dose on sunscreen use on the face (chi-square=5.71, df=2, p=0.058). Students whose cumulative, teacher-delivered dose of the intervention across Years 1-3 was high were significantly more likely to have used sunscreen on their face all the time while outside at post-test in 1999 than those in the low dose [OR=1.7, 95% CI=(1.02, 2.81)] and possibly those in the medium dose group [OR=1.6, 95% CI=(1.00, 2.58)].

Differences in the use of sunscreen on the face were not related to level of program dose in Year 1 alone (chi-square=1.97, df=2, p=0.374), Years 1 and 2 combined (chi-square=2.41, df=2, p=0.299), or the level of cumulative Year 1 to 4 dose (chi-square=0.02, df=2, p=0.991) (Table 4.27).

Table 4.27 - Logistic regression results for whether sunscreen used on the face when outside (all the time v less than all the time) [a] (n=668)

Sunscreen use on face (all the time v less than all the time) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	1.97	2	0.374	Med v Low	1.38	0.342	1.32	0.188	(0.853, 2.248)
				High v Low	1.07	0.281	0.27	0.788	(0.642, 1.794)
				High v Med	0.77	0.323	1.02	0.308	(0.474, 1.266)
Sum of all Yr 1 & 2 activities	2.41	2	0.299	Med v Low	1.22	0.323	0.76	0.448	(0.728, 2.053)
				High v Low	1.50	0.393	1.54	0.123	(0.896, 2.506)
				High v Med	1.23	0.195	-0.85	0.393	(0.768, 1.958)
Sum of all Yr 1, 2 & 3 activities	5.71	2	0.058	Med v Low	1.05	0.288	0.19	0.851	(0.615, 1.801)
				High v Low	1.69	0.437	2.04	0.042*	(1.020, 2.807)
				High v Med	1.61	0.151	-1.96	0.050*	(1.000, 2.584)
Sum of all Yr 1, 2, 3 & 4 activities	0.02	2	0.991	Med v Low	0.98	0.259	-0.06	0.952	(0.588 1.649)
				High v Low	1.02	0.261	0.07	0.948	(0.615 1.682)
				High v Med	0.97	0.234	-0.13	0.893	(0.643 1.660)

* Significant at 5%

[a] Models contain random intercept term to account for school-level clustering

[b] Dose measures fitted in four separate models

[c] Odds ratios adjusted for value of dependent variable at baseline and parent education level (Note: measure at baseline is sunscreen use for the whole body, not just on the back)

Sunscreen on the arms

The results of the analyses investigating the impact of program dose on sunscreen use on the arms are shown in Table 4.28. The dose in the middle years of the program seemed to have some effect on sunscreen use on the arms at the end of the study. While the overall tests of the cumulative dose for Years 1 and 2 (chi-square=4.62, df=2 p=0.099) and for Years 1 to 3 (chi-square=5.61, df=2 p=0.061) were not significant, individual comparisons of dose categories were. In particular, students who received a 'high dose' score over the first two years of the study were significantly, and 1.8 times more likely to wear sunscreen on their arms all the time when outside, than students who received a 'low dose' score [OR=1.8, 95% CI=(1.02, 3,22)]. The differences in sunscreen use on the arms between students with a medium and low cumulative dose score, or a medium and high cumulative dose score for Years 1 to 2 were not statistically significant (Table 4.28). When effects of levels of dose were assessed for the Years 1 to 3 cumulative program dose score, students in the high dose group had increased odds of wearing sunscreen on their arms than students in the low [OR=1.8, 95% CI=(1.02, 3.22)], or medium [OR=1.7, 95% CI=(0.99, 2.86)] dose group. There was no significant

difference in sunscreen use on the arms for students in the low and medium dose groups for the cumulative Years 1 to 3 program dose score (Table 4.28).

The program dose in Year 1 alone had no significant effect on whether students wore sunscreen on the arms all the time when outside (chi-square=1.19, df=2 p=0.552). Further, the addition of the Year 4 dose did not increase the likelihood that students would protect themselves with sunscreen on the arms all the time when outside (chi-square=0.46, df=2 p=0.794).

Table 4.28 - Logistic regression results for whether sunscreen used on the arms when outside (all the time v less than all the time) [a] (n=668)

Sunscreen use on arms (all the time v less than all the time) *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	1.19	2	0.552	Med v Low	1.35	0.375	1.09	0.277	(0.785, 2.330)
				High v Low	1.20	0.350	0.63	0.527	(0.680, 2.127)
				High v Med	0.89	0.311	0.43	0.670	(0.517, 1.528)
Sum of all Yr 1 & 2 activities	4.62	2	0.099	Med v Low	1.21	0.368	0.64	0.523	(0.670, 2.201)
				High v Low	1.81	0.531	2.02	0.044*	(1.017, 3.216)
				High v Med	1.49	0.178	-1.51	0.132	(0.887, 2.503)
Sum of all Yr 1, 2 & 3 activities	5.61	2	0.061	Med v Low	1.06	0.327	0.17	0.861	(0.575, 1.936)
				High v Low	1.78	0.513	2.00	0.045*	(1.012, 3.133)
				High v Med	1.69	1.600	-1.94	0.053	(0.994, 2.863)
Sum of all Yr 1, 2, 3 & 4 activities	0.46	2	0.794	Med v Low	1.06	0.315	0.19	0.851	(0.590 1.896)
				High v Low	1.20	0.344	0.64	0.522	(0.685 2.107)
				High v Med	1.14	0.236	-0.48	0.634	(0.672, 1.921)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for value of dependent variable at baseline and parent education level (Note: measure at baseline is sunscreen use for the whole body, not just on the back)

Sunscreen on the back

Analyses for sunscreen use on the back were conducted for those students who reported they did not have their back covered all the time when outside. There was no significant association between sunscreen use on the back, and any of the dose measures (Table 4.29).

Table 4.29 - Logistic regression results for whether sunscreen used on the back when outside (all the time v less than all the time) [a] (n=355)

Sunscreen use on back (all the time v less than all the time) [d] *Dose Measure* [b]	χ^2	*df*	*p*	*Dose level*	*OR* [c]	*SE*	*Z*	*P>|z|*	*95% CI*
All Yr 1 activities	1.20	2	0.549	Med v Low	0.93	0.304	-0.22	0.829	(0.492, 1.766)
				High v Low	0.68	0.248	-1.05	0.295	(0.337, 1.392)
				High v Med	0.73	0.481	0.87	0.382	(0.368, 1.467)
Sum of all Yr 1 & 2 activities	1.74	2	0.420	Med v Low	0.92	0.297	-0.26	0.798	(0.489, 1.733)
				High v Low	1.36	0.445	0.93	0.351	(0.714, 2.582)
				High v Med	1.47	0.208	-1.27	0.205	(0.808, 2.689)
Sum of all Yr 1, 2 & 3 activities	3.36	2	0.187	Med v Low	0.85	0.282	-0.49	0.623	(0.442, 1.629)
				High v Low	1.47	0.482	1.17	0.242	(0.772, 2.794)
				High v Med	1.73	0.177	-1.79	0.074	(0.948, 3.153)
Sum of all Yr 1, 2, 3 & 4 activities	0.37	2	0.833	Med v Low	1.13	0.367	0.38	0.704	(0.599 2.134)
				High v Low	1.22	0.395	0.60	0.546	(0.644 2.298)
				High v Med	1.08	0.278	-0.24	0.807	(0.598 1.934)

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Odds ratios adjusted for student gender and value of dependent variable at baseline (Note: measure at baseline is sunscreen use for the whole body, not just on the back)
[d] Only students who reported they did not have their back covered all the time included in analyses

Time spent outside between 11am and 2pm

The results of multiple regression analyses (Table 4.30) show there was no significant association between any of the intervention dose variables and time spent outside in the middle of the day. As is evident from the median values, the amount of time spent outside between 11am and 2pm in the summer school holidays in 1998/99 was similar in the high, medium and low dose groups for each cumulative dose variable.

Table 4.30 - Multiple regression results for time spent outside between 11am and 2pm during summer school holidays [a] (n=699)

Total time (hours) spent outside between 11am and 2pm [d] *Dose Measure* [b]	*Median # hours spent outside* [e]	χ^2	*df*	*p*	*Dose level*	*Coeffi cient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 9.69 Med 11.22 High 10.70	0.40	2	0.818	Med v Low High v Low High v Med	0.074 0.055 -0.019	0.121 0.125 0.126	0.61 0.44 -0.15	0.542 0.657 0.882
Sum of all Yr 1 & 2 activities	Low 9.50 Med 12.19 High 10.28	3.47	2	0.177	Med v Low High v Low High v Med	0.148 -0.054 -0.202	0.120 0.123 0.112	1.24 -0.43 -1.79	0.216 0.664 0.073
Sum of all Yr 1, 2 & 3 activities	Low 9.38 Med 10.75 High 10.70	0.01	2	0.993	Med v Low High v Low High v Med	-0.013 -0.013 -0.001	0.122 0.123 0.110	-0.11 -0.11 -0.01	0.916 0.913 0.996
Sum of all Yr 1, 2, 3 & 4 activities	Low 10.40 Med 10.38 High 10.70	0.57	2	0.754	Med v Low High v Low High v Med	0.006 -0.072 -0.077	0.114 0.121 0.111	0.05 -0.60 -0.70	0.961 0.551 0.484

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for southern European ethnicity
[d] Transformed as ln(total hours +1)
[e] Median raw score

4.6.2 MULTIVARIATE ANALYSES OF ASSOCIATIONS BETWEEN LEVEL OF PROGRAM DOSE AND STUDENT SUNTANNING

Separate multiple linear regression analyses were conducted for the two continuous, dependent suntanning variables (melanin density on the back and forearms) and each of the cumulative dose variables (Year 1, Year 1 and 2, Year 1, 2 and 3 and Year 1, 2, 3 and 4). The melanin density measures estimated the percentage of the epidermis that contained melanin, with higher percentages indicating darker skin. These analyses addressed research Hypotheses Five to Eight, listed on page 6 in Chapter One of this thesis.

Suntanning on the back

The effect of dose on level of suntanning as assessed by melanin density on the back are shown in Table 4.31. There was no significant association between dose in any year of the program and melanin density, or level of tanning, on the back.

Table 4.31 - Multiple regression results for melanin density on the back [a] (n=703)

Suntanning on the back *Dose Measure* [b]	*Mean melanin density / dose level (%)* [d]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 3.64 Med 3.51 High 3.56	0.36	2	0.837	Med v Low High v Low High v Med	-0.024 -0.041 -0.017	0.066 0.069 0.070	-0.36 -0.59 -0.24	0.718 0.554 0.807
Sum of all Yr 1 & 2 activities	Low 3.61 Med 3.62 High 3.49	1.44	2	0.488	Med v Low High v Low High v Med	0.040 -0.034 -0.074	0.068 0.069 0.062	0.59 -0.48 -1.20	0.554 0.628 0.232
Sum of all Yr 1, 2 & 3 activities	Low 3.54 Med 3.66 High 3.50	1.36	2	0.507	Med v Low High v Low High v Med	0.028 -0.041 -0.069	0.067 0.069 0.059	0.41 -0.59 -1.16	0.679 0.554 0.245
Sum of all Yr 1, 2, 3 & 4 activities	Low 3.61 Med 3.57 High 3.55	1.41	2	0.494	Med v Low High v Low High v Med	-0.076 -0.046 0.031	0.064 0.069 0.060	-1.19 -0.66 0.51	0.235 0.508 0.607

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for value of gender, tendency to burn and winter 1999 inner arm melanin density
[d] Mean raw score estimating percent of epidermis that contains melanin. Higher percentage indicates higher density, ie. darker skin colour

Suntanning on the forearm

Apart from tanning on the back, the level of suntanning on the forearm (as assessed by melanin density) was also evaluated for dose effects. The results are shown in Table 4.32.

There was no significant association between Year 1 dose and tanning on the forearm. While not significant overall (Chi-square=4.48, df=2, p=0.107), students who received a high cumulative dose of the intervention over the first two years (Year 1 and 2 dose) tended to have slightly lower melanin density (by 0.05% on average) than students who received a low dose with the difference just below the 0.05 level of significance (p=0.049). Forearm melanin density was similar for students whose teachers delivered a low or a medium dose of the intervention in Years 1 and 2 (Table 4.32).

The difference in level of tan on the forearm was greatest for the cumulative Year 1 to 3 dose (Chi-square=7.28, df=2, p=0.026), with students who received a high dose over the three years having a significantly lower melanin density (ie. were less tanned) than students who received a low program dose (Regression coefficient =-0.06%, p=0.009).

The four-year program dose was not related to the degree of tanning on the forearm at the end of the study (Table 4.32).

Table 4.32 - Multiple regression results for melanin density on the forearm [a] (n=703)

Suntanning on the forearm *Dose Measure* [b]	*Mean melanin density / dose level (%)* [d]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 3.96 Med 3.94 High 3.94	3.49	2	0.175	Med v Low High v Low High v Med	-0.032 -0.038 -0.006	0.022 0.022 0.022	-1.43 -1.75 -0.30	0.152 0.080 0.766
Sum of all Yr 1 & 2 activities	Low 3.97 Med 3.94 High 3.94	4.48	2	0.107	Med v Low High v Low High v Med	-0.038 -0.045 -0.007	0.021 0.023 0.020	-1.78 -1.97 -0.34	0.075 0.049* 0.737
Sum of all Yr 1, 2 & 3 activities	Low 3.96 Med 3.96 High 3.93	7.28	2	0.026*	Med v Low High v Low High v Med	-0.024 -0.062 -0.037	0.022 0.024 0.020	-1.11 -2.62 -1.87	0.267 0.009* 0.061
Sum of all Yr 1, 2, 3 & 4 activities	Low 3.96 Med 3.95 High 3.94	2.86	2	0.240	Med v Low High v Low High v Med	-0.030 -0.040 -0.010	0.022 0.024 0.020	-1.35 -1.64 -0.51	0.177 0.101 0.610

* Significant at 5%

[a] Models contain random intercept term to account for school-level clustering

[b] Dose measures fitted in four separate models

[c] Regression coefficients adjusted for machine used, week of observation, gender and winter 1999 inner arm reflectance

[d] Mean raw score estimating percent of epidermis that contains melanin. Higher percentage indicates higher density, ie. darker skin colour

4.6.3 MULTIVARIATE ANALYSES OF ASSOCIATIONS BETWEEN LEVEL OF PROGRAM DOSE AND NUMBER OF NAEVI STUDENTS DEVELOPED

Separate multiple linear regression analyses were conducted for each of the continuous, dependent naevi variables (number of naevi on the back, arms and face for boys and girls and on the chest of boys) and program dose. For each of these analyses the dependent variable was transformed by taking the log of the number of naevi after the addition of a constant (1) to account for zero values and normalise the data. These analyses addressed research Hypotheses Nine to Twelve, listed on pages 6 and 7 in Chapter One of this thesis.

Naevi on the back

Firstly naevi on the back were assessed for dose effects. The results in Table 4.33 show that there was no significant association between the dose of the intervention in any year and number of naevi on the the back.

Table 4.33 - Multiple regression results for naevi on the back [a] (n=762)

Number of naevi on the back [d] *Dose Measure* [b]	*Median # naevi / dose level* [e]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 6.00 Med 6.00 High 6.00	0.11	2	0.946	Med v Low High v Low High v Med	0.012 0.007 -0.005	0.036 0.036 0.036	0.33 0.20 -0.13	0.741 0.844 0.895
Sum of all Yr 1 & 2 activities	Low 6.00 Med 6.00 High 6.00	0.11	2	0.944	Med v Low High v Low High v Med	-0.004 -0.012 -0.008	0.036 0.037 0.035	-0.12 -0.33 -0.22	0.903 0.741 0.823
Sum of all Yr 1, 2 & 3 activities	Low 6.00 Med 6.00 High 6.00	0.00	2	0.999	Med v Low High v Low High v Med	0.000 -0.000 -0.000	0.037 0.037 0.034	0.01 -0.01 -0.01	0.995 0.995 0.989
Sum of all Yr 1, 2, 3 & 4 activities	Low 6.00 Med 6.00 High 6.00	0.39	2	0.821	Med v Low High v Low High v Med	0.014 0.023 0.008	0.037 0.037 0.034	0.39 0.63 0.25	0.695 0.531 0.805

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for value of dependent variable at baseline, observer 1999, observer 1995, gender, hair colour and inner arm reflectance
[d] Transformed as ln(naevi+1)
[e] Median raw score

Naevi on the chest

Naevi were counted on the chests of boys only. The results of analyses assessing the effect of program dose on the logged number of naevi on the chests of boys are shown in Table 4.34.

The dose of the intervention delivered to boys in Years 1 to 3 had no effect on naevi development on the chest at post-test. However there did seem to be a weak effect of dose for boys who received a medium level of intervention dose over the four years of the program, compared to those who received a low dose. The cumulative Year 1 to 4 program dose was not significant overall in the regression equation (chi-square=4.77, df=2, p=0.092), however boys in the medium group for cumulative program dose

delivered in Years 1 to 4 tended to have a lower logged score for naevi on the chest than those in the low dose group. The median number of naevi on the chest in the low dose group was two compared with a median of 1.8 in the medium dose group.

Table 4.34 - Multiple regression results for naevi on the chest [a] (n=400)

Number of naevi on the chest (boys only) [d] *Dose Measure* [b]	*Median # naevi / dose level* [e]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 1.94 Med 1.94 High 1.79	0.65	2	0.722	Med v Low High v Low High v Med	0.027 -0.012 -0.039	0.048 0.049 0.050	-0.56 0.24 -0.78	0.572 0.811 0.434
Sum of all Yr 1 & 2 activities	Low 1.94 Med 1.79 High 1.79	0.18	2	0.912	Med v Low High v Low High v Med	0.006 0.021 0.015	0.050 0.051 0.048	0.12 0.41 0.32	0.908 0.682 0.751
Sum of all Yr 1, 2 & 3 activities	Low 2.08 Med 1.94 High 1.79	0.30	2	0.862	Med v Low High v Low High v Med	-0.001 -0.024 -0.022	0.050 0.051 0.047	-0.02 -0.46 -0.48	0.985 0.647 0.632
Sum of all Yr 1, 2, 3 & 4 activities	Low 2.01 Med 1.79 High 1.94	4.77	2	0.092	Med v Low High v Low High v Med	-0.107 -0.035 0.072	0.051 0.051 0.047	-2.09 -0.69 1.54	0.037* 0.493 0.123

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for value of dependent variable at baseline, and hair colour
[d] Transformed as ln(naevi+1)
[e] Median raw score

Naevi on the face

The results of analyses assessing the effect of program dose on the logged number of naevi on the face are shown in Table 4.35. There was a significant dose-response effect for Year 1 dose (chi-square=6.63, df=2, p=0.036). Students in the medium intervention dose group had developed significantly fewer naevi on the face by the end of the study than students in the low intervention dose group (p=0.015). Students who received a high dose of the intervention in Year 1 also seemed to have developed fewer naevi on the face than students who received a low dose in that year, although the significance of this difference was just over 0.05 (p=0.059). The median number of naevi on the face at post-test in 1999 was six for students who received a low program dose in Year 1 and five for those who received a high and medium level of program dose.

There was no significant association between naevi on the face and any of the later dose variables (Table 4.35).

Table 4.35 - Multiple regression results for naevi on the face [a] (n=779)

Number of naevi on the face [d] *Dose Measure* [b]	*Median # naevi / dose level* [e]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 6.00 Med 5.00 High 5.00	6.63	2	0.036*	Med v Low High v Low High v Med	-0.132 -0.108 0.024	0.054 0.057 0.057	-2.44 -1.88 0.42	0.015* 0.059 0.671
Sum of all Yr 1 & 2 activities	Low 6.00 Med 5.00 High 5.00	0.09	2	0.957	Med v Low High v Low High v Med	-0.002 0.012 0.014	0.055 0.056 0.052	-0.05 0.22 0.28	0.963 0.830 0.778
Sum of all Yr 1, 2 & 3 activities	Low 5.00 Med 6.00 High 5.00	1.63	2	0.442	Med v Low High v Low High v Med	-0.053 -0.068 -0.016	0.053 0.056 0.050	-0.99 -1.23 -0.31	0.322 0.217 0.753
Sum of all Yr 1, 2, 3 & 4 activities	Low 6.00 Med 5.00 High 5.00	2.86	2	0.239	Med v Low High v Low High v Med	-0.079 -0.074 0.005	0.499 0.550 0.497	-1.59 -1.36 0.10	0.111 0.175 0.923

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for value of dependent variable at baseline, observer 1999, observer 1995 and inner arm reflectance
[d] Transformed as ln(naevi+1)
[e] Median raw score

Naevi on the arm

With regard to the number of naevi on the arm, some weak effects from the middle years' dose variables were observed (Table 4.36). The program dose in Year 1 was not significantly related to the number of naevi on the arm, and the cumulative Year 1 and 2 dose of the intervention was also not significant overall in the regression equation (chi-square=4.00, df=2, p=0.14). However, there seemed to be an effect for students whose teachers delivered a high program dose in Years 1 and 2 compared to those whose teachers delivered a low dose. Students in the Year 1 and 2 high program dose group had significantly fewer naevi on their arms than those in the low program dose group (Regression Coefficient=-0.09, p=0.046). The median number of naevi were 12 and 15 in the high and low dose groups respectively. Differences in the number of naevi on the arms of students between the medium and high dose groups, and the medium and low dose groups for Years 1 and 2 were not significant.

A similar pattern was seen for the cumulative program dose scores up to the third year of the study. Although not significant overall (chi-square=5.43, df=2, p=0.06) students in the high cumulative Years 1 to 3 dose group had significantly fewer naevi on the arm at post-test in 1999 than those in the low dose group (Regression coefficient=-0.097, p=0.038). Again the median number of naevi in the high dose group was 12 compared with 15 in the low Year 1 to 3 cumulative dose group. The high dose students also had fewer naevi on the arms than the group who received a medium program dose in these years, with the regression coefficient approaching significance (Regression coefficient=-0.082, p=0.051). After four years of intervention the students in the high program dose group had fewer naevi on the arms than the medium and low program dose groups, however these differences were not significant (Table 4.36).

Table 4.36 - Multiple regression results for naevi on the arm [a] (n=778)

Number of naevi on the arm [d]									
Dose Measure [b]	*Median # naevi / dose level* [e]	χ^2	*df*	*p*	*Dose level*	*Coefficient* [c]	*SE*	*Z*	*P>|z|*
All Yr 1 activities	Low 14.00 Med 13.00 High 13.00	1.49	2	0.476	Med v Low High v Low High v Med	-0.014 -0.058 -0.044	0.046 0.050 0.048	-0.30 -1.17 -0.93	0.765 0.243 0.350
Sum of all Yr 1 & 2 activities	Low 15.00 Med 14.00 High 12.00	4.00	2	0.136	Med v Low High v Low High v Med	-0.055 -0.094 -0.039	0.046 0.047 0.043	-1.19 -2.00 -0.92	0.233 0.046* 0.360
Sum of all Yr 1, 2 & 3 activities	Low 15.00 Med 14.00 High 12.00	5.43	2	0.066	Med v Low High v Low High v Med	-0.016 -0.097 -0.082	0.045 0.047 0.042	-0.35 -2.07 -1.95	0.728 0.038* 0.051
Sum of all Yr 1, 2, 3 & 4 activities	Low 14.00 Med 14.00 High 12.00	0.99	2	0.609	Med v Low High v Low High v Med	-0.026 -0.047 -0.021	0.043 0.047 0.042	-0.60 -1.00 -0.50	0.549 0.320 0.620

* Significant at 5%
[a] Models contain random intercept term to account for school-level clustering
[b] Dose measures fitted in four separate models
[c] Regression coefficients adjusted for value of dependent variable at baseline, observer 1999, observer 1995, gender, hair colour and inner arm reflectance
[d] Transformed as ln(naevi+1)
[e] Median raw score

4.7 SUMMARY OF RESULTS

Data from students, parents and teachers from 19 study schools were assessed in this study. All schools selected to participate remained in the study for the full five years. Student/parent response rates were high at over 98% at baseline and over 81% at post-test in 1999. Teacher response rates for each of the process evaluation measures were also high at over 78% each year. Over 72% of parents or students completed the Summer Club questionnaire each year it was administered, however, response rates for the Summer Club work samples were low, ranging from 23% to 32%.

Selective attrition was assessed for each outcome measure separately. Non-respondents to the parents' sun-related behaviour questionnaire were more likely to be parents of male students in the high intervention group. Students who did not have their naevi assessed in winter 1999 had more naevi on their arms at baseline. There were no other significant differences in constitutional or outcome variables at baseline between respondents and non-respondents at post-test in 1999.

There were few differences between teachers who returned process evaluation measures and those who didn't, although teachers who did not return the program checklist measure were more likely to be male and have completed more years of tertiary education than respondents to this measure.

Parent and child-reported use of the Summer Club materials was high. A parent/child Summer Club implementation questionnaire was administered at the end of summer in February 1996, 1998 and 1999. Ninety six percent of respondents in 1996, 71% of respondents in 1997 and 100% of respondents in 1998 indicated they received and used at least some of the Summer Club materials.

Time spent on the program was assessed via the teacher self-report checklist. The median time spent delivering the program was just under five hours in Year 1, seven hours and 20 minutes in Year 2, eight hours and forty minutes in Year 3 and six hours in Year 4. Time spent on the activities was greatest for theme one each year and tended to decrease as the program progressed. A similar pattern was seen in terms of

implementation, with implementation levels usually higher for activities in earlier themes than later ones each year.

Dose of the intervention delivered by teachers each year was assessed via teacher self-report checklists and the evaluation of student work samples. The program checklists evaluated completion of all program activities. Work samples provided an objective measure of dose to assist in determining the concurrent validity of teacher self report, however, did not cover all program activities, only those with a pen-and-paper component. Between these two measures the mean percent agreement across all the activities was 70% in Year 1, 80% in Year 2, 91% in Year 3 and 86% in Year 4.

A combined dose score was created using data from the teacher self report checklist and, where self report data were missing, data from student work samples. This combined measure, indicated teachers taught 65% of activities in Year 1, 76% of activities in both Year 2 and Year 3 and 64% of activities in Year 4. A weighting was applied for each activity according to the extent that it met program outcomes. These weightings were applied to teacher implementation scores to give a weighted implementation score. Mean teacher implementation rates for 'all activities' using this weighted combined score were 66% in Year 1, 78% in Year 2, 79% in Year 3 and 71% in Year 4. The weighted scores were similar for high and moderate intervention group teachers each year, except for Year 2 where high intervention group teachers were more likely to be in the medium level of implementation dose group than moderate intervention group teachers (χ^2=6.04, df=2 p= 0.049).

Students were assigned cumulative program dose scores based on the sum of their teachers' weighted dose scores in Year 1, Years 1 and 2, Years 1, 2 and 3 and Years 1, 2, 3 and 4. The cumulative dose scores were divided into tertiles to create low, medium and high program dose groups each year. A 'low dose' corresponded to about two-thirds of the program being taught, a 'medium dose' to between two-thirds and three quarters of the program and a 'high dose' to between three quarters and all of the program being taught.

Dose-response analyses were conducted to determine the effect of the cumulative weighted dose score each year on student outcomes assessed at post-test in 1999. Dose-

response analyses for behavioural outcomes indicated no effect of program dose in any year on the type of bathers worn, hat usage, sunscreen use on the back or time spent outside between 11 am and 2 pm. An effect for level of program dose was seen for back coverage, shade use and sunscreen use on the face and arms. Students with a high implementing teacher in Year 1 were 1.7 times more likely [95% CI=(1.19 2.68)] to have their back covered by clothing all the time when outside at post-test than those with a low implementing teacher and 1.6 times more likely than those with a medium dose implementing teacher [95% CI=(1.05 2.33)]. Students with high cumulative program dose scores for Years 1 and 2 were 1.7 times more likely to stay in the shade at least half the time when outside than those with low cumulative program dose scores [95% CI=(1.03, 2.91)] and 1.6 times more likely than students in the 'medium' cumulative dose group [95% CI=(1.03, 2.66)]. Students with high implementing teachers in Years 1, 2 and 3 were 1.7 times more likely to wear sunscreen on the face all the time at post-test in 1999 [95% CI=(1.02, 2.81)] than students with low implementing teachers in those years. Sunscreen use on the arms at post-test 1999 was also associated with level of program dose. Students with a high cumulative dose score in Years 1 and 2 were 1.8 times more likely to use sunscreen on the arms all the time when outside than those with a low cumulative dose score [95% CI=(1.02, 3,22)]. There was a similar protective effect of receiving a high cumulative dose over Years 1, 2 and 3 of the program compared to receiving a low cumulative dose for those years [OR=1.8, 95% CI=(1.02, 3.22)]

Level of program dose had no impact on tanning on the back, but was related to somewhat reduced tanning on the forearm at post-test in 1999. A high cumulative dose in Years 1 and 2 was related to one third of a percent reduction in melanin density on the forearm at post-test in 1999 compared to a low cumulative dose over the first two years of the program (p=0.049). A similar level of reduction in tanning was seen for students who received a high dose from teachers in the first three years of Kidskin compared to those who received a low dose in Years 1 to 3 of the program (p=0.009).

The effect of classroom and home program dose on naevi was mixed. There was no relationship between program dose and naevi on the back, although there was some impact of level of program dose in different years on naevi counts on other parts of the body. Boys who received a 'medium' cumulative dose in Years 1 to 4 had a median of

1.8 naevi on the chest compared to a median of two naevi for boys in the 'low dose' group (p=0.037). There was no dose-response relationship for the high dose group for naevi on boys' chests. Similarly, students in the medium dose group in Year 1 tended to have fewer naevi on their face than those in the low dose group. The median for the medium program dose group was five naevi compared to a median of six naevi on the face for the low program dose group at post-test in 1999.

A high cumulative dose of the intervention in Years 1 and 2 and Years 1, 2 and 3 was associated with fewer naevi on the arms at post-test. Students with a high cumulative dose for Years 1 and 2 had a median of 12 naevi on their forearm compared with a median of 15 for students in the low dose group (p=0.046). Students with a high cumulative dose up to Year 3 attained similar results, with a median of 12 naevi on the forearms compared to a median of 15 for students in the low dose group for Years 1 to 3 (p=0.038).

These results are summarised below in Table 4.37.

Table 4.37 - Outcomes for which significant effects were found for level of dose

	Year 1 dose	**Cumulative Year 1 and 2 dose**	**Cumulative Year 1, 2 and 3 dose**	**Cumulative Year 1, 2, 3 and 4 dose**
Back coverage	√	-	-	-
Bathers type	-	-	-	-
Hat wearing	-	-	-	-
Shade use when outside	-	√	-	-
Sunscreen on face	-	-	√	-
Sunscreen on arms	-	√	√	-
Sunscreen on back	-	-	-	-
Time outside 11am-2pm	-	-	-	-
Suntanning on back	-	-	-	-
Suntanning on forearm	-	√	√	-
Naevi on back	-	-	-	-
Naevi on chest	-	-	-	√
Naevi on face	√	-	-	-
Naevi on arms	-	√	√	-

5. DISCUSSION

This chapter begins with a discussion of the aims of this study and its limitations. The dose of the classroom and home intervention delivered by teachers and the effect of dose on student outcomes are then discussed in relation to findings from relevant studies in the literature. Conclusions and recommendations for program dissemination and further research are also presented.

5.1 AIMS OF THE STUDY

The high prevalence of skin cancer in Australia has made its reduction an important public health issue [223]. Findings that sun exposure during childhood is strongly linked to melanoma in later life [3] have led to primary school-aged children being identified as a key target group for measures to reduce sun exposure. Programs delivered through schools can be effective in reaching a high proportion of this population [57, 63] and have been shown to be effective in changing sun-related behaviours in upper primary school children [22, 23, 27, 28, 30, 99]. The Kidskin program was developed in response to low implementation of sun safety education in schools [57] and limited comprehensive resources for junior primary school teachers in this area [224].

The larger Kidskin study was a seven-year non-randomised community based 'group' intervention trial. This trial designed, implemented and evaluated the effects of 'Kidskin', an intervention designed to reduce sun exposure and increase sun protection behaviours in primary school-age children. This larger study found Kidskin was moderately effective in eliciting change in sun-related outcomes in lower primary aged children [85]. The results of the between groups' differences found in the larger study have been outlined in Chapter 2.

This thesis assessed the use of the Kidskin materials by teachers and families and evaluated whether the level of dose of the intervention implemented by teachers affected the study outcomes. This process evaluation is a valuable component of the overall study evaluation plan as it can help to reduce the likelihood of Type III error [135] (evaluating a program that has not been adequately implemented).

Results reported in this thesis focus on the cohort of students in the two intervention groups from the larger Kidskin study, their parents and teachers. These students received the Kidskin intervention from Year 1 to Year 4 of primary school. Student baseline measures were assessed prior to program implementation in 1995 and dose was assessed in relation to student outcomes (sun-related behaviours, level of tanning and the development of naevi) after four years of program implementation at post-test in 1999.

Few studies have assessed in detail how sun safety programs are used by teachers [99, 101, 104] and there exists little information showing how the level of dose of school-based sun safety interventions influences changes in students' sun-related behaviours or biomedical outcomes. This study provides information to guide recommendations to enhance further dissemination and implementation of these materials in schools.

5.2 LIMITATIONS OF THE STUDY

Prior to discussing the results of this study, limitations related to the sample selection, instrumentation, testing, timing and attrition will be addressed. These limitations may have threatened the internal and external validity of the study findings reported in Chapter 4.

Limitations due to study design

As the key predictor variable was dose of the Kidskin intervention delivered by teachers, this process evaluation did not include a control group. While the larger Kidskin study included a control group, these students and their teachers did not use the Kidskin program and therefore could not be assigned a Kidskin dose score. The current study sample included the moderate and high intervention groups from the larger study only. Comparisons are made between levels of teacher dose of the intervention, rather than between participants assigned to different study groups.

The structure and content of the school- and home-based intervention, for which teacher implementation dose was assessed, were the same for each of the study groups. Although teachers in high and moderate intervention groups were trained separately, the same project staff carried out both trainings each year to ensure consistency. All

intervention teachers received the same teaching kit each year and completed the same evaluation measures. However, other Kidskin intervention components were provided to the high intervention students/schools, which were not included in the dose measure, and may have impacted on outcomes. Students at high intervention schools received the 'Totally Cool Summer Club' booster intervention during the school summer holidays and could purchase cost-price sun-protective swimwear prior to summer each year. High intervention schools were assisted, from the third year of the study, in making environmental and policy changes to improve sun protection at school. The larger Kidskin study found that students in the high intervention group were more likely to perform a number of sun protective behaviours at post-test in 1999 than the control and moderate intervention groups [85]. However, given that most of these interventions targeted families out of school time, it was not expected that high intervention group teachers would have higher, or lower, implementation rates for the Kidskin classroom and home educational curriculum. Implementation of the Kidskin intervention was similar for high and moderate intervention group teachers in Years 1, 3 and 4. In Year 2, high intervention group teachers were slightly more likely to deliver a medium dose of the intervention than moderate intervention group teachers. To account for any differences due to assignment to the high or moderate intervention components, group was controlled for in the dose-response analyses.

Limitations due to sample selection

Schools in the Kidskin study were not randomly assigned to study groups due to concerns about contamination between schools in close proximity to each other. Instead they were randomly selected from geographically determined clusters after stratification by size, socio-economic status and proximity to the beach. Further, to minimize study costs associated with travel, sample selection was structured such that high intervention schools were located closer to the centre of the metropolitan area while those eligible for selection into the control group tended to be located furthest from the centre of the metropolitan area [80]. This selection process most likely explains the finding of higher parental education levels in the high intervention group compared to the control group in the larger study even though schools were stratified by socio-economic status during the sample selection [80]. Control group data were not assessed in the current study, so the variation in location within the metropolitan area is less likely to have affected these

results, however, to minimise the risk of bias parental education level was controlled for in the analyses.

To further assess possible bias from the absence of randomisation of schools, differences between the three study groups at baseline were assessed. In the larger study, differences were found at baseline for southern European ethnicity, parental education and reported sun exposure, which was higher in the high intervention group [80]. The variables that differed at baseline for the larger study, and those likely to directly affect sun exposure, were controlled for within the analyses to minimise risk of bias.

Of the original 33 schools selected to participate in the study, five refused to participate. The extent of the difference between these schools and those who participated is not known, therefore self-selection bias may have influenced the generalisability of the results [225], eg. schools with more/less enthusiastic teachers.

The sample size selected for the larger Kidskin study provided 90% power to detect an eight percent change in number of naevi due to a 25% reduction in sun exposure. As the full sample was not used in this process evaluation, the current study has less than 90% power to detect changes in naevi.

Limitations due to participant attrition

Student outcome measures

Students who were lost to follow-up were similar for most constitutional variables to those who remained in the study. Non-respondents to the post-test sun-related behaviour questionnaire (n=142) were more likely to be male (p=0.02) and from the high intervention group (p=0.002). Students who did not have naevi data collected in 1999 had a higher (p=0.02) unadjusted score for naevi on the arms at baseline, but not on any other body site. This may have led to loss to follow-up bias [225]. As the dropouts may have been those with higher numbers of naevi on the arms, this may have spuriously inflated or deflated the effect of dose on naevi on the arm.

Teachers

Respondents and non-respondents to the two implementation measures differed on gender and academic qualifications and time spent teaching sun safety earlier in the year before the Kidskin program was implemented. Non-respondents to the program checklist were more likely to be male and to have completed more years of university education. Further, teachers who did not provide student work samples reported spending more time teaching sun safety that year, prior to implementation of the Kidskin program, than teachers who did provide work samples. Given the predominance of female teachers in Western Australian primary schools, particularly in the junior primary grades (Kindergarten – Year 3), the gender difference is likely to have been due to the small number of male teachers in the sample rather than any real differences in response. The differences in hours spent teaching sun safety at the start of the year, prior to the Kidskin program, was based on the questionnaire responses of only three teachers. Academic differences between respondents and non-respondents may have introduced bias, however, given the small attrition rate, high response rates and that only three teachers returned neither the checklist nor program checklist over the four years, this selective attrition is unlikely to affect this sample.

Students and parents and the Summer Club

Rates of Summer Club work sample collection were low at between 18% and 31%. It is probable that children who completed a low dose of the holiday activities were less likely to return work samples than those who completed more of the activities. Thus the Summer Club work sample data are likely to be biased, and were therefore not used in the determination of dose. This low work sample return rate limited our ability to assess the validity of parent and student self-report of activity completion provided in the Summer Club implementation questionnaire. Therefore the data on completion of the Summer Club activities obtained via this measure may be subject to social desirability bias, or recall bias.

The high participation and minimal attrition of students, teachers and schools during the study indicate the results obtained are representative of the sample population. However, while the study participants may accurately represent the schools involved in the study, they may not represent non-study schools, or schools outside of Western

Australia. Caution should be used in generalising the study findings beyond this population.

Limitations due to testing effects

There may have been changes in outcomes due to the skin testing alone, ie. it may have acted as an intervention. This testing effect may have contributed toward the null results seen in the larger study assessing differences between the control and intervention groups. However, this assertion is not supported by previous findings. Buller et al. [28] used a Solomon four-group design to assess testing effects in an evaluation of a school-based sun safety program. Results indicated that testing appeared to have had no significant effect on knowledge or behaviours, although it did increase students' terminology recognition.

Measuring process data may have influenced the amount of the program teachers taught their class. At the pre-intervention in-service training each year, teachers were given instructions about how to complete the program checklist and were also told that work samples would be collected at the end of the year. Knowing that their level of implementation of the program would be assessed is likely to have increased the level of implementation above that which may have been implemented outside of a study situation. Post-implementation data collected as part of the larger Kidskin study indicated that about 30% of teachers each year would teach only a few of the activities when they used the materials again, while between 16% and 33% each year indicated they would use the materials in their existing form [43].

Observations conducted as part of the formative evaluation of the materials may have caused teachers to change their teaching in the observed lesson. However, as observations were conducted in year two of the program only, and teachers were only observed for one session the effect is likely to have been minimal on the overall results.

Limitations due to information bias

The validity of this study's findings may have been influenced by bias resulting from the measurement of student outcomes or through the assessment of implementation of the intervention. Bias may be introduced via the data collection instrument (self-report bias), via the data collection process (intra- and inter-observer bias) or through

participant responses (social desirability bias, recall bias) [138, 225, 226]. The strategies employed to minimise the effect of information bias are discussed below.

Parent sun related behaviour questionnaire

Students' sun related behaviours over the summer were assessed at the end of summer each year via a parent questionnaire. Due to the young age of students at the commencement of the study and the likelihood that parents of children this age would be more likely to be monitoring their activities, parent report was considered a more reliable and valid measure than asking young children directly [33]. The reliability and validity of this measure were both good [83, 84]. A composite sun exposure index developed from parent report of sun exposure to the arm agreed with skin tanning data for the arm ($p<0.001$) [83, 84]. Tanning on the back was also positively related to parent-reported exposure. Mean skin reflectance values for the back were 5% higher in children with no reported sun exposure to the back (ie. they were less tanned) than for children with at least some exposure reported for this site [83, 84].

This agreement between self-report and biomedical measures indicates that the bias toward the over-reporting of desirable sun protective behaviours often seen in self-report measures [227], does not seem to have been a major source of error in this study.

Parents of children whose teacher delivered a high dose of the intervention may have also been more aware of sun related behaviours that were considered positive and thus may have been more prone to social desirability bias in their responses. However, given that program dose levels received by students varied each year this is unlikely to have been a major source of bias.

Skin tanning and naevi assessment

Students' level of tanning and number of moles was assessed in 1995 and 1999. Level of tanning was assessed at the end of summer in 1999 as suntan is relatively short lived. Naevi were assessed in winter 1999 when tanning and freckling were likely to be lightest and have the least influence on mole classification. As all students could not be assessed at the same time, week of assessment was controlled for in all analyses to counter bias due to timing of measurements [85]. Spectrophotometer machines used were calibrated daily during testing and analyses controlled for machine used. All

assessors were trained and followed set protocols to minimise the risk of observer bias [225]. Intra- and inter-rater reliability were assessed throughout and were found to be high [80, 91] and analyses were adjusted for observer. It is therefore unlikely that systematic observer bias [225] had a large influence on student skin characteristics outcomes.

Implementation measures

Interpreting intervention study outcomes without assessing program implementation increases the risk of Type III error [38] – that is, wrongly attributing the results attained to the intervention. This study provides information about program implementation that can enhance the understanding and validity of the outcome findings [85, 91]. However, several limitations need to be considered in the assessment of implementation in this study.

The annual student program dose measures used in this study were based on teacher implementation measures, thus all students in a class were assigned the same dose. This is a limitation as it did not take into account whether each student in a class was present at all Kidskin lessons. Therefore, the teacher-delivered classroom dose measures used in this study are likely to slightly overestimate student dose received.

Additionally, due to difficulties in collecting valid data, several aspects of the intervention may have been inadequately assessed in terms of dose. For example, each year the Kidskin intervention included four to six take-home activities for students to complete with their parents during term time. While the dose of these activities administered by teachers was assessed in the dose measurement, the level of completion and time spent on each of these activities by individual parents were not assessed. This is a limitation of this study, as individual students may not have completed a home activity even though it was delivered to the class by the teacher. Thus the home activity dose measure may overestimate home activity dose. A review of all student work books to identify whether home activities had been completed, may have been more effective than the sample of five books per class that was collected.

It was also difficult to obtain a valid assessment of the dose of the booster ‘Summer Club’ intervention completed by students. Information on the receipt of the intervention

materials was obtained via the parent/student questionnaire. Information on the completion of individual activities was difficult to assess as in many cases parents were uncertain which activities their child had completed. This was especially true as children got older and parents were less involved in assisting them to read and complete activities. Work sample collection at the end of the holiday period was attempted to obtain an objective dose measure, however response rates were low (18% to 31%) and these data were not used in the assessment of dose.

Mayer et al. [31] assessed work sheets as part of a sun safety program run through recreation centres and obtained higher response rates to this home activity measure (43% to 57%) than the current study. This may have been due to the presence of a more regular and formalised point of return at swimming lessons conducted during the six week intervention period.

The use of multiple sources of information to provide comprehensive assessment of program activities has been recommended [180]. In a multi-component intervention it is often difficult to accurately capture information on the dose and fidelity of implementation of all program components using just one measure. Multiple implementation measures were used in this study as each had limitations in assessing implementation of all aspects of the curriculum. The student work sample score provided the most objective measure, as it was independent of teacher report of completion and elicited the highest response rate of the implementation measures. However, it was not possible to use the work samples as a gold standard measure to assess criterion validity [226] as has been done previously [152] since these samples did not cover all possible activities or activity components. Student work sample assessment only provided an objective measure for pen-and-paper-based activities (approximately 40% to 58% of the full school- and home-based program each year). The impact of this is particularly evident in the Year 1 curriculum, where only Themes 1, 5 and 6 contained core activities for which there was work sample evidence. However, teachers were more likely to complete the earlier themes for which there was limited evidence. Therefore using the work sample measures alone to estimate the dose score for Year 1 would underestimate implementation in that year.

Work sample data in Year 1 may also have been biased due to missing data as five teachers returned incomplete work samples. As these data were collected at the end of the school year some teachers had already sent Kidskin work home with students. This was addressed in the following years of the program by providing teachers with a class set of scrapbooks in which students could separately store their Kidskin work.

Another limitation to the work sample data may have arisen due to the assessment of only a sample of student work books from each class. Several teachers complained that the children chosen via random selection were weak students, and thus may not give an adequate indication of the work of the class as a whole or of the standard of teaching. A solution to this may have been to collect Kidskin work from all class members.

The teacher program checklist assessed all intervention activities, however was prone to bias due to teacher self-report. Response rates were only slightly lower than for student work samples however, some teachers returned incomplete checklists. The Kidskin program was conducted during the last quarter of the year and teachers were asked to return their program checklists at the midpoint and end of the program to minimise the effects of recall bias and to maximise the response rate.

Qualitative data from these checklists supported the likelihood that teachers were responding truthfully in terms of activities completed. Teachers were advised at the in-service training that their comments on these forms would be used to improve the intervention and that positive and negative comments about activities, including why they were not taught, were of value. It was assumed that if teachers believed they would not be penalised they may be more likely to complete the checklist truthfully. For example, a number of teachers indicated that they had not completed activities due to a lack of time, particularly as program implementation was requested in the busy final quarter of the school year. However, there is also some evidence, as discussed in the next section, that teacher self-report of implementation may have overestimated the amount taught, especially in the first year. This over-reporting may have led to an incorrect estimation, most likely an underestimation, of the dose-response effect in the lower years.

Association between teacher implementation measures

The use of multiple measures for the evaluation of implementation is recommended [38] to assess concurrent validity [221]. However, the validity of measures has not been routinely reported in process evaluation studies [34, 35].

This study assessed percent agreement between teacher self-report and work sample evidence of activities being taught to determine their concurrent validity. The percent agreement between teacher self report and work sample evidence varied for each activity from moderate to high, with the average ranging from a low of 70% agreement in Year 1, to a high of 91% in Year 3. Over-reporting by teachers was highest in Year 1 (25% of activities) and lowest in Year 3 (6% of activities). The fact that Year 1 had the lowest percent agreement and highest level of over-reporting may indicate a greater effect of social desirability bias in this year. However, given that the Year 1 teachers' report of activities taught and percent of total dose delivered is the lowest of the four years (66%), these results are more likely to indicate that work samples were a less useful measure of activity completion in Year 1 where many program activities were not pencil and paper based.

The variability in percent agreement between activities may reflect the fact that the work sample only represented part of the activity and the teacher may have taught the activity in a way that sufficiently met the program objective without completing the written component. For example, if the teacher used group work or discussion in an activity rather than individual written work, work samples may not be present even though the activity was taught. Alternatively, some teachers' responses may have been influenced by social desirability bias to over-report use of the materials. These results highlight the difficulties of developing measures of program implementation with high concurrent validity that are logistically feasible and acceptable to teachers. Suggested approaches to improve the validity of teacher-report include telephone calls, or personal interviews to facilitate more accurate completion checklists, and assurances of no negative consequences if non-completion of activities is reported [34].

Only one of the studies of sun safety education programs that assessed program implementation used multiple dose or fidelity measures. This evaluation of a school-based intervention for Years 8 to 10 students [99] used post-test feedback surveys and

lesson observations, however, the agreement or association between these two measures was not reported. The two other studies that reported associations between teacher self-report and student work samples assessed the correlations between the two measures, rather than percent agreement [146, 152]. Spearman rank correlation coefficients of 0.56 [152] and 0.45 [146] were reported, indicating a moderate degree of association between the teacher report and work sample measures.

Several studies have compared teacher report of implementation to observed implementation with mixed results. A process evaluation study reported by Markham et al. [149] obtained 89% agreement between teacher self-report and observer report for three activities in a school-based sexual health program for teenagers. This is similar to the level of agreement found in Years 3 and 4 in the current study. However, several other studies compared teacher report to other measures and concluded that teacher report may have over-estimated implementation [158, 172] .

The variability between years in the percent of activities teachers reported teaching may also point towards the validity of self report in the current study. The fact that the reported percent of activities taught varied, rather than remaining consistently high, may indicate that teachers were more likely to be responding truthfully about the number of activities they taught.

Therefore, in this study it can be argued that teacher self-report appeared to provide a reasonably valid measure of implementation, particularly in the latter years, possibly in part, due to the steps taken by program staff to facilitate accurate reporting of dose by teachers. However, without observation data to indicate integrity and fidelity to teaching strategies it is difficult to be sure of the level of fidelity in the teaching of the activities.

Weighting of program activities provided a surrogate measure of fidelity of implementation as well as quantity of implementation or dose. The consensual validity [221] of the weightings were determined through agreement by an expert panel by indicating to what extent the activity met the program outcomes. This methodology allowed some subjective judgment and may have introduced some bias. However, using unweighted measures may have also introduced bias. If the unweighted dose score was

used, teachers who completed only extension activities may have scored the same dose score as teachers who completed core activities, without meeting as many program outcomes or incorporating skills-based activities.

Limitations due to data analysis

Findings related to sunscreen use may have been influenced by adjusting for the baseline measure of sunscreen use in the regression analyses. The baseline measure asked about overall sunscreen use and was not body site specific. The post-test measure assessed sunscreen use on the face, arms and back separately [85]. Therefore the baseline measure may not be a true indication of sunscreen use on each body site which may have led to over- or under-adjustment for this variable [42].

Summary of limitations

The results of this study are subject to a number of potential limitations that may have influenced their internal and external validity. The study design was non-randomised, therefore factors likely to influence outcomes were adjusted for in all analyses. Only data from the intervention groups' cohort of the larger Kidskin study were assessed in this process evaluation, therefore the power of this study to detect changes in student outcomes will be reduced below that of the larger study. Attrition was generally low, although there were baseline differences between respondents and non-respondents to two of the outcome measures in terms of number of naevi on the arm, gender and intervention group. Differences between the baseline and outcome measures of sunscreen use may have also introduced bias via the data analysis process.

There were several limitations associated with the measures used to assess program implementation. Testing effects may have influenced level of teacher implementation, and teacher reported implementation may have been subject to social desirability bias. Work sample data provided a measure of the validity of teacher self-report, however, work samples were not available for all activities and provided no evidence of completion of non-pencil and paper activities. The validity of parent- and student-report data on use of the Summer Club intervention is uncertain due to low response rates to Summer Club work sample collection.

While the implementation measures assessed only teacher-delivered curriculum dose, other intervention components, not incorporated into the dose measure, may have also had an effect on outcomes. Additionally, all students within a class each year were assigned the same level of dose, regardless of whether or not they attended all lessons, therefore dose may be overestimated. An accurate measure of home activity dose was also not available due to the lack of student-level data on the implementation of these activities.

The findings of this study should be considered in light of these limitations and caution should be used in generalising these results to other populations.

5.3 DISCUSSION OF THE FINDINGS

5.3.1 RESPONSE RATES

Maintaining high response rates and minimising attrition in a study can help reduce the threats to validity due to selection bias [225]. The student, parent and teacher response rates obtained in this study were generally high and will be discussed below.

During the course of the study, rigorous follow-up procedures were followed to minimise bias due to participant attrition at a school and individual level. All schools remained in the study for the full five years in spite of regular staff changes [70], state-wide teachers' industrial disputes, and a number of other programs competing for teacher and classroom time. This high participation rate may have been due to the time spent with schools during the initial recruitment process and the brief but regular communication between the researchers and school staff.

While 70% of all the students invited to participate in the study provided active consent [80] it is not possible to determine whether these students differed from those who did not give their consent. Response rates for all student outcome measures were high at both baseline and post-test in 1999.

Student outcome data

Parental consent was obtained for 75% (n=960) of intervention group students invited to participate. This compares to a 70% consent rate for the larger Kidskin study (ie. including the control group). These figures are higher than the consent rate reported by the 'Sunny Days Healthy Ways' study (55%, n=2038) for a three-year sun safety curriculum for middle school-aged students [30], possibly reflecting a greater emphasis on sun safety in Australia than the U.S.A., or more willingness to participate in such school-based programs among parents of younger children.

Of the participants of European origin, about 99% completed skin testing and returned a parent questionnaire on sun-related behaviours at baseline. Post-test response rates ranged from over 80% to 91%. Similar, high response rates have been reported in two other large, three-year duration, school-based studies of sun safety education programs [30, 99] and in a similar duration study addressing cardiovascular health [228].

Teacher process data response rates

Teacher participation was high, therefore respondents were likely to have been representative of the sample from which they were drawn. Rigorous follow-up methods, including follow-up letters, faxes and telephone calls, were used to minimise teacher attrition. During the four years of implementation only two classrooms had non-participant teachers, with all others returning implementation information via at least one measure.

Over 95% of teachers each year returned pre-implementation questionnaires and implementation measures each year. Similar results were obtained by Resnicow et al. [152] who collected student work samples from 100% of classes during one year of the three-year Know Your Body study. The lower response rates to the teacher program checklist in Year 4 do not seem to be related to lower implementation rates, but may reflect the fact that by the fourth year of the study few of the participating teachers were involved in the school's original decision to participate in the study and were therefore less willing to complete study processes [229]. However, while response rates to the program checklists in Year 4 were lower, teacher response to the work sample measure remained high in that year. The high rate of return of work samples may be because this

measure required little time and effort from teachers, as work books were collected, assessed and returned to them by Kidskin study staff. Therefore, measures that place the burden of completion and return of data on researchers, rather than teachers [35] may be more likely to be completed, particularly near the end of the school year.

Similar response rates (90 to 95%) were reported for several two-year studies of school-based nutrition programs that used teacher self-report checklists [156, 158] while another study of multi-topic health curricula [169] reported lower response rates for teacher checklists (60% to 78%).

Parent/student process data response rates

Response rates for the assessment of the 'Totally Cool Summer Club' intervention were more variable than for other dose measures. Response rates of between 72% and 83% were attained each year for the Summer Club implementation questionnaire. Rates of Summer Club work sample collection were lower at between 18% and 31%. Children who completed a low dose of the holiday activities may have been less likely to return work samples. Therefore, low work sample return limited our ability to assess the validity of parent and student self-report of activity completion and the data on completion of the Summer Club activities may be subject to social desirability, or recall bias.

These results highlight the difficulty of collecting objective, non-self-report data on dose from home-based interventions, particularly during the long, summer school holiday period (six to seven weeks) when use of the intervention was not formalised as in a school setting. A pilot test of work sample collection, conducted for the formative evaluation of the Kidskin materials, during a two-week school holiday period was more effective (unpublished data). Anecdotal reports indicated it was difficult for families to keep track of all the materials. In some cases students felt the materials were 'too much like school', so either didn't attempt, or lost/threw out materials and didn't return them. Even for those children who used some or all of the materials, once they were completed there was little incentive to store them to return after the holidays. Collecting materials more regularly during the holidays may have limited their effectiveness as reminders and boosters for sun safety messages as they would no longer have remained in the home environment as cues to action. Response rates were less likely to be

bolstered by reminders from students' teachers, as most had a new teacher each year after the holidays who had not been involved in Kidskin the previous year. As the Summer Club materials collection occurred at the beginning of Term 1, prior to recruitment of the student cohort's new teachers into the program each year, the motivation for these teachers to follow up work completed outside of the school setting tended to be somewhat limited.

As described previously, Mayer et al. [31] achieved somewhat higher response rates for the return of home activity samples when activity sheets were distributed and returned through children's swimming classes. Forty-three percent of children returned two of four children's activity sheets and 57% of children returned two of four family activity sheets. The structure provided by the swimming classes and the shorter time period for collection (one-and-a–half to four weeks) may have increased the likelihood that work samples were returned.

5.3.2 INTERVENTION REACH

While one of the objectives of this study was to assess the dose of the intervention delivered to students by teachers, it was necessary to ensure the intervention components were made available to all teachers and families equally to minimise bias in implementation. A number of steps were taken to maximise the reach and delivery of intervention components.

In each year of the study, prior to the commencement of program implementation, all teachers of the relevant year group at intervention schools were invited to attend a three-hour training to support their implementation of the Kidskin materials. Paid teacher relief funding was provided by the Kidskin project for all attendees. Schools and teachers were given the opportunity to decide who would be implementing the program, which appeared to increase the attendance rates and helped to ensure the majority of classes (over 87% each year) were taught by a trained teacher. The teacher training was delivered by the same staff member each time to ensure equivalence for all teachers who attended. Additional, relief funded trainings were conducted at schools for teachers who were unable to attend, by the same staff member who ran the larger training. While four of these six extra sessions were fairly equivalent to the larger training, two sessions were

highly modified and brief. Further, due to illness or prior commitments preventing attendance at the group training, and in several cases unwillingness of teachers to schedule an individual training session, 9% of teachers over the four years received no training. The effect of minimal or no training on implementation of the program was not assessed as part of this study due the small number of teachers who were untrained, however this may have biased the degree of implementation by these teachers [151, 175, 230].

A personal set of intervention materials were distributed to each teacher at the training, taken to absent teachers by colleagues at their school who had attended, or delivered directly to the teacher at school by Kidskin project staff. These steps ensured all implementing teachers had their own copy of all intervention materials required to implement the program. It can therefore be assumed that all teachers had similar access to the intervention materials and training so teacher implementation rates are unlikely to have been affected by differential program reach.

To maximise the reach of the summer holiday 'booster' intervention, the first edition of the 'Totally Cool Summer Club' was distributed to students at school just prior to the end of the school year. Included with the materials was a form which parents could return indicating a change of address or a holiday address if they were likely to be away for a significant proportion of the holidays. As the subsequent editions of the Summer Club were mailed to students' home addresses, this maximised the proportion of families (at least 90% in each year this was assessed) who indicated their child received the materials and reduced the likelihood that differences in dose of the intervention were due to differential program delivery.

5.3.3 STUDENT SAMPLE CHARACTERISTICS

The student sample included in this thesis included those students from the intervention groups only. Students in the study sample were already moderately sun protected at baseline, although use of different sun protection measures was variable and some behaviours such as hat wearing, shade and sunscreen use were poorly practised. Fifteen percent of students at baseline wore hats all the time when outside while one-third used shade at least half the time. About 20% used sunscreen on exposed areas of skin and

half of the students covered their back all the time when outside. Almost two-thirds of students used sun protective swimwear. Midday sun exposure was moderate with students spending a median of almost half-an-hour outside between 11am and 2pm daily. Levels of sun protection knowledge, attitudes and behaviour are higher in Australia than elsewhere [231] which may limit the amount of change that could be expected from the intervention.

Students in the sample had a median of three naevi on both the back and chest, four naevi on the face and nine naevi on the arms at baseline. Other studies have also reported that naevi are common in children [44, 232, 233]. A previous survey of naevi in 2,595 primary school-aged children in Perth, Western Australia in 1985 indicated a similar pattern, with naevi being more common on the face, neck and lateral surfaces of the arms than on other body sites [44]. This previous study reported median naevus counts of seven on the back, five naevi on the chest, eight naevi on the face and neck and 14 naevi on the arms. While these naevus counts show similarities to the baseline data from the current study, they are not directly comparable due to the older age range of the children (5 to 7 years) and the different classification of the anatomical areas on which naevi were counted.

5.3.4 TEACHER SAMPLE CHARACTERISTICS

Teachers from 216 of the 220 classes involved over the four years of the study returned teacher pre-implementation questionnaires. Thirty-three teachers taught the program in more than one year and were included in the analyses of differences between teachers in each year only for their first year of teaching. The average teacher in this study was a female, 41 years old, three-year university trained, with 16.5 years of teaching experience and who taught full time. This is slightly younger than the current general population of teachers in Western Australia, where most are aged between 45 and 55 years [69].

Teachers differed between years in terms of gender, teaching status, academic qualifications, amount of health training in recent years and the frequency with which they gave their students incidental sun safety messages.

There were more male teachers in 1998 (i.e. Year 4) than in the other three years of the program. This is typical of WA schools in general where the majority of junior primary school (Kindergarten to Year 3) teachers are female [69] and the number of male teachers increases in the middle and upper primary school grades.

The Year 3 teachers in 1997 were more likely to teach on a part time or tandem teaching basis than teachers in other years and there was the highest proportion of full time teachers in 1995 (Year 1). Teaching on a less than full time basis does not seem to have limited the amount of time spent teaching the Kidskin program, with Year 3 teachers reporting they spent more time teaching the program (seven hours twenty minutes) than did teachers in other years.

Teachers in 1995 (Year 1) tended to have fewer years of university education than teachers in other years. As age and years of teaching experience were similar for teachers in different years it is unlikely that this was due to changes in requirements for university teaching course structures over time.

Teachers in 1995 (Year 1 teachers) tended to have less recent health education training than teachers in other years. This may have been due to the presence of other research and competing health programs that involved a training element. At least one other school-based health program intervention trial that included a training component was known to have commenced in several of the Kidskin study schools at about the same time as the Kidskin project [216]. Although this study was conducted with older students it have accounted for some of the differences seen across year groups.

The number of incidental reminders about sun safety that teachers reported giving their students at the start of the year tended to decrease as students got older. This is similar to findings from a study of parents, that found parental encouragement of their child to stay sun protected declines as their child grows older [58]. However, in all Years from 2 to 4 (Year 1 not assessed) teachers commonly gave sun protection messages, with few (n=4) reporting they ‘never’ gave incidental sun safety messages to their students. Most schools involved in Kidskin had ‘No hat, no play in the sun’ policies when the study commenced [70], so this widespread incidental support for sun protection is not surprising.

Further investigation of the effects of teacher characteristics on implementation of the Kidskin intervention is warranted, but was beyond the scope of this thesis.

5.4 DISCUSSION OF THE FINDINGS IN RELATION TO STUDY OBJECTIVE ONE: ASSESSMENT OF IMPLEMENTATION RATES

Objective One of this study was to determine the dose of the Kidskin classroom and home intervention delivered to students. The implications of the results in relation to this objective are discussed below.

5.4.1 TEACHER DOSE OF THE CLASSROOM AND HOME INTERVENTION

According to the weighted combined program checklist and work sample data, teachers delivered about two-thirds of all activities in Year 1, just over three-quarters of all activities in Years 2 and 3 and about 70% of activities in Year 4.

The percent of the program implemented, as reported by teachers in this study, tended to be lower than the percent completion rates attained by self-report in a number of other studies of multi-unit, school-based health promotion interventions [149, 150, 158, 160]. These programs had a similar number of activities and similar time requirements each year to the Kidskin classroom curriculum and results of these programs indicated they had teacher-reported completion rates of between 88% and 94% of activities. Other studies of programs with a similar number and duration of classroom activities attained implementation rates more like the current study [36, 169] with teachers reporting they taught an average of between 68% and 76% of program activities each year. However, it should be noted that these were all one or two year programs. Maintaining teacher implementation and enthusiasm over a longer period, such as in the Kidskin program required commitment from teachers and schools and ongoing support from project staff.

Slightly higher rates of classroom implementation than in the current study were reported in the CATCH study [40], where teachers taught between 80% and 84% of

program activities in each year of the three-year intervention. This program was more intensive than the Kidskin program, including 15 sessions in Grade 3, 24 sessions in Grade 4 and 20 sessions in Grade 5. However, these higher rates of implementation were based on observations of one lesson per year, so may not be comparable to the results obtained from teacher self-report in the current study.

The increased proportion of the Kidskin program completed by Year 2 and 3 teachers was reflected in the greater length of time they spent teaching the program. Teachers reported spending between about five and eight-and-a-half hours per year teaching Kidskin activities. The curriculum was designed to require about four hours each year to teach the core activities and about eight hours of teaching time to complete all program components. While teachers in Years 2 and 3 reported spending approximately eight hours on the program they only completed slightly less than 80% of program components. This indicates that, in spite of formative testing and piloting of the materials, the amount of time required to teach the full program may have been underestimated by the program designers. Post-tests conducted with teachers as part of the larger Kidskin program indicated that while teacher and student satisfaction with the intervention was high, 44% of Year 1 teachers, 54% of Year 2 teachers, 69% of Year 3 teachers and 45% of teachers in Year 4 indicated they felt it required too much teaching time [43]. Therefore, while teachers in Year 2 and 3 were the highest implementers of the program, they were also the least satisfied with the amount of time they spent on the activities. These factors may have implications for the sustainability of implementation rates with further program dissemination.

This concern was illustrated by teacher responses about ongoing use of the Kidskin materials. Approximately one-third of teachers in Years 1, 3 and 4 and 16% of Year 2 teachers indicated they would use the materials again in their existing form. However, between 31% and 53% of teachers each year responded that they would use the materials in a slightly modified form and between 26% and 41% each year indicated they would only teach several activities from the program, while less than 5% of teachers each year said they would not teach the program again [43].

These results indicate that creating interventions that are easily implemented [103] (eg. cross-curricular, all resources provided, training), perhaps prioritising activities or types

of activities for teachers in terms of which are the most 'active ingredients,' is important for positive outcomes [185]. The importance of extensive consultation with teachers in the development of such programs is also highlighted [146].

As seen in previous research [156, 234], the proportion of activities taught by teachers tended to decrease over the course of the Kidskin study, particularly from Theme 3 onwards. However, the decrease in percent of the total weighted dose per theme taught was not so marked. This indicates that while the number of activities teachers taught decreased, they tended to cut the more lightly weighted extension activities first rather than the core activities. This differs from findings in other studies [150, 158] that teachers were less likely to complete the more complex or skills-based activities. This result may reflect the fact that each year at the Kidskin training, teachers were asked to make teaching the core and home activities a higher priority than the extension activities. Orienting teachers to the most important components in the program and ensuring they are trained to teach those components should be a focus of initial teacher training to enhance program implementation [211] and effectiveness.

In intensive programs such as these it may be unsurprising that implementation is not maximal or decreases over time, particularly given the quantity of learning outcomes teachers are expected to achieve. However, this highlights the issue faced by program developers of ensuring the program includes sufficient dose to achieve outcomes while not becoming a burden for teachers with too many activities to teach, which may lead to a decrease in implementation [146]. Rogers Diffusion Theory [103] indicates that the degree of adoption of an innovation is enhanced when the users perceive the innovation as simple rather than complex, when it is compatible with current or existing resources and practices and when it is able to be easily modified. Ongoing formative evaluations with teachers who have used the materials may be useful to identify modifications that could be made to activities to make them more streamlined while still meeting program outcomes [185]. The challenge is to strike a balance between flexibility of a program for classroom use and maintaining sufficient program dose and fidelity [178].

The generally high levels of program implementation by teachers over the four years of the study are reflected in the positively skewed student cumulative dose scores. Students categorised to the 'low dose' group received up to two thirds of the total

cumulative dose. Students in the 'medium dose' group received between two thirds and three quarters of the total possible cumulative dose of all activities and the 'high dose' group received between three quarters and 100% of the total possible cumulative dose each year. Therefore, the limited variability across the dose levels may have limited our ability to detect differential effects of dose, particularly as the teacher sample size was not large.

Home activities

As discussed previously, in the limitations section, data on individual student completion of home activities during term time were not included in this thesis, therefore it was not possible to assign a student level of dose for these home activities. While student level data on home activity dose was not available, teachers reported using between 87% and 92% of home activities each year. Therefore exposure of children to the activities was likely to be high, even if they did not complete them.

A recommendation for further study is the assessment of the effect of home activity dose on student outcomes. This would allow the evaluation of the added or synergistic effect of dose of family involvement over classroom dose.

5.4.2 COMPLETION OF SUMMER CLUB ACTIVITIES

Over 92% of respondents in Years 1, 3 and 4 reported they remembered receiving any of the three or four issues of the Summer Club intervention. About half remembered receiving all four issues in Year 1 and all three issues in Year 3, while approximately one-third remembered receiving all three issues in Year 4. In Years 1 and 4, most children (over 96%) who received the Summer Club used at least some of it. The Year 3 Summer Club intervention was less widely used with only 71% of recipients reporting they used the materials. This corresponds with the fact that children were less interested in receiving the materials in Year 3 than in other years. Anecdotal evidence collected for the formative evaluation of the Summer Club indicated a number of children felt that by Year 3 the materials were 'too much like school work' and they were unwilling to complete the activities. This finding guided the development of the Year 4 Summer Club, which included fewer activities for children to complete, but increased the number

of incentives/cues which included a drink bottle with sun safety messages, stickers and fridge magnets.

As part of their 'SunSafe' and 'Pool Cool' program, Glanz et al. [32, 39] also used sun safety-related incentives for children to take home, rather than activities to be completed. While a small degree of over reporting of receipt of incentives was noted [33] no actual report on the percent who received these incentives was provided. Instead, lessons and activities completed were combined to create a composite score. Two thirds of respondent parents indicated they received sun protection information and over half indicated their swimming teachers taught sun safety during swimming classes [33]. This is lower than the number of families reporting they received the home materials in the Kidskin study, however, this may be influenced by the use of a cross sectional rather than a longitudinal cohort.

High rates of receipt and implementation of a home-based component of a sun safety intervention were reported over a similar period of time (6 weeks) by Mayer et al. [31] in their evaluation of 'Sunwise', a sun safety program for children 6 to 9 years, delivered through swimming pools. This program also used more formalised delivery of information than the Kidskin Summer Club, incorporating brief lessons given at recreation centre activities and swimming lessons, as well as take-home activities for children and their families. Ninety-nine percent of parents reported receiving the take-home kit and 92% reported reading at least half of the parent materials. Almost three quarters of parents reported that their family undertook at least two of the four family activities, while 90% indicated their child completed at least two of the four child activities. While most families completed at least half of the home-based program, this dose, combined with the swimming instructor-led activities, led to improvements in hat wearing, but had no effect on other sun protection measures or on level of tanning.

The percent of participants reporting they used at least some of the Kidskin Summer Club program compares favourably with the findings about home activity use in programs addressing other health topics. A number of studies reported over 70% of families completed at least some of the home activities in their program [10, 156, 164, 235, 236], while others reported lower participation rates of between 33% to 70% [12, 150, 237]. As in the current study, the reliance on self-report of home activity completion is a

methodological limitation with most of these studies. Over reporting, where participants indicated they received more, or different, home components than had been sent home, has been reported at between 6% [33] and 20% [158] in other studies. Therefore, the results of the current assessment of the Kidskin Summer Club materials should be interpreted with some caution.

In several studies the older age of children may have been related to lower participation by parents [158, 237]. Family involvement in use of the Summer Club materials did not seem to decrease as this study progressed each year, with about two-thirds to three-quarters of children who used the Summer Club activities reportedly receiving support to do so from other family members. Increasing awareness and reinforcement of sun safety behaviours through the child's support network may assist in the establishment of positive norms and reinforcement of sun protective messages [107].

Given the already high levels of implementation of the school- and home-based intervention, an expansion of the Summer Club component may be a useful way of increasing program dose without placing extra burden on teachers. However, the between groups evaluation of the larger Kidskin study indicated the 'high' intervention, including the Summer Club, offered only a moderate increase in effectiveness over the 'moderate' intervention and therefore the additional expense associated with this expanded intervention may not be warranted [42]. However, this limited effect may also have been due to insufficient dose being provided in the high level intervention, or to theory failure. Perhaps using vacation swimming classes, such as trialed by Glanz et al. [32, 33, 39] may reinforce sun safety messages delivered through home-based programs such as the Summer Club. Such lessons are widely attended by Australian school-aged children during the summer holiday period. The dose of intervention which could be delivered through such a system is likely to be small, as parents paying for swimming lessons are likely to accept only minimal time being spent on sun safety activities [31]. However, the provision of such booster messages, accompanied by modeling by instructors and social reinforcement by peers and families may represent 'teachable moments' for children and their families [107].

5.4.3 SUMMARY OF ASSESSMENT OF IMPLEMENTATION RATES

Between two-thirds and three quarters of the classroom and home intervention was taught by teachers each year. This level of implementation is comparable to those of previous studies. While most teachers spent approximately the recommended amount of time on the program they did not meet all outcomes. This, coupled with some dissatisfaction with the amount of teaching time the program required and the reports teachers would modify their teaching of the program has implications for future program modification for sustainability and impact.

The cumulative program dose for the student cohort over the four years of implementation tended to be high, reflecting sustained high levels of teacher implementation. Teacher delivery of the home activities during term time was also high, however, information on family implementation of and satisfaction with these activities was not available to permit the calculation of the home activity dose received by the student cohort. Implementation of the summer holiday activities was difficult to assess fully, however, rates of implementation seem comparable to those found in other studies. Finding ways to expand family involvement in children's use of these holiday materials, for example, by linking them to other summer, community-based initiatives may increase the Kidskin program's effectiveness and warrants additional research, as increasing teacher implementation further may be difficult.

5.5 DISCUSSION OF THE FINDINGS IN RELATION TO STUDY OBJECTIVE TWO: ASSOCIATION BETWEEN LEVEL OF DOSE AND STUDENT OUTCOMES

Dose-response analyses were conducted to determine the effect of cumulative program dose on student outcomes. These analyses addressed Objective Two of this study, namely to determine the association between the level of dose of the Kidskin classroom and home intervention and student sun-related behavioural and biomedical outcomes. The implications of the study results with regard to this objective and to the study hypotheses addressing sun-related behaviours, tanning and naevi development are discussed below.

5.5.1 EFFECT OF LEVEL OF DOSE ON STUDENT BEHAVIOURAL OUTCOMES

Research Hypotheses One to Four (see Chapter 1, page 5) were related to the effect of levels of cumulative dose each year on students' sun-related behaviours. Significant associations were found with regard to level of cumulative dose received in the first three years of the program, but not for the fourth year. Level of dose in Year 1 was related to back coverage outcomes. The level of cumulative Year 1 and 2 program dose had an impact on shade use and sunscreen use on the arms, while level of cumulative dose in Years 1 to 3 influenced sunscreen use on the face and arms. The level of cumulative four-year dose was not related to any of the behavioural outcomes.

Effect of level of dose on covering the back at all times when outside

Significant effects of dose on back coverage were related to the program dose in Year 1 of the study only. Students in the high dose category in Year 1 were more likely to have their back covered all the time when outside at post-test in 1999 than those in the low dose and medium dose categories. Therefore, to show an effect on children's back coverage with clothing when outside, teachers needed to provide over three-quarters of the total possible Year 1 dose, while the dose in other years appeared to have no impact on this behaviour at post-test. This finding may highlight the importance of early intervention to influence children's behaviours.

The larger Kidskin study found that students in both intervention groups were significantly more likely to cover their back in 1999 than the control group students, although the numbers of students covering their back in all study groups tended to be lower in 1999 than in 1995 [(85)]. However, receiving a high intervention dose early on in the program seemed to reduce the degree of 'backsliding' in back coverage.

Effect of level of dose on type of swimwear worn

No significant relationship was found between cumulative dose level and whether or not students wore sun protective swimwear that covered their back and arms. Therefore, teacher dose of the classroom intervention does not seem to have been the 'active component' of the intervention influencing the increased use of sun-protective swimwear reported in the intervention groups, and particularly the high intervention

group, in the larger Kidskin study [85]. It is likely that the provision of cost price swimwear each year as part of the high intervention was more important in eliciting this change, and the normative effect of seeing other children wearing the swimwear would likely have also been more influential than classroom dose.

Effect of level of dose on hat wearing when outside

Similarly, there was no significant relationship seen between level of cumulative program dose and students' likelihood of wearing a hat all the time when outside. Overall, the Kidskin intervention appeared to have had little effect on hat wearing, as the larger Kidskin study also found little difference between groups with regard to hat wearing at all post-tests [85].

The dose delivered by teachers with regard to hat wearing may have been high, even for those teachers who were not high implementers of the classroom activities. In Year 2, 80% of teachers reported giving students incidental reminders about sun protection 'everyday' or 'most days', with 72% reporting doing so in Year 3 and 59% in Year 4. While data on the type of incidental messages given was not reported as part of this thesis, it is likely that messages about hats would have been given since 91% of moderate intervention schools and 75% of high intervention schools in the Kidskin study had implemented 'No hat, no play in the sun' policies at baseline [70]. Interestingly, this expectation of hat wearing at school does not seem to have translated to 'out of school' hours, as only about 20% of parents reported their child wore a hat all the time over the summer holidays at post-test in 1999 [85]. So despite the likelihood of high levels of dose, behaviour out of school does not seem to have been affected. In part this may have been due to the categorization of hat wearing into a binary variable that assessed hat wearing 'all the time' versus 'less than all the time'. While there may have been a shift in hat wearing behaviours from 'sometimes' to 'most of the time' in the study groups, this change would be unable to be detected using this variable.

Effect of level of dose on shade use when outside

Students who received a high cumulative dose over Years 1 and 2 of the study were more likely to stay in the shade at least half the time when outside than students in the low or medium cumulative dose groups. These results suggest the Year 1 dose alone was not sufficient to affect shade use behaviours and may highlight the importance of

longer term interventions. Further, only the high dose group showed an association with shade use. These results suggest that students needed to have high implementing teachers in both Year 1 and 2 for there to be an effect on their shade-use behaviours.

In the larger Kidskin study no significant difference in shade use between study groups was seen at any of the post-tests, although there was a weak non-significant trend from highest prevalence of shade use more than half the time in the high intervention group to lowest in the control group [85]. Therefore, while dose seems to have influenced this behaviour, the degree of change does not seem to have been sufficient to lead to significant between group differences.

Effect of level of dose on sunscreen use when outside

The effect of level of cumulative program dose on sunscreen use differed for different body parts. Students whose teachers delivered a high cumulative dose of the intervention in Years 1, 2 and 3 were more likely to use sunscreen on their face all the time when outside than students whose teachers delivered a low cumulative dose in Years 1 to 3. There was also a weak, effect of receiving a high cumulative dose for Years 1 to 3 over a medium cumulative dose on wearing sunscreen on the face all the time when outside. Level of dose in Year 1, Years 1 and 2 and Years 1 to 4 had no effect on the frequency of use of sunscreen on the face.

Students who received a high cumulative dose in Years 1 and 2 and Years 1, 2 and 3 were more likely to wear sunscreen on the arms all the time than those in the low dose group. As for sunscreen use on the face, dose in Year 1 alone did not seem to influence sunscreen use on the arms and the addition of the Year 4 dose also did not seem to add any additional protective effect. Similar to findings for use of sunscreen on other parts of the body the larger study found no difference between study groups at post-test in 1999, indicating general backsliding in sun protective behaviours which may not have been influenced by the level of program dose delivered.

The findings of little effect of dose level in Year 1 on sunscreen use may have arisen due to parents rather than children taking responsibility for applying their child's sunscreen when they were younger. By Year 2 or 3 the higher dose may have had an effect as students began to take responsibility from their parents for their own sun screen

use. Such declines in parents' active involvement in the sun protection of their children as they get older is reported elsewhere [238-240]. In an Australian study of sun protection in children aged 5 to 13 years, Dixon et al. [58] found that the frequency with which parents encourage their child to use sun protection declined as the child's age increased. These findings, reinforce those of the current study that indicate the middle primary school years seem to be an important period for additional support and intervention for sun protection [58].

The level of program dose had no effect on the prevalence of sunscreen use on the back among children who did not have their back covered by clothing all the time. Unlike the application of sunscreen on the face and arms which are behaviours children could complete themselves, applying sunscreen to the back is likely to be dependent on adult assistance. It may therefore have been less likely to be directly affected by the child's dose of the intervention, although problem solving and asking for help with sun protection were addressed in most years of the program. Overall the intervention appeared to have little effect on sunscreen use on the back, especially as the larger Kidskin study found no difference between control and intervention groups for prevalence of sunscreen use on the back at post-test in 1999 [85].

It is interesting that level of program dose was related to some sunscreen use and not other sun safety behaviours, such as time spent outside. The Kidskin program recommended sunscreen as an adjunct to other sun protection measures, rather than being relied on by itself as the only sun protection measure used. However, as discussed previously, this may have been a sun protection measure that was easier for children to use themselves, especially on their face and arms, whereas other measures were more reliant on adult input. Perceived behavioural control has been shown to influence middle school-aged children's reported use of sunscreen [193]. This may be supported by the finding that there was no effect of dose on sunscreen use on the back.

Effect of level of dose on time spent outside between 11 and 2 during the holidays.

While the larger Kidskin study found the high intervention group students spent less time outdoors during the middle of the day than control group students at post-test in 1999, this did not appear to be related to the dose of the classroom intervention delivered by teachers. Avoiding outdoor activities, where possible, in the middle of the

day was one of the key messages of the intervention. For example, the final program activities prior to the summer holidays each year addressed planning for morning or afternoon activities to avoid the middle of the day. However, children may have little influence on the timing of holiday activities, so the dose of the intervention they received may have been less important than parental factors. This is consistent with the findings of the larger Kidskin study where children in the high intervention group (who received the intervention with a higher home component) spent less time outside in the middle of the day than students in the control group at post-test in 1999. While the classroom intervention included take-home activities for children to complete with their parents, it may have been the booster messages sent home during the holidays that were more important in reducing midday sun exposure than those sent home prior to the holidays.

Topics taught by teachers and behaviours for which there was a dose-response relationship

An assessment of the percentage of each theme completed by teachers did not show any apparent link between those topics most comprehensively taught by teachers and the behaviours most influenced by dose. For example, teachers were no more likely to complete activities addressing behaviours for which a dose-response was seen (ie. covering the back with clothing, shade or sunscreen use) than activities that addressed behaviours for which no dose-response was seen (ie. hat wearing, or avoiding the midday sun). Instead, it appears level of classroom dose in general may have had more effect on those behaviours over which children had control. However, the lack of change in proportion wearing a hat all the time is difficult to explain in relation to this argument, although, as discussed previously, the categorisation of the hat wearing responses may have influenced this result.

Discussion of the findings for behavioural outcomes

Several studies have assessed the effect of sun safety programs on behavioural outcomes [22, 27, 28, 99], but few have assessed behaviour change based on dose of the program delivered.

The evaluation of the 'Pool Cool' program by Glanz et al. [33, 39] found an effect on reported behaviours for children who received two or more, five-minute lessons from the eight-lesson program conducted at swimming pools. While it is difficult to directly

compare this program to Kidskin, the finding of a dose-response effect from this relatively short program is notable, given the current study only found an effect at the highest levels of implementation of a comprehensive, multi-unit, multi-year intervention. Given the intensity of the Kidskin intervention a greater dose-response relationship may have been expected, particularly in Year 4 as the dose in this year was provided closest to assessment of behavioural outcomes. However, the current study detected a sustained effect of dose, up to three years later, on outcomes. The Pool Cool dose-response evaluation was conducted over an eight-week period, so is assessing only the short-term effects of dose. A limitation of both the Pool Cool and Kidskin studies was the use of parent-report of behaviour which may have been subject to social desirability bias.

The Pool Cool program was conducted in the U.S.A. where population-wide sun safety campaigns have been less prevalent than in Australia [95]. There may have been a greater level of general awareness of sun protection factors in the Australian population at baseline, therefore a greater dose of a more intense program may have been needed to produce any behavioural changes [95]. As with Kidskin, the Pool Cool Program contained educational, environmental and policy components, but only the effect of the dose of the educational program on outcomes was reported, making it difficult to isolate the effects of different program components.

Similar to the current study, other studies have also found that high levels of program implementation are required to elicit positive changes in behavioural outcomes, and that moderate levels of implementation may not be sufficient. In their assessment of teacher implementation of health education programs for Grades 4 to 7 students, Connell et al. [166] reported 85% greater effects for student self-reported health-related practices in classrooms where the program was fully implemented compared to classrooms with average level implementation.

Pentz et al. also found a moderate level of dose of a drug use prevention program was insufficient to elicit behaviour change [160]. Their study assessed the effect of one year of program exposure (number of sessions multiplied by time per session) on drug (tobacco, alcohol and marijuana) use and found that high program exposure (above median) was associated with significantly reduced reported drug use. Low exposure

students reported less drug use than students in the no exposure group, however this difference was not significant.

Similarly the evaluation of a nutrition program for primary school children found only high levels of program dose had an effect on student behaviours. Dose-response analyses of the 5-a-day Power Plus Program [156] found that Grade 5 students at schools that were lower implementers of taste-testing activities had lower fruit and vegetable intake than students at schools that were higher implementers of these activities.

However, other studies have found no significant effect of school-based health promotion program dose on student behaviours. Resnicow et al. [152] found the teacher-delivered dose of the Know Your Body comprehensive health promotion program had no significant effect on dietary behaviours, however there was a non-significant trend for a number of behaviours indicating a positive linear trend with increasing dose. A dose-response analysis of the Gimme-5 nutrition program [34] found no effect of self-reported dose (or any other dose measure) on asking behaviours or fruit and vegetable intake. However, these studies did find an effect of dose on physiological outcomes [152] and knowledge [34].

In summary, the current study indicated the level of cumulative program dose of the Kidskin intervention delivered by teachers had variable effects across the behaviours assessed. The greatest effects on student behaviour were seen with high levels of program dose. The behaviours for which dose effects were seen did not appear to be addressed more frequently in the classroom content delivered by teachers, but they tended to be behaviours over which the child may have had most control. Level of teacher-delivered program dose had no influence on the type of swimwear worn, or time spent outside between 11am and 2pm. Therefore the between study groups differences found for these behaviours in the larger Kidskin study [85] were likely due to the other socio-ecological intervention components of the intervention.

5.5.2 EFFECT OF LEVEL OF DOSE ON STUDENTS' SUNTANNING

Research Hypotheses Five to Eight (see Chapter 1, page 6) were related to the effect of levels of cumulative program dose each year on students' level of tanning as measured by melanin density estimation at post-test at the end of summer in 1999. Level of cumulative program dose in Years 1 and 2 and Years 1, 2 and 3 was associated with level of tanning on the forearm. Level of dose in Year 1 and cumulative level of dose over the whole four years of the program was not related to tanning outcomes.

Effect of level of program dose on tanning on the back

There was no significant association between level of cumulative program dose in any year and melanin density on the back. This result is interesting given a high level of program dose in Year 1 was associated with reported more regular back coverage at post-test. This may indicate that students were covering their backs with clothing outside of the peak UV period of the day when there was less effect on tanning levels. The larger study results showed no significant differences between groups in terms of tanning on the back at post-test in 1999 [85] and this outcome does not seem to have been influenced by level of program dose.

Effect of level of program dose on tanning on the arms

Students who received a high level of cumulative program dose in Years 1 and 2 and in Years 1, 2 and 3 tended to be less tanned on the arm than those who received a low cumulative program dose in those years. These results show a similar pattern to the results for dose and sunscreen use on the arms and may reflect the importance of maintaining dose over these early years. These findings imply that Year 1 dose alone was not sufficient to influence outcomes and that a repeated dose was required.

Discussion of findings for tanning

The effects of tanning may have been more pronounced if the effects of dose in the first two years on 1997 tanning outcomes had been assessed. The larger Kidskin study reported intervention group students were significantly less tanned on the back and forearm than control group students after two years of the intervention, however these between groups differences were no longer significant at post-test in 1999 after four years of intervention [85]. Dose-response analyses conducted for the level of cumulative dose to Year 2 and student outcomes reported in 1997, may show a larger effect of dose level on degree of tanning, however, this was not assessed in this study.

Few other studies have measured the effect of a sun protection intervention on sun tanning. An evaluation of the Sunny Days Healthy Ways program for students in Grades 4 to 6 reported reduced levels of tanning in children who received the five-week curriculum [28]. In contrast, the Sunwise program, run through recreation centres, involving four, five-minute lessons at swimming classes [31] was found to have had no effect on children's level of suntan. One other intervention study assessed children's sun tanning, however this measure was used to assess the validity of students reported sun-related behaviours only [30]. No other studies were found that reported the effect of level of program dose on sun tanning outcomes.

5.5.3 THE EFFECT OF LEVEL OF PROGRAM DOSE ON NAEVI

Reducing the development of naevi on the back by reducing sun exposure in intervention group children was the primary objective of the larger Kidskin study [80]. The current study assessed the effect of level of program dose on naevi on the back, chest (boys only), face and arms. The number of melanocytic naevi on the skin has a strong positive relationship to increased risk for malignant melanoma [5]. Naevi are strongly related to an individual's past sun exposure [44, 87, 88] and tend to be more common on body sites exposed to the sun, in particular on the lateral surfaces of the upper limbs, the back, neck and face [44].

Research Hypotheses Nine to Twelve (see Chapter 1, page 6) addressed the effects of cumulative program dose each year on the number of naevi students had developed when assessed at post-test in 1999. Significant associations were found with regard to level of cumulative program dose in each year of the program, although not for all body sites on which naevi were assessed. Dose-response analyses indicated there was no association in any year between the level of cumulative program dose and naevi on the back at post-test in 1999. The level of cumulative program dose over the full four years of the program was associated with the number of naevi that developed on boys' chests, while Year 1 was the only year in which the level of program dose was associated with naevi on the face at post-test. The levels of cumulative program dose delivered by teachers in Years 1 and 2 and in Years 1, 2 and 3 were associated with the development

of naevi on the arms at post-test, however, levels of program dose in the other years were not associated with this outcome.

Effect of level of program dose on naevi on the back

The null findings for naevi on the back are not unexpected given the null findings for level of dose on tanning on back and reported sunscreen use on back. There was, however, a positive effect of level of program dose in Year 1 on reported back coverage which may have been expected to have some impact on naevi on the back. The larger Kidskin study found a similar pattern, with back covering behaviour not necessarily leading to significant reductions in naevi on the back [85]. It has been suggested [81, 91], based on this and other similar findings [232, 241], that the number of naevi in children may not be a sensitive indicator of the relatively small changes in level of sun exposure that occur between individuals within a population in a particular geographic location.

Effect of level of program dose on naevi on the chests of boys

Boys who received a medium cumulative program dose over the four years developed 11% fewer naevi than those who received a low cumulative dose. Surprisingly, the medium intervention dose appears to have a more positive influence than the high intervention dose for this outcome. Further, this was the only outcome for which the dose in Year 4 had an influence. This may indicate that boys responded differently to the level of dose of the program than did girls, although in the absence of data on the number of naevi on the chests of girls this is not able to be assessed.

Mixed findings on the effect of gender were obtained in the larger Kidskin study. While no differences were found between boys and girls in terms of sun protective behaviours such as covering the trunk [42], results from the larger Kidskin study's post-test conducted in 2001 indicated that boys in the high intervention group had fewer naevi on the trunk compared to the control group. This between groups' effect was not found for girls at post-test in 2001 [81].

A number of studies of naevi in children have reported gender differences [44, 232, 242] which may be related to the pattern and amount of sun exposure [44]. Studies of sun-related attitudes and behaviours have also found differences between primary school-aged boys and girls in terms of attitudes to tanning and sun protection, preferred

clothing, swimwear and hat styles, degree of use of sun protection and perceived barriers to sun protection [58, 182]. These gender differences may lead to differential responses to the dose and content of sun safety programs. The effect of the level of Kidskin program dose on outcomes in boys and girls may warrant further research.

Effect of level of program dose on naevi on the face

Only the level of program dose in Year 1 had a significant effect on naevi on the face at post-test in 1999. Students who received a medium program dose in Year 1 developed fewer naevi on the face than students who received a low program dose in Year 1. A similar trend was seen for students who received a high program dose in Year 1 compared to a low dose, however the significance of this difference was just over 0.05.

These results may indicate the importance of early intervention in the reduction in naevi. Alternatively, it may be due to the time lag in development of naevi that only the dose of the Year 1 intervention had an effect on naevi in 1999. As naevi take several years to develop after sun exposure [89, 96], the effects of the program dose in Years 3 and 4 may not have had sufficient time to have an effect on prevalence of naevi. However, the Year 4 program dose was not related to any of the more 'immediate' behavioural or tanning measures either, which makes this a less likely explanation for the lack of dose-response relationship for the Year 4 curriculum.

Effect of level of program dose on naevi on the arms

Students whose teachers delivered a high level of cumulative program dose in Years 1 and 2 and Years 1, 2 and 3 had significantly fewer naevi (20%) on the arms than students whose teachers delivered a low cumulative program dose in these years. The Year 1 program dose alone did not appear to be sufficient to influence the development of naevi on the face at post-test. Furthermore, the addition of the Year 4 dose to the previous three years did not appear to provide any added benefit in terms of effect on this outcome.

This finding of an effect for high level of cumulative dose in the middle years of the program is a similar pattern to that seen for sunscreen use on the arms and melanin density on the arms. Taken in combination, these results seem to suggest that students who received a high level of dose of the intervention over two or three years were more

likely to protect their arms from sun exposure than those who received a low level program dose. While the relationship is relatively modest, this pattern of findings suggests a degree of consistent effect of high levels of program dose on sun protection of the arms by students.

The dose-response findings related to naevi on the arms should, however, be interpreted cautiously as students who did not have naevi assessed at post-test were more likely to be those with more naevi on the arms at baseline. This attrition may have led to an incorrect estimation of the effect of program dose on the development of naevi on the arms as it is unclear what effects the Kidskin program may have had on these children.

The larger Kidskin study found children in the intervention groups had about 5% fewer naevi on the back and between 3% and 11% fewer naevi on the chest, face and arms compared to the control group, however, these differences were not statistically significant [91].

Discussion of findings for naevi

Two other studies have assessed the effect of an intervention on the development of naevi in children [89, 90], however, neither reported the effect of dose of the intervention on outcomes.

Several studies of a school-based program have found an effect of dose on physiological outcomes in children. Taggart [167] assessed the effects of four-year implementation of the Know Your Body (KYB) comprehensive school health program on physiological heart disease risk factors in primary school children. Teachers were classified as either 'effective' or 'ineffective' teachers based on a composite score that assessed dose and teaching quality. Students of effective teachers were found to have reduced heart disease risk factors such as cholesterol level and blood pressure, than students of ineffective teachers. In another study of KYB, three-year dose-response effects were examined [152]. Students classified as having high exposure to the program had significantly lower cholesterol and blood pressure values than the control group (no dose group) and lower cholesterol levels than the moderate and low exposure group students. Few positive physiological program effects were reported in students who received low or moderate exposure to the program.

Contrary to these results, however, in the current study a moderate or high dose of the Kidskin program in certain years, not over the full program, had an impact on physiological outcomes. The findings regarding the effect of level of program dose on the development of naevi on the arms tended to be the most consistent. The significant findings relating to naevi on the chest and face appeared to be more random and the practical importance of these results is more difficult to determine. However, these results should be considered bearing in mind that they were based on data from the larger Kidskin study's intervention groups only. The reduced sample size would have decreased this study's statistical power to detect changes in naevi due to level of dose below the 90% power estimated for the larger Kidskin study.

5.6 IMPLICATIONS OF FINDINGS

A high level of cumulative dose over the first three years of the program appeared to have the most consistent effect, particularly for outcomes related to protecting the arms. However, only moderate improvements in behavioural and tanning outcomes, and weak improvements in naevi outcomes, at post-test in 1999 were reported in the larger study [81, 85, 91]. There may be several implications of these findings. Firstly, the further dissemination of this program, particularly during Years 1 to 3 when the level of intervention dose appears to have most effect, should be supported. Secondly, the limited improvements in outcomes may have, in part, been due to an insufficient proportion of students being taught a high level of dose of the intervention. While further research may be required to clearly determine the nature of the relationship between dose and naevi, these findings support the need to ensure a dissemination structure for the Kidskin intervention that enhances and maintains high levels of teacher implementation. Thirdly, while the intervention dose delivered by teachers was relatively high and was related to student outcomes, it may have been insufficient to maintain long term changes in outcomes. This supports the need to reinforce the socio-ecological aspects of the comprehensive approach used in the Kidskin study to incorporate greater parent and community involvement and increased policy and environmental support for sun protection.

Early, high intensity intervention

Most of the changes in outcomes in this study were associated with having teachers who delivered a high dose of the intervention over the first three years of the program. These years may be particularly important as they coincide with the period when parental support and encouragement of sun protection may start to decrease [58, 238-240]. It has been suggested that many health behaviours, including those related to sun protection, may stabilise at about the age of 9 or 10 [243, 244]. Therefore providing a high dose of the intervention in earlier years may assist in the formulation of positive attitudes and behaviours [244, 245] that can help to counteract the decline in sun protection attitudes and behaviours reported as children enter adolescence [55, 58, 59, 61, 62, 182, 195, 245-248]. Additional formative work may be required to provide information about the best way to modify or enhance the Kidskin program such that it provides better support for students' sun protective behaviours at a time when parental support for these behaviours may be decreasing.

The finding that high levels of intervention dose had most effect on behaviours over which children had some control further supports the need for the intervention to be delivered during this period. However, this also reinforces the need to continue and/or expand the parent and family components of the intervention, to address the factors over which children have less control, that are less influenced by the dose received by the child. The Kidskin Totally Cool Summer Club intervention was designed to involve families by providing cues to action for sun protection during the summer holidays. The assessment of dose of the Summer Club intervention indicated a high proportion of students received and used these materials, and while in most cases other family members assisted them, the degree of involvement of parents, or significant others, in this intervention, and the effect of this involvement on outcomes, was not assessed. Although the parent interventions in the Kidskin program were designed to minimise barriers to parent participation by using mail-out and take home materials, a more intensive [164] or more tailored [121, 122, 249] dose may have been necessary. Additional measures, or different modes of delivery to involve harder to reach parents may be warranted to strengthen this program component, as methods to recruit and engage parents often attract those who are already practising positive behaviours [134, 250, 251]. Given the importance of parents as role models and enablers and reinforcers of sun protection in children [18, 20, 56, 252, 253], additional research into the way the sun safety

interventions are perceived by parents and families may be necessary to maximise their use by parents and the dose they deliver to their child [7, 183].

Maintenance of high levels of teacher implementation

As levels of teacher-reported implementation during this study were relatively high overall, increasing the level of classroom and home dose delivered by teachers is likely to be difficult, particularly in a 'real world' or dissemination trial setting where implementation rates are often lower than under effectiveness study conditions [38, 152, 167, 178]. This is evident in the findings from annual post-test evaluations of teacher satisfaction with the Kidskin program where between 26% and 41% of teachers indicated they would only teach several activities from the program the next time they implemented it [43].

However, this study's finding that most positive program outcomes were related to sustained high levels of teacher dose highlights the importance of maintaining high levels of teacher implementation dose and fidelity during Kidskin's dissemination to maximise program effects.

A number of key factors have been reported to be associated with maintaining levels of program implementation and fidelity by teachers. These factors should be considered during dissemination of the Kidskin program. They include staff training [153, 169, 178, 201, 204-207], administrative [169] and district support for the program and for health [36, 169, 201, 254], availability of financial and staffing resources [178, 255], characteristics of the teachers [202, 256], such as their skill level, and the degree of importance they place on health issues [103], school priorities [178, 201, 255], and features of the intervention [103, 257]. Therefore, to facilitate program implementation with fidelity to program outcomes diffusion of this program should take into account the multiple levels of influence on teachers that serve as enablers, or barriers to implementation [258, 259].

Implementation measures assessed

Other factors associated with the effect of implementation on outcomes, which were not assessed in this study, may have also influenced outcomes and may have been related to

the limited effects seen in the larger study. Teacher fidelity to program activities or goals [34, 36, 40, 104, 167, 260, 261], modification of lessons [35, 262], teachers' classroom management skills [36], or rapport with students [34] have all been shown to be associated with student health outcomes. Teacher factors such as these, that relate to the quality of teaching, may have as much, or more, influence on the effectiveness of the Kidskin program than the teacher-delivered dose. For example, 'better' teachers may have implemented more of the program, but may also have taught the activities in a more effective way. Further investigation of the effects of teacher characteristics and teaching style on program implementation and outcomes may provide valuable information that could be used to guide Kidskin teacher training and support structures to maximise program outcomes.

An attempt was made to incorporate an assessment of fidelity of implementation into the dose evaluation used in the current study by using activity weightings as a proxy measure. However, it is difficult to accurately measure fidelity without observing lessons. Neither the program checklist nor work sample measures allowed us to see whether the interactive components of the lesson were implemented as planned by teachers. Lack of staff time/funding limited the use of lesson observations to one year of the program, and one lesson per teacher only. These data were used formatively to guide the development of successive years' learning activities.

Most process evaluation measures assess only a portion of all program dimensions. Multiple measures provide the best solution, however there is not yet a consensus as to the validity of each measure, or how best to combine multiple measures to illustrate actual dose [35]. The selection of methods of evaluating program implementation should be guided by an assessment of the acceptability of the measure to both the participants providing the data and the agencies who will be utilising the results. This study will add to the growing new knowledge of ways to support researchers making such evaluation decisions by providing information on response rates to, and concurrent validity of, self-report and work sample measures of teacher implementation.

Broaden the scope of the intervention to extend classroom dose

Relatively high levels of teacher dose were reported in this study. Therefore, further increases in program dose may need to be achieved through modification or

strengthening of family and community involvement, and enhancement of environmental, structural and policy components, rather than relying on increased curriculum dose alone. The literature supports this finding that classroom based curricula are necessary components of health promotion intervention, but may not be sufficient to elicit strong effects or maintain those effects over time [30, 99, 263].

This seems to be particularly true in Australia where awareness of personal sun protection is already high, and program components, such as improving policy and environmental support for sun protection may be more important [7, 95]. This high level of awareness and sun protection may also mean that changes due to sun safety interventions may be smaller than in other countries, [7] with programs showing a 'diminishing rate of return' [95] as greater effort is required to elicit smaller changes in behaviour, or to access higher risk groups.

The theoretical literature supports comprehensive approaches to school health [64, 188, 189, 264, 265], such as outlined by the Health Promoting Schools Model [189]. These models, while utilising a predominantly school-based approach, highlight the importance of extending beyond the traditional classroom activities to also encompass the school policies, environments and community partnerships [203].

The larger Kidskin study utilised intervention components to address the school environment and sun-related policies [70] and to promote partnerships with families through its home based components [43]. While these additional components only provided a limited additional improvement in outcomes, [85, 91] increased support for these measures was associated with improved outcomes [70]. Increasing this support for the comprehensive approach may therefore be warranted, however, the added benefits should be weighed against the increased costs associated with such an approach.

While the value of adopting a comprehensive approach to school health has been acknowledged, empirical evidence showing the best way to support schools and to increase their capacity to implement comprehensive health programs with fidelity is still limited [7, 100, 201, 203, 266]. However, a number of key facilitating factors have been identified. These include: providing negotiated planning and coordination; strengthening intersectorial action to create partnerships between schools, families and the wider community; provision of sufficient resources including staff, funding and

materials; political and financial support from school and community decision makers; and ongoing evaluation [201, 203]. As well as further trials to determine the effectiveness of comprehensive school health approaches, ongoing process evaluation to guide the dissemination of effective programs and build schools' capacities to adequately implement such programs is needed [100, 203].

Beyond schools, a number of community based sun-safety initiatives addressing sun protection for children and adults in the community have shown positive results [50, 117, 267-270] and may be the most cost effective method of facilitating change [53]. Improving the linkage of such programs within comprehensive school-based initiatives such as Kidskin may provide a synergistic effect beyond that which schools alone can provide.

5.7 CONCLUSIONS

The dose of the classroom- and home-based intervention implemented by teachers was generally high across all four years of the program although the effect of the level of cumulative program dose on behavioural outcomes was variable. A high cumulative dose of the intervention (ie. greater than 75% of total) over the first three years of the program was significantly associated with sun protective behaviours including more frequent back coverage when outside, shade use and sunscreen use on the face and arms. There was no association between program dose and use of sun protective swimwear, hat wearing, sunscreen use on the back and time spent outside in the middle of the day. A high level of dose in the first three years of the program was, however, associated with reduced tanning and fewer naevi on the forearms. Medium dose levels in Years 1 and over the whole program were associated with fewer naevi on the face and chest respectively. Therefore, the most consistent effect of dose appeared to be on sun protection on the arms resulting from a high level of cumulative dose over the first three years of the program.

These results indicate that a high dose of the classroom and home intervention would need to be taught, particularly in Years 1, 2 and 3 to have an effect on student sun related outcomes. Even then, the influence of dose on student sun-related outcomes tended to be weak. A review of the program content, particularly for the Year 4

intervention, including further formative research with children in each year group is required to identify the appropriate mediators and moderators of sun protection behaviours to intervene on with children of this, and other ages to enhance outcomes.

The high levels of implementation reported in this study suggest that the results from the larger Kidskin study were unaffected by Type III error. However, given these high teacher implementation levels, a larger effect of the program on student sun-related outcomes may have been expected. Increases in classroom dose beyond those reported in this study may prove difficult to achieve during subsequent implementation of the Kidskin program, and are unlikely to adequately address many of the socio-ecological barriers to children's sun protective behaviours. Therefore, as well as supporting teacher implementation, future dissemination efforts should focus on providing increased support for Kidskin's family, community and school environmental and policy components to elicit greater change in student outcomes. To maximise the effects of this approach further research into the most appropriate ways to tailor the programs to build schools' and families' capacities to support sun protection in children would be needed. Further evaluation of the cost-effectiveness of this approach is required [8], including research to determine the differential effects of the individual components of comprehensive sun protection [8] and school health programs [263]. Studies such as described in this thesis contribute to this process through the detailed provision of information on classroom program implementation and its effects on student health outcomes.

5.8 RECOMMENDATIONS

5.8.1 RECOMMENDATIONS FOR THE FURTHER DISSEMINATION OF THE KIDSKIN INTERVENTION

- Implementation of the Kidskin program needs to take place across the school year, in at least the autumn, spring and summer school terms. In the current study, Kidskin was implemented only in the spring and summer school terms due to logistic requirements. A longer implementation period would facilitate the delivery of a high dose of the intervention by teachers while reducing time constraints and teachers' and students' feelings of being overburdened, or tiring of the program. This would also enable the establishment of more entrenched and practiced behaviours for sun safety. Furthermore, in Western Australia, UVR can reach very high or extreme levels over most of the year [271] and the Cancer Council of Western Australia recommends extra precaution being taken with sun protection in Perth, Western Australia from at least September through May [272]. Implementing the program across spring, summer and autumn would reinforce the need for sun protection during all these periods, not merely during the peak of summer.
- The number of learning activities could be reduced by removing the extension activities which met few program outcomes. Additionally, the core program activities could be refined and streamlined, or adapted to be delivered using newer technologies, such as computer-based programs delivered on CD Rom, to enhance student interest and facilitate their implementation.
- The 'high impact' learning activities, such as the core activities that most fully address the program outcomes, should continue to be highlighted for teachers to increase the likelihood that these activities are taught. This may be important in facilitating planning by teachers, as in the current study the proportion of activities implemented tended to decrease over the course of the program.
- The implementation of the classroom and home intervention needs to be maximised, particularly in the first three years of the program, as in these years dose seemed to have the highest association with outcomes. As well as supporting teacher implementation, to maximise effectiveness of the Year 4 program, further formative research is recommended to guide the modification of lesson content and the structuring of increased socio-environmental supports for sun protection, to address the developmental needs of this age group.
- Avenues of support and intersectorial action should be expanded to assist schools in building their capacity to support high level teacher and parent implementation. Such support is also needed to enhance schools' capacities to

adopt, implement and institutionalise the socio-ecological components of the intervention, such as parental and community involvement and ongoing environmental and policy adaptations. Enhancing the use and delivery of these program components, beyond the classroom intervention, appears to be necessary to achieve additional gains in effectiveness for the Kidskin program.

5.8.2 RECOMMENDATIONS FOR FURTHER RESEARCH

- Additional research is needed to explore the mediating and moderating factors influencing sun protective behaviours in primary school-aged children as well as parents' support and practise of these behaviours. A comprehensive exploration of these factors, including additional formative evaluations with children and parents would guide the ongoing adaptation and development of Kidskin and other sun protection interventions to maximise their effectiveness.
- While the current study assessed the effects of program dose on outcomes after fours years of intervention, more frequent examination of dose effects is recommended for future research, particularly for the more seasonal (behaviours) or short-lived (tanning) outcomes. Although costly, a comparison of dose with outcomes each year may provide a more detailed indication of the effect of program dose that could assist in modifying program activities to provide enhanced outcomes.
- A number of teacher-level variables, other than the dose variables assessed in the current study, may have influenced implementation quality and quantity. Further research assessing these factors and their effect on adoption, implementation and maintenance of the Kidskin program, their impact on engaging parents in the program, as well as their affect on student outcomes, is recommended. The results of this research would assist in the identification of factors required to build the capacity of teachers and schools to effectively deliver programs such as Kidskin.
- The use of lesson observations to objectively investigate the dose and fidelity of implementation of the Kidskin program and their effect on outcomes is recommended. Lesson observations would permit an assessment of implementation of both written and interactive program components to facilitate a measure of dose that may be more comprehensive than those used in the

current study. Lesson observations could also be used to facilitate the investigation of factors associated with teaching and learning styles, and classroom organisation and climate which may influence program effectiveness.

- Assessment of the differential effects of the dose of the intervention on boys and girls may be warranted due to differential sun-related attitudes and behaviours between genders. The findings of such an evaluation would guide the tailoring of different program components to address the requirements of both boys and girls at different stages of their development.
- Given the importance of parents in influencing their children's sun protection, further research on the dose of the family components of the intervention received and used by both parents and children would provide valuable information to increase their effectiveness. As well as assessing dose received and implemented by families, further research should address parental attitudes to the intervention, and enablers and barriers to family participation in sun protection interventions with their children. Such information could facilitate the tailoring of family intervention components to more effectively target hard to reach groups, or to provide sun protection messages in a way that engages families more effectively.
- Further research should assess the individual effects of the different socio-ecological components of the Kidskin intervention. While the current Kidskin study included intervention components addressing environmental, community and policy factors, it was difficult to assess the individual effects of each of these components. Structuring a study such that each study group received different, or additional intervention components would allow the effect of each component to be assessed. Process evaluation should be incorporated to determine the degree of adoption, implementation and maintenance of intervention components, as well as participant satisfaction with the components. The results of such a study would inform the development of recommendations on the most effective elements of the interventions. This information could be used to guide future dissemination and funding of sun protection interventions in schools.
- Evaluation of the effectiveness and implementation of the Kidskin program with disadvantaged high need populations is also an area recommended for further research. For example, higher risk groups such as single parent families, lower socio-economic groups, fair skinned children, or individuals living at lower

latitudes may require selective and indicated interventions, in addition to the population-based approach, to maximise positive program outcomes. These may include targeted parental interventions, additional intervention via the school nurse, or general practitioners, or free provision of sunscreen to students at schools.

- Further research is recommended into the assessment and development of schools' capacities to implement comprehensive sun protection interventions such as Kidskin. Building organisational-level capacity should increase the level of implementation and institutionalisation of such programs. Further evaluations may include assessing the effect of facilitating whole-school level leadership and planning for the Program, the development of parent and community links, district level advocacy for environmental change and ongoing teacher training and support for implementation. The degree and type of support schools require for this capacity building process to facilitate implementation should be evaluated.

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Chapter 7. APPENDICES 1-22 excluded for copyright reasons