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**REPORT PREPARED FOR THE NATIONAL INSTITUTE
OF HEALTH & CLINICAL EXCELLENCE**

**SYNTHESIS OF THE
WEST MIDLAND HEALTH TECHNOLOGY
ASSESSMENT COLLABORATION REPORTS:
*PROVIDING PUBLIC HEALTH INFORMATION TO
PREVENT SKIN CANCER: REVIEW OF
EFFECTIVENESS AND COST-EFFECTIVENESS*
(Dated February 2009) and ADDENDUM (Dated May
2009)**

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**(* revised to incorporate before-and-after studies not originally included in
WMHTAC report)**

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EXECUTIVE SUMMARY

This report provides: a) a synthesis of the findings pertaining to the effectiveness of intervention delivery presented in the February 2009 report and Addendum *Providing Public Health Information to Prevent Skin Cancer: Review of effectiveness and cost effectiveness* provided by the West Midlands Health Technology Assessment Collaboration (WMHTAC) to NICE, and b) an analysis of before and after studies identified, but not included, in the original WMHTAC report. Studies are categorised by target population segment then by type of intervention delivery.

The original review was intended to provide evidence to support recommendations regarding the following questions.

- 1. What are the effective and cost effective ways of providing information to change people's knowledge, awareness and behaviour?*
- 2. What content do effective and cost effective primary prevention messages contain? What is the most effective and cost effective content?*

A number of studies suggested evidence of effectiveness on knowledge-related outcomes, however very few demonstrated effectiveness relating to sun protection or skin cancer prevention behaviours. Very few studies provided sufficient detail of the content of the intervention or were not designed in such a way as to enable comparison of different components or content. Consequently, it was not possible to determine what content or component of the intervention was the most effective. There is therefore insufficient evidence available to enable a definitive answer to be provided to either question, although aspects of message framing do show promise and this area is recommended as requiring further investigation.

Of the studies reviewed, only two before-and-after studies used mass consumer media (no RCTs or CBAs used this type of media). One (USA) study showed significant changes in self reported behaviours and the second (Australian) study showed a significant increase in adults presenting with suspicious lesions, methodological and reporting weaknesses suggest that neither study can be recommended as having application beyond the population / setting studied.

The largest number of studies reviewed relate to delivery within educational environments. Eighteen studies involved university students, three used mass media, one new media, nine print-based methods and five mixed methods. Numerous confounding factors were evident and this, coupled with insufficient participant numbers or details, insufficient methodological details and lack of availability of outcome details did not enable any study to be recommended as having application to a broad range of populations and settings. The use of USA-based university students as study participants in return for academic credit raises concerns regarding generalisability. While many of these studies reported significant increases in knowledge or short term, self reported attitudes or behaviours; none investigates actual



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sustained behaviour change. Some strategies, such as variations in message framing, appear to offer promise but would need to be investigated and reported in a much more systematic manner for generalisable conclusions as to effectiveness to be drawn.

Seven studies involved secondary school students, all using mixed methods of delivery and all reporting significant increase in knowledge. Only one included attitude change and showed little impact. One (USA) before-and-after study measured behaviour change but found no significant difference in actual sun protection-related behaviours post intervention .

One study, using mixed media, (website and verbal advice across a wide age range (5 – 15 years) found increases in knowledge only within some participating schools. A number of factors including delivery differences and children’s cognitive limitations at different age groups may have contributed to this. The study must be regarded as applicable only to the population and setting studied.

Twenty-five studies involved primary school students; two used new (electronic) media, ten group-based lessons, one a health fair and twelve used mixed methods. Inadequate reporting in several studies makes identification of lesson structure, resource utilization or use of mixed methods material impossible. While several of these studies reported higher knowledge of sun protection behaviours, there was little evidence of actual behaviour change and inadequate reporting of the actual intervention delivery makes it impossible to determine what effects individual method components or delivery strategies may have had. None of these studies can therefore be recommended as having application to a broad range of populations and settings.

Seventeen studies involved various home (nine studies) or recreational (eight studies) settings, ranging from seminars for sports coaches, displays at sports events, messages at ski fields and telephone counselling supported by print media, with mixed results. Five studies used mixed methods, involving verbal advice supported by either visual or printed material, with only two studies reporting significant improvements in sun protection knowledge and only one providing self-reported sun protection behaviours, but the participants were self selected, white, well educated and well motivated, raising issues regarding generalisability of the findings. Five studies involved different types of home delivered print material and revealed some evidence of improved self reported sun protection behaviours but did not allow identification of the most effective message style or message framing strategy. Two studies focussing on airline passengers found no significant effects post-intervention. Similarly, a brief message intervention in swimming pool settings also found no significant effects. Only short term effects were found via one mixed methods intervention targeting those responsible for supervising children at outdoor venues. None of these studies can therefore be recommended as having application to a broad range of populations and settings.

Four workplace setting interventions provided some evidence of increased sun protection knowledge but little evidence of positive changes relating to actual sun protection behaviours. None of these studies can therefore be recommended as having application to a broad range of populations and settings.



Eight studies in medical practice or hospital settings also showed mixed results, with increased knowledge and self reported skin protection behaviours indicated via the use of a computer-based intervention within a medical practice; print-based delivery of information appears to have limited impact on behaviours. Several studies did not directly measure sun protection-related behaviours. Due to the lack of statistical data and inadequate reporting of methodology, message content and delivery variables, none of these studies can therefore be recommended as having application to a broad range of populations and settings.

There are a number of supplementary and confounding factors that should also be considered in assessing the relative effectiveness of the available interventions. These are reviewed in Section 3 and include what is known from the extant literature

regarding message framing effects, reactance effects when messages appear to threaten personal freedom or conflict with perceived norms. Also reviewed in this section is the strength of normative beliefs regarding the social benefits of acquiring a sun tan which presents a significant barrier to communication effectiveness, as does unrealistic optimism and denial of personal risk from sun exposure. We have also included a brief commentary on evidence regarding children's cognitive development at different ages, particularly in relation to young children's ability to generalise 'learned' material to settings outside the classroom.

Given that two of the reviewed studies were based on the Stages of Change Model, we have also included in Section 3 a review of recent criticism of this model and have provided additional material relating to theoretical foundations for future interventions including a recent development from the Theory of Planned Behaviour which incorporates a much wider range of background influences than other theoretical models.

Further barriers to communication come from conflicting messages from both media editorial and programme content, including holiday / beach activity portrayal, celebrity portrayal which glamorises tanning.

A recent additional confounding factor which has received prominence in the media relates to the Vitamin D debate and we have included a sample of recent headlines and some evidence from Australia of the potential impact of this coverage on sun exposure behaviours.

We have also included a brief analysis of the advertising expenditure of commercial sun care manufacturers, with obvious potential synergies but also potential risks if official sun protection messages are not integrated or conflict with those of the commercial sector. The need for message integration is further highlighted by the growth in simultaneous media use. However we offer caveats regarding message source credibility, the ability of mass media to raise awareness but seldom to achieve actual behaviour change and also the difficulties of community-based interventions. Section 3 concludes with an overview of readability factors, given that most official



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health advice is written at a level well above the ability of a significant percentage of the population to comprehend it.

The report concludes with recommendations for future reviews and research which are contained in Section 4.

SECTION ONE: Terms of Reference / Methodology

This report provides a synthesis of the findings pertaining to the effectiveness of intervention delivery presented in the February 2009 report '*Providing Public Health Information to Prevent Skin Cancer: Review of Effectiveness and Cost Effectiveness*' provided by the West Midlands Health Technology Assessment Collaboration (WMHTAC) to NICE.

As such, it uses the WMHTAC report as the source of data regarding interventions effectiveness. It therefore does not involve a review of the original 73 papers reporting 59 different studies (49 RCTs and 10 CBA) used as data sources in the WMHTAC report unless it was necessary to obtain clarification when different sections of the WMHTAC report provided conflicting conclusions in relation to a single document source. The full references for the various papers cited in the WMHTAC report have not been repeated in full other than in the references. Only the author and date have been used in this report, with the original paper title also included in the summary tables (see Appendix 1) of this synthesis report and a cross reference made to the reference number in the original WMHTAC documents.

Two additional papers (Buller 2006 and Vitols 1997) were originally misclassified as before and after studies and therefore not analysed in the February 2009 WMHTAC report. These 2 papers were subsequently analysed by WMHTAC and presented in May 2009 in a separate report '*Providing Public Health Information to Prevent Skin Cancer: Review of Effectiveness and Cost Effectiveness: Addendum*' and are also covered in this report.

Where studies were reported by WMHTAC under more than one category (for example, Code et al., 1990; Mahler et al., 2007; Mickler, 1999), they are presented and discussed in this report once only in order to minimise confusion.

This report includes twenty three before-and-after studies identified but not analysed in the original WHMTAC reports¹. This revised report therefore provides both the synthesis of the RCT and CBA studies and the analysis of the before-and-after studies.

The two WMHTAC reports (February and May 2009) covering RCT and CBA alongside the 23 B&A studies identified a total of 98 papers reporting 84 studies and for the purposes of the synthesis these have been categorised into the following themes:

- Mass consumer media
- Educational, broken into university, secondary and primary school settings, then broken into further subcategories according to the type of media used.

¹ Please note that the original WHMTAC reports identified 26 before and after (BA) studies. However, 3 of these studies were misclassified as BA studies (2 of these studies were CBA and 1 was a RCT) and had already been analysed and presented in the original WHMTAC reports.



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- Home, broken down into subcategories according to the target and type of media
- Recreational, broken down into subcategories according to the target and type of media
- Workplace
- Medical Practice
- Hospital.

Evidence statements have been generated using the above categorisation of the studies and applicability ratings have been derived using the author's judgement (rather than using/amending WMHTACs evidence statements).

The synthesis (Section Two) of this report also refers to a number of other referenced supplementary papers that are not the subject of the main analysis but which are important to consider when reviewing the evidence. An overview of any reoccurring themes and findings across each of the above categories is also provided in Section Two of the report.

A number of key factors known to impact on public health intervention effectiveness across a range of subject areas including sun protection and skin cancer prevention were not included in the original WMHTAC report as their evidence base did not meet the inclusion criteria specified (randomised controlled trials [RCTs] or longitudinal intervention studies [LIS]). We have therefore included in Section Three a brief summary of major supplementary and compounding factors, drawn from the extant literature and recent publications by the author, which are recognised as warranting consideration in designing and implementing sun protection or skin cancer interventions.

Most of these papers referenced in the supplementary and compounding sections were not included in the qualitative evidence review or included in the WMHTAC effectiveness and cost effectiveness reports; however, a number of the papers referenced in supplementary text section were identified by WMHTAC to be multi-component studies and will therefore be processed in future evidence review. Full references for the studies cited in this supplementary section are provided in the reference list at the end of this document.

A short conclusion section relating to the following primary research questions is also provided at the end of Section Three:

1. What are the effective and cost effective ways of providing information to change people's knowledge, awareness and behaviour?

2. What content do effective and cost effective primary prevention messages contain? What is the most effective and cost effective content?

Finally, this report provides a summary of recommendations for future research in Section Four.

SECTION TWO: Synthesis

MASS CONSUMER MEDIA

Two before-and-after studies used mass media such as television advertising or news coverage to reach the general population:

- Gelb, Boutwell, & Cummings (1994): 3 x cities in Texas, USA (Rated – quality).
- Del Mar, Green, & Battistutta (1997): Queensland, Australia (Rated – quality)

These studies are summarised in Table 1 (Appendix 1). The first study involved brochures, news conferences, interviews, public service announcements and promotional activity at a baseball game and was targeted at adults. This study focussed only on self-reported behaviour change in relation to actions to reduce the risk of skin cancer and reported significant impact on self reported actions among those remembering communications (follow up period not specified). The second study involved delivery of television advertising to the general population (all adults) and focussed measurement of the numbers of suspicious lesions excised over time, not on changes to sun protective behaviours. The study reported a significant increase in excised lesions during the campaign period.

Evidence statement: Mass Consumer Media

ER2.1 Evidence from 1 USA and 1 Australian B&A study suggest that the provision of mass consumer media-based interventions can significantly impact ($p < 0.01$) on sun protection awareness, self reported (but not independently verified) behaviour change (Gelb, Boutwell & Cummings, 1994 B&A, USA [-] and in the number of people presenting with suspicious lesions Del Mar, Green, & Battistutta, 1997 B&A, Australia [-]). Costs associated with the use of television advertising are noted in the latter study. Neither study provides sufficient methodological information to enable them to be judged as applicable beyond the population / setting studied.

Educational Settings

University Students

16 studies (reported in 17 papers) involved university students; 3 studies were mass media interventions, 1 was a new media intervention; 9 covered print-based material and 3 involved mixed methods interventions.

Mass Media (as defined by WMHTAC) Campaigns

Mass media is a term most commonly applied to television, radio and print media (DePelsmacker et al, 2001). None of the interventions reviewed in the WMHTAC report used this type of mass media. However the following three RCT studies which focused on alternative media formats (such as delivery of videos) to university students were identified:

- Cody & Lee (1990): Newcastle, Australia (RCT rated – quality)
- Mahler et al. (2005 and 2007): San Diego, USA (two papers relating to different stages of a study) (RCTs both rated + quality)
- Mickler (1999): USA, exact location unspecified (RCT rated ++ quality).

These are summarised in Table 2.1 (Appendix 1). All are likely to have been impacted by a range of confounding effects such as the effects of wider community-based interventions or from the inclusion in the studies (of some unspecified number) of participants who had a family history of skin cancer.

The use of university students is in itself also problematic, particularly in relation to the USA-based studies as many American universities permit students to obtain academic credits for research participation. This raises concern regarding what participants represent in relation to the wider student population, let alone the broader age cohort overall and also the potential for contamination and response effects from repeated project participation, even if assigned to control groups.

The reported studies focussed on knowledge and / or self reported future behavioural intentions, most immediately after the intervention rather than actual attitude or behavioural changes. The first used a video which discussed causes, consequences and incidence of skin cancer and significantly increased knowledge immediately after the intervention and at 10 week follow-up. The Mahler et al. (2005 and 2007) study used a videotaped slide show focussing on photaging, with or without UV photos of participants' skin and found the video to significantly improve self reported behaviour intentions immediately, one month and a year post the intervention. The Mickler et al. (1999) study used a video to provide information on skin cancer, detection and protection advice and significantly increased knowledge immediately and three weeks post the intervention. The focus of two of the studies on health risk and skin cancer detection may also have impacted on responses, given the use of university students. Future health risks such as skin cancer development is known to not be a strong influencing factor with young adults (Eadie & McAskill, 2007) and measures that appear to demand behaviour that contradicts social norms such as the perceived social



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value of a sun tan has been shown to not only be ineffective but to actually reinforce the continuation of unsafe sun exposure practices (Hunsley, 1997).

There is a larger body of research available (which did not meet the inclusion criteria for the WMHTAC evidence review) that indicates that the use of appearance-based interventions can be effective with this age group and it is recommended that this be reviewed before any interventions targeting this group: see, for example, additional studies by Mahler et al. (2005, 2006, 2008) and the work of Hillhouse (1997, 2000, 2002), Turrisi et al. (1998, 1999 and 2007) and Olsen et al. (2007 and 2008). The latter author's work has already been identified as a multi-component intervention and will be included in future analyses.

Evidence regarding the impact of mass media interventions across all areas of health promotion is sparse and mixed. Generally, these interventions achieve increases in awareness levels but evidence of sustained behaviour change is rarer, particularly in a UK setting (Melia et al, 2000; Smith et al., 2005); Smith et al., 2002). Numerous confounding factors potentially impact both positively and negatively on this type of intervention (see Section Three of this report for brief discussions of the major factors). The most significant factors relate to mass media coverage, both in editorial and programme content and in the impact of promotional activity undertaken by commercial sunscreen manufacturers and retailers.

Any consideration of the applicability of these studies to other populations or settings should be tempered by the comments made in Table 1.1. In particular those with regard to the confounding factors identified, problems noted above with the use of university students as participants and the restriction of the study to knowledge acquisition (possibly seen in a similar context to other 'learned' material studied) rather than attitudinal and behaviour change.

New Media

New media is generally taken to mean electronic / Internet based communication forms including user-generated content 'social media' platforms such as Facebook (Lievens, 2007).

One new media-focussed (Internet-based) RCT study involving university students was identified

- Bernhardt (2001): South East USA (rated + quality).

This is shown in Table 2.2 (appendix 1). This study used an internet platform to present either tailored or generic sun protection webpage information. A concern is that, while significant differences in self reported importance and feeling more attractive with a tan were noted immediately after the intervention; no significant difference in actual self reported sunscreen usage was evident. The approach reported is likely to be applicable only to the population / setting studied.



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Mixed Methods: Lecture plus Supporting Visual Material

Three RCT and two B&A studies were identified as relevant to this category:

- Jackson et al. (2006): Phoenix Arizona (rated ++ quality) RCT
- Katz & Jernigan (1991): USA (precise location not specified) (rated – quality) RCT
- McClendon & Prentice-Dunn (2001): USA (rated ++ quality) RCT
- Gooderham, M. J., & Guenther, L. (1999a): Ontario, Canada (rated + quality) B&A
- Liu, K. E., Barankin, B., Howard, J., & Guenther, L. C. (2001): (Ontario, Canada (rated – quality) B&A.

These studies are summarised in Table 2.3 (Appendix 1). The first two studies involving educational sessions including video testimonial from women diagnosed with skin cancer and lecture supported by slides primarily report significant increases in self reported knowledge of skin cancer risks and preventative measures rather than attitudes or behaviour change immediately after the intervention delivery. The third study reported perceptions regarding vulnerability, threat and self efficacy but reported means and standard deviations rather than providing statistical significance outcomes. The fourth study measured knowledge gains after the incorporation of a melanoma case study into the dermatology curriculum of first year medical students and a subsequent requirement for the students to develop and deliver a lecturer to primary school students on sun awareness (see Gooderham & Guenther, 1999b for analysis of the impact of this intervention on the school children). It reported significant improvement in knowledge ($p < 0.001$), significant reduction in attitudes regarding healthiness of tanned appearance ($p < 0.03$) one week after the intervention. The fifth paper revisited the same medical students one year later and measured knowledge retention and actual behaviours against those indicated as intentions in the 1999 study. This study reported a significant loss in knowledge at the 1 year follow-up period ($p < 0.0001$) and behavioural intentions did not occur.

All of this group of studies are likely to be applicable only to the populations / settings studied.

Printed material

Eight RCT studies and 1 CBA study were identified as relevant to this category:

- Boer et al. (2006): Enschede, Netherlands (RCT rated ++ quality)
- Cho & Salmon (2006): USA (exact location not specified) (RCT rated - quality)
- Jones et al. (1994): USA (exact location not specified) (RCT rated - quality)
- McMath & Prentice-Dunn (2005) Alabama, USA (RCT rated - quality)
- Prentice-Dunn et al. (1997): USA (exact location not specified) (RCT rated - quality)
- Rothman (1993): Yale, USA (RCT rated + quality)
- Stephenson & Witte (1998): South-west USA (RCT rated - quality)
- Castle et al. (1999): South coast of UK (RCT rated + quality)



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- Greene et al. (2003): South-east USA (CBA rated - quality)

These are summarised in Table 2.4 (Appendix 1). Each of these studies examined different aspects of print delivery such as print and / or text, high versus low threat levels, health versus appearance factors. All measured effects immediately after, or very shortly after the intervention, only Cho & Salmon (2006) and Greene et al. (2003) provided follow-up test data (approximately 4 weeks post intervention). This group of studies used combinations of booklets, essays or leaflets to test different forms of message delivery. Findings indicated that different types of message framing did generate significant differences, with positive-framed messages and those that emphasised self-efficacy appearing to be the most effective; however significance data was frequently not reported. All the studies reported are hampered by the use of university students, including those participating in research projects in return for academic credits. This raises the question of how well they reflect the likely effects of these types of interventions for other sectors of the population. Further, there is a lack of sufficient detail to determine the potential influence of confounding factors on the findings. In addition to these factors the studies occurred in an artificial environment of lecture-formats where 'learning' is expected, with tests immediately after interventions rather than testing for actual application / behaviour in a real-world setting. It is unclear as to whether long term effects, rather than the reported short term effects were achieved. The use of an academic learning environment also raises the possibility that the material was treated as knowledge 'learned' as any other subject might be learned by these cohorts, rather than applicable to actual behaviour outside the classroom.

It is likely that these studies are applicable only to the populations and settings studied for the reasons listed above. Two other potentially important factors should be noted. Firstly, wide variations in message framing effects have been found across other studies including the use of fear appeals and the possibility of reactance effects. Secondly, the Stages of Change model (used in the Castle et al. (1999) study) has been criticised. These factors are reviewed in Section Three.

Evidence statements: University Students

Mass Media

ER2.2 There is evidence from 1 Australian and 2 USA-based RCTs to suggest that video-based messages can significantly increase self reported knowledge and self reported behavioural intentions regarding skin cancer prevention and detection and sun protection strategies for university students over a period of up to 3 months. However there is no evidence of actual behaviour change (Cody & Lee, 1990 RCT, Australia [-]; Mahler et al., 2005 and 2007 RCT, USA [+]; Mickler, 1999 RCT, USA [++]) and the first of these studies, the only one to measure effects at a follow up period (10 weeks post intervention) found a significant decrease from post intervention knowledge measures.

Mixed Methods

ER2.3 Evidence from 3 USA-based RCTs and 2 Canadian B&A studies involving educational sessions or lectures supplemented by video testimony, video and essay or slides delivered to university students is mixed. Educational sessions including videotaped testimonial from a woman diagnosed with skin cancer significantly increased knowledge of, perceived susceptibility to skin cancer, severity of photo aging effects and benefits of sun protection immediately post intervention (Jackson et al., 2006 RCT, USA [++]). Lectures delivered to students supported by slides of different types of skin cancer also significantly increased short term self reported knowledge of skin cancer risk and prevention strategies measured immediately post intervention but knowledge declined after two weeks (Katz & Jernigan, 1991 RCT, USA [-]). The impact of a lecture-based format accompanied by video and essays increased perceptions regarding vulnerability, threat and self efficacy but reported means and standard deviations rather than providing statistical significance outcomes. (McClendon & Prentice-Dunn, 2001 RCT, USA [++]). Inclusion of melanoma content into first year medical student curriculum and the requirement for these students to then develop and deliver lesions to primary school children resulted in significant increases in knowledge of sun awareness, attitudes relating to sun tans and self-reported behaviour change, including intention to use higher SPF factor sun screens, at one week post intervention (Gooderham & Guenther, 1999a B&A, Canada [+]) but knowledge declined significantly in a 1-year follow up study with the same students; behavioural intentions signalled in the 1999 study did not occur B&A, Canada (Liu et al., 2001 [-])

New Media

ER2.4 There is evidence from 1 USA-based RCT to suggest that university students (aged 18 plus) presented with 20 plus tailored messages (based on social cognitive theory principles) via an internet webpage are significantly less likely to report how important it is for them to tan or feeling more attractive with a tan immediately after the intervention. However, there was no significant increase in self-reported sunscreen use when engaging in outdoor activities (Berhardt, 2001 RCT, USA [+]).

Printed Material

ER2.5 There is mixed evidence from 8 RCTs, 6 from the USA, one from the Netherlands and one from the UK and 1 USA CBA study utilizing print media with university students, but some promise in message framing effects:

- The use of booklets containing different combinations of picture-based and text-based information did not provide any statistically significant increase in self reported knowledge of skin cancer risk and prevention strategies immediately post intervention (Boer et al. 2006, Netherlands, RCT [++]).
- The use of high versus low threat measures (delivery mechanism unclear) resulted in a significant increase in self reported sun-safe behaviour at 4 weeks follow up post intervention (Cho & Salmon 2006, USA, RCT [-]). Health-based messages delivered via essays were reported to be convincing and appearance-based messages were more likely to result in self reported sunscreen use than health based messages at follow periods of up to 3 months but significance data is lacking (Jones et al. 1994, USA, RCT [-]).
- High threat messages delivered via essays also appear to impact on beliefs regarding severity of, and vulnerability to, skin cancer; high coping strategies increase perceptions of self efficacy immediately post intervention but significance data is lacking (McMath & Prentice-Dunn, 2005, USA, RCT [-]). Similarly, an RCT testing essays with different levels of tan benefits and skin cancer risk reduction strategies indicates that high efficacy messages scored higher on self reported skin cancer risk knowledge immediately post intervention (Prentice-Dunn et al., 1997, RCT, USA [-]).
- Positive message framing delivered via pamphlets appears to generate higher positive reaction scores and negative framed messages to increase perceived personal risk immediately after the intervention of but significance data is lacking (Rothman, 1993, USA, RCT [+]) and high threat and high efficacy messages (delivery unclear) to higher danger control; high efficacy messages led to more positive attitudes regarding protective behaviours immediately after the intervention but, again, significance data is missing (Stephenson & Witte, 1998, USA, RCT [-]).
- Use of an official Health Education Authority leaflet significantly increased in self reported knowledge of sun protection and tanning risk one week after reading the material (Castle et al., 1999, UK, RCT [+]). A test of statistical versus narrative-based message delivery found the statistical message format to be significantly better in improving perceptions of tanning bed use risks than the narrative version measured via telephone survey at 3 – 4 weeks post intervention (Greene et al., 2003, USA, CBA [-]).

Secondary School Students

Seven studies involving secondary school children (age 12 to 16) were identified, all involving mixed methods, although details of methods used were not specified.

Mixed Methods: video and printed materials

Four RCT and 3 B&A studies were identified as relevant to this category:

- Mermelstein et al. (1992): Chicago, USA (rated - quality) RCT
- Syson-Nibbs (1996): Derbyshire, USA (rated - quality) RCT
- Hughes et al. (1993). Various locations, UK (rated - quality) RCT
- Kristjansson et al. (2003): Stockholm County, Sweden (rated + quality) RCT
- Geller et al. (2005): Florida, USA (rated +) B&A
- Jansson et al. (2003): Stockholm, Sweden (rated -) B&A.
- Kamin et al. (1993): Texas, USA, (rated -) B&A

These are summarised in Table 2.5 (Appendix 1). The four RCT studies all involved combinations of video and print material and all reported significant increases in self reported knowledge, measured by questionnaire between 1 week and 3 months post intervention, between the intervention and control groups. However, the only study that included attitude statements (Kristjansson et al. 2003) showed significant change only in relation to two attitude statements at 3 months follow up. Behavioural change was not measured in any of the RCT studies.

The first two B&A studies involved lessons for which the details are not provided. The third (Kamin et al, 1993) involved the use of a video, discussions and a handout. ; One B&A study (Jansson et al., 2003) reported only on attitudes towards protecting children from sunburn rather than personal behaviours and found significant increases in attitudes towards protecting children among females only ($p < 0.001$). Behavioural change was measured only in one B&A study (Geller et al., 2005) and found no significant difference in reported use of sunscreen, hats or sunglasses at 5 month follow up. The remaining B&A study (Kamin et al., 1993) reported only knowledge acquisition, reporting only mean scores and not significance data.

A number of confounding factors may have impacted on the findings, including high pre-intervention knowledge from previous subject educational activity and contamination due to classes in the same school being allocated to different intervention arms.

Given the lack of evidence of behaviour change and limitations in the methodology identified, it is unlikely that any of these interventions have applicability beyond the population and setting studied.

The Syson-Nibbs (1996) study also notes an additional potentially significant factor: students had to spend midday breaks outside with minimum shade. For behaviour-change-focussed interventions to be effective, greater focus must be placed on ensuring



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that environmental factors support rather than work against the recommended behaviours.

This will require integrated upstream legislative / regulatory actions to ensure that environments such as schools have common, enforceable policies regarding sun protection. In addition, with both young adults, such as university students, and adolescents, such as secondary school students, factors such as strong normative beliefs regarding the social desirability of acquiring a sun tan and unrealistic optimism and denial regarding personal risk from unwise behaviours will also work against behaviour change even if knowledge is gained. These factors are discussed in Section 3 (page 35). Additionally, these age cohorts, particularly girls, are known to be influenced in their own behaviours by the portrayal of role models in the media. Thus if celebrities openly endorse unwise sun exposure practices, safe sun exposure messages are likely to be disregarded. These factors are briefly reviewed in Section Three of this report (page 41).

Evidence statements: Secondary School Students: Mixed Methods

ER2.6 Evidence from 2 US, 1 UK and 1 Swedish RCTs plus 2 USA and 1 Swedish B&A suggests that the provision of information, in a variety of different forms such as leaflets, workbooks or videotapes as part of lesson content, to secondary school children (aged 12 to 16 in all but two studies, 15 – 18 years in Geller et al., 2005; 16 – 19 year olds in the Swedish B&A) leads to a significant increase in self reported knowledge of skin cancer risk at periods ranging from 1 week – 5 months follow-up period (Mermelstein et al. 1992 RCT, USA [-]; Syson-Nibbs 1996 RCT, USA [-]; Hughes 1993 RCT, USA [-] and Kristjansson et al 2003 RCT, Sweden [+]; Geller et al, 2005 B&A, USA [+]; Jansson et al., 2003 B&A, Sweden [-]; Kamin et al., 1993 B&A, USA [-]). Only one study assessed actual behavioural outcomes relating to sun protective behaviours, reporting no significant difference. One study (Syson-Nibbs 1996) suggested that in order to foster behavioural change, supportive environmental factors were needed.

Broad Age Range – Incorporating both Primary and Secondary Students

One study (reported in two papers) involving children aged 5-15 years was identified, this study involved a mixed methods intervention (verbal advice combined with Sun Wise website).

Mixed Methods: verbal advice and website

The following CBA study was identified

- Geller et al (2002 and 2003a and b): USA (rated - quality).

This study is summarised in Table 2.6 a (see Appendix 1). The study reports an increase in self reported knowledge of sun protection strategies at baseline and 6 and 12 months follow-up among students from some participating schools. Further, the specific methodology is not reported in sufficient detail to enable the applicability of the study methodology to other settings to be fully assessed. The applicability is



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therefore probably restricted to the population / setting studied. The study raises an additional factor – it covers an age range of 5 - 15 years, but does not provide a breakdown of findings by age cohorts. It is possible that there may have been different impacts across the age cohorts, with the older children likely to have been impacted by the factors discussed under secondary schools. For younger children, the level of cognitive development at different ages is likely to have impacted on their ability to understand the significance of material taught and to apply it outside classroom situations (please see Section three for further details).

Evidence statement: Broad Age Group: Mixed Methods

ER2.7 A mixed method delivery using group verbal advice plus the use of a SunWise website increased self reported knowledge regarding sun protection strategies at baseline, 6 and 12 months post intervention among children aged 5-15 from some, but not all of the participating schools. Significance levels are not reported and the methodology is not reported in sufficient detail to enable this study to be judged as applicable beyond the population and setting in which it was conducted (Geller et al., 2002 & 2003a & b CBA, USA [-]).

Primary School Children

Twenty-five studies (reported in 38 papers) involved primary school children aged 5 - 12; 2 studies were new media interventions; 10 involved group based lessons, 1 was a health fair intervention and 12 involved mixed methods interventions.

New Media

Only one RCT study involving WMHTAC definition of new media was included in the WMHTAC report; however we have grouped it with a second CBA study that compared computer-based lessons to workbook-based lessons. Both these studies can more correctly be termed internet / computer mediated interventions. The studies are:

- Hornung et al. (2000). North Carolina, USA (RCT rated +_quality)
- Hewitt et al. (2001): Nottinghamshire UK. (CBA rate - quality)

These are summarised in Table 2.6b (see Appendix 1). The Hornung et al. (2000) study focussed on the impact of a CD-Rom based computer programme that used cartoon characters to model different types of sun protective behaviours. There are no details provided regarding the characteristics of the children involved in this study (e.g. gender, socio-economic status etc) or of any other interventions that may have occurred within the wider community either preceding or concurrent with this intervention – or even whether any sun protection lesson content was provided within the standard school curriculum.

While self reported knowledge of sun protection strategies is significantly higher in the intervention group compared to the control group immediately post interventions and at 7 month follow up, there was no significant difference in self reported behaviours.



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This may be due to the limitations on behaviour that can be expected to be generalised from specific learning situations due to young children's limited cognitive development (discussed in Section Three). The study also suffered from contamination effects due to students from the same school being allocated to different study arms and from children trying to answer 'correctly' in order to please teachers and researchers. It is therefore unlikely that this study has potential applicability across a broad range of other settings.

The Hewitt et al. (2001) study was conducted in Nottinghamshire in the UK and compared the use of either computer-based or workbook-based lessons, with baseline tests and follow up at six week. The workbook group showed significantly higher self reported knowledge of sun protection strategies than the control group, whereas the difference between the computer-based group and the control group was not significant. Several weaknesses are evident in that the control schools were self selected and there is insufficient information to determine whether the groups were equivalent at baseline. There is also insufficient information provided to determine exactly how the two types of lessons were implemented and whether the ease or complexity of use of the computer-based option had any impact on the outcomes. Again, problems with children's limited cognitive development may also have impacted on the findings (see page 36 for further information). This study is probably applicable to the population / setting studied.

Lesson Based (details of supporting material not provided)

Ten studies (reported in 19 papers) were included in this category (5 RCTs, 2 CBAs and 3 B&A studies):

- Vitols et al. (1997): Sydney, Australia (CBA rated - quality)
- Loescher et al. (1995): USA (exact location not given) (RCT rated + quality)
- English et al. and Milne et al (7 reports centred on the 'Kidskin' programme: Perth, Western Australia (CBA rated - quality)
- Buller et al. (1994): Mesa, Arizona, USA (RCT rated - quality)
- Buller et al. (1998): (3 reports) USA (RCT rated - quality)
- Girgis et al. (1993): Australia (exact location unspecified) (RCT rated - quality)
- Buller et al. (2006a) and Reynolds et al. (2006): (2 reports) Colorado and New Mexico, USA. (RCT rated + quality)
- Freak (2007): Dorset, UK (B&A rated – quality)
- Bastuji-Garin et al. (1999): France (B&A rated – quality)
- Perkins (1993): Southampton, England (B&A rated + quality)

These studies are summarised in Table 2.7 (Appendix 1). A range of lesson formats were tested in this category, with inadequate details of the way the lessons were delivered or what form of supporting material (if any) was used. The same comments regarding the impact of children's cognitive development on their ability to generalise classroom-acquired knowledge to other settings noted in relation to the studies discussed in the previous category (see Section Three for discussion) also apply here and may explain why there is stronger evidence for an increase in self reported



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knowledge regarding sun protection rather than behaviour change across the studies at periods ranging from 2 weeks to 8 months follow up.

Other potentially confounding factors for some of the studies include previous subject lessons, high existing baseline knowledge from previous school or community-based interventions or mass media campaigns and the probability of children giving expected versus actual behaviour details. As there is evidence of varying increases in self reported knowledge of sun protection behaviours but not of significant increases in self-reported sun protections of up to 8 months in all bar one study (Batuji-Garin et al. which was based on children's recall), this set of studies are likely to be applicable only to the populations and settings studied.

Health Fair

One non-standard lesson delivery-based RCT study was reported for primary school students:

- Buller et al. (1997): Tuscon, Arizona, USA (rated - quality)

This is summarised in Table 1.7b in Appendix 1; it involved children's attendance at an interactive health fair, participation in which enabled the child to enter into a prize draw. As for the previous set of interventions reviewed in relation to Table 1.7a, self reported knowledge regarding sun protection behaviours increased significantly immediately post intervention, possibly due in part to the incentive of a possible prize, but behaviour did not and there was no significant difference between the intervention and control groups at 3 months follow up. The study suffered from the same limitations and potential confounding effects noted in the previous category; and it is probably applicable only to the population and setting studied.

Mixed Methods: Lesson based, including verbal advice, videos and / or printed materials

This category includes a range of mixed methods, centred on conventional lessons but also including videos, leaflets, worksheets or activities books, presentations.

Twelve studies (reported in 13 papers) were identified (3 RCTs, 2 CBAs and 7 B&As):

- Buller et al. (1996): Tuscon, Arizona, USA (RCT rated - quality)
- Buller et al. (2006b): Tuscon, Arizona, USA (RCT rated + quality)
- Barankin et al. (2001): London, Ontario, Canada (CBA rated - quality)
- Reding (1994): Wisconsin, USA (CBA rated - quality)
- Naldi et al. (2003 and 2007): Italy (RCT rated + quality)
- Gooderham & Guenther (1999b): Ontario, Canada (B&A rated – quality)
- LaBat et al. (2005): Minnesota, USA (B&A rated – quality)
- McWhirter et al. (2000): South of England (unspecified) (B&A rated + quality)
- DeLong et al. (1999): Minnesota, USA (B&A rated – quality)
- Gilaberte et al. (2008): Southern Spain (B&A rated + quality)
- Thornton & Piacquadio (1996): San Diego, USA (B& A rated – quality)
- Fork et al. (1992): Texas, USA (B&A rated – quality)



The studies are summarised in Table 2.8 (Appendix 1). Once again, there is clearer evidence of improvement in self reported knowledge of sun protection strategies than in independently verified behaviours at follow-up periods up to 8 months (4 years for the LaBat et al. study) for most of these studies. The Gooderham & Guenther (1999) and Gilerberte et al. (2008) reported significant self reported behaviour changes although it is likely that some of the effects are due to children trying to give what they perceived as ‘right’ answers, rather than accurately recalling actual behaviours. This set of studies also suffers from potential contamination effects as discussed in the previous sections and several were inadequately described, hampering efforts to determine exactly which part of the intervention had the most impact or potential applicability to other populations or settings might be. The studies reported in this group are therefore probably applicable only to the population or settings studied.

Section 3 of this report provides a brief review of potential problems with knowledge generalisation in relation to all studies involving primary school children, and a brief review of the key issues that cognitive development stages present.

Note: WMHTAC note that no specific mass media interventions focussing on children were reported. This does not, of course mean that there is no activity undertaken with this segment, merely that no interventions were identified by the search strategy or published that met the selection criteria. For example, two Australian studies report on parental recall of media campaigns targeting parents and carers of children aged 12 and under (Smith et al, 2005 and 2002). A large amount of unpublished data is also likely to reside within organisations such as SunSmart.

Evidence statements: Primary school children

New Media

ER2.8 There is mixed evidence from one US based RCT and one UK CBA study about the provision of information via new media formats for primary school children aged 5 to 12). A significant increase in self reported knowledge of skin cancer detection was found for those using a cartoon character based CD-rom programme to model different type of sun protective behaviours at 7 month follow-up period (Hornung et al.2000 RCT, USA [+]). Whereas another study found that differences between those using a computer based lessons and the control group were not significant at 6 week follow-up period; although a significant increase in the knowledge of sun protection behaviour was reported for those using work-book lessons compared to the control group (Hewitt et al 2001 CBA, England [-]). Neither study reported significant changes in behaviour. However, issues over the cognitive development of young children and inherent weaknesses within the studies suggest that these findings should be treated with caution.

Lesson-based delivery

ER2.9 There is mixed evidence from 5 RCTs, 2 CBAs and 3 B&A studies across several countries centred primarily on lesson-based delivery (in all cases, no details of lesson teaching aids or any supporting material is provided) for primary school children aged 5 to 12 years:

- A lesson-based intervention compared to a question and answer session found both methods effective in increasing self reported knowledge of sun protection behaviours , with no significant difference between methods at 2 weeks follow-up (Vitols et al.,1997, Australia, CBA [-]. An RCT targeting preschoolers significantly increased self reported knowledge about sun safety but did not significantly change behaviours at 7 weeks follow-up (Loescher et al., 1995, RCT, USA [+]).
- Seven reports centred on the Australian ‘Kidskin’ programme used lesson-based delivery in the spring of 4 consecutive years found no significant evidence of reduced sun exposure, suntan or naevus except, for the latter, a subgroup of boys on some anatomical sites (English et al. and Milne et al, CBA, Australia [-]). A lesson-based delivery (details not provided) of sun protection strategies significantly increased self reported knowledge and some behaviours at unspecified follow-up periods but the significance of the latter was not reported (Buller et al.,1994, USA RCT [-]). An extension of this study used print material as part of the lesson-based delivery but found no significant difference in summer sun protection and significant improvements in 5 of 7 winter sun protection behaviours (Buller et al. (1998: 3 reports; USA, RCT [-]).
- An Australian 4 week intervention based on the NSW Cancer Council ‘SkinSafe’ booklet provided only regression equation data and indicates that the intervention was a predictor of higher solar protection at 8 month follow-up period (Girgis et al., 1993, Australia, RCT [-]). A USA lesson programme (details unspecified) found significantly improved self reported knowledge regarding sun protection but no significant difference in actual sun protection

ER2.10 Three lesson-based B&As contain major methodological and / or reporting weaknesses: A UK intervention, using lessons for which details are not specified, is reported in terms of the author's opinion of success of knowledge increase (Freak, 2007 B&A, UK [-]; A Spanish intervention which used a package of materials for which details are not provided, relied on children reflecting back over considerable periods to report on claimed positive sun protection behaviours (Bastuji-Garin et al., 1999 B&A, France [-]; Perkins, 1993 B&A, England [+] found mixed results regarding knowledge, with no discussion of possible reasons, together with minimal details of intervention delivery.

Health Fair

ER2.11 There is evidence from a USA RCT that attendance at an interactive 'health fair' (involving a prize draw), of a significant increase in primary school children's (age not specified) self reported knowledge of sun protection behaviours immediately post intervention but not at 3 month follow up (Buller et al., 1997, RCT, USA [-]).

Mixed Methods

ER2.12 There is evidence from 3 RCTs, 2 CBAs and 7 B&As of improvement in sun protection knowledge and attitudes rather than behaviours through mixed method delivery for primary school children aged 5 to 12 years, but the delivery methods used are not clear:

- Multi-disciplinary teaching units delivered over a 5 week period and supported by workbooks and newsletters improved knowledge and attitudes regarding tanning but do not appear to have led to significant differences in self-reported sun protection behaviours among 9 to 12 year olds; skin chroma meter scores were also used but the results are unclear (Buller et al., 1996, USA, RCT [-]). A study evaluating the effects of a similar programme targeting kindergarten children through to those of approximately 11 years of age found self reported knowledge of significantly increased in both intervention and control groups and no significant difference in behaviours or skin chroma scores at 6 week follow up period (Buller et al., 2006b, USA, RCT [+]).
- Lessons based on presentations from medical students, supplemented by interactive slide presentations and activity books found statistically significant improvement in self reported knowledge and self reported behaviour / behavioural intentions at one month (Gooderham & Guenther, 1999b, B&A, Canada [-]); in a further study involving some of the original authors, some improvement in knowledge and self reported behaviours, plus self-reported sunburn reduction was evident at 5 month follow-up period; but statistical significance data is not provided (Barankin et al., 2001, Canada, CBA [-]). Note- these studies are inked
- A USA CBA using a booklet as part of lessons as a summer camp (exact delivery details unclear) found statistically significant increases in self reported knowledge of sun protection immediately after the intervention but actual behaviour change data was not collected (Reding, 1994, USA, CBA [-]).

- There is no evidence of significant differences in parental reports of child sunburn between intervention and control groups (follow-up period unclear) from two reports of an Italian RCT involving lessons using print material and video (content unclear); the study authors noted high levels of existing sun protection and reported methodological challenges due to problems with schools' ability to comply with the study requirements (Naldi et al., 2003 and 2007 RCT, Italy [+]).
 - Three B&A studies focussed on measurement of knowledge and awareness measurement rather than actual behaviour change. McWhirter et al., 2000 B&A, England [+] used a video and handbook distributed to teachers, but provides no details on its actual use; Thornton & Piacquadio 1996 B&A, USA [-] incorporated a book into the curriculum but do not provide details of its use; Fork et al. 1992 B&A, USA [-] used presentation by older children to younger children, however for this latter study, small numbers prevented a comparison being made between the effects of the different presentations. Gilaberte et al. (2008) B&A, Spain [+] used a package of materials including activity guides, workbooks and posters and reported significant self reported behaviour changes although it is likely that some of the effects are due to children trying to give what they perceived as 'right' answers, rather than accurately recalling actual In addition to the lack of details regarding these interventions, a further limitation is that minimal relevant statistical data is provided for the impact of the interventions.
 - One B&A study used a class room and field trip intervention, for which details are not provided. Questionnaires compared children's knowledge and appearance preferences and acceptance of sun protection recommendations at ages 10- 13 and 4 years later, finding knowledge to be retained but preferences for tanned appearance to have increased, and sun protection recommendations to have been rejected (LaBat et al., 2005 B&A, USA[-]).
 - One B&A study involving the same authors as above (DeLong et al., 1999 B&A, USA [-]) used an intervention comprising overheads for class presentations, together with a videotape and an age-appropriate word-find worksheet. The study focussed on awareness of sun protection qualities of hats and attitudes towards different styles and found increases in awareness of the sun protective qualities of different styles of hats, but behavioural intentions were based more on personal style preferences.
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Home Settings

Nine studies, seven RCTs, one CBA and one B&A (reported in 10 papers) were based in home. Three related to mixed methods and five to printed material

Mixed Methods – Verbal Advice and Supporting Visual and Printed Material

Two RCT studies (reported in 3 papers), 1 CBA and 1 B&A study were identified as relevant to this category:

- Rodrique (1996): Florida, USA(CBA rated - quality)
- Geller & Gilchrist (2006) / Geller et al. (2006) USA (RCT rated - quality)
- Benjes et al. (2004): Falmouth, USA (RCT rated + quality)
- Attew et al. (1999): Oxfordshire, England (B&A rated – quality)

These studies are summarised in Table 3.1 (Appendix 1) and represent a range of approaches centred on the provision of verbal advice, supplemented by supporting material such as booklets, or videos. All the studies have limitations.

The Rodrique (1996) study combined verbal advice and an informational video and found statistically significant differences in self reported knowledge of sun protection and sun protection behaviours between the intervention and control groups at 2 and 12 weeks follow up. A small sample of self selected white, well educated and well motivated mothers (affiliated to parent-teacher associations) was used and relied on self-reporting. The study reported by Geller & Gilchrist (2006) and Geller et al. (2006) focussed on adult siblings of melanoma patients, who were likely to be high in both knowledge and motivation compared to the general population. A significant increase in self reported knowledge of sun protection at 6 and 12 month follow up was evident for only 2 of 7 questions and there was no evidence of an increase in self reported sun protection behaviours at either 6 or 12 months follow up.

The Benjes et al. (2004) study used a telephone-based delivery of sun protection messages by a nurse, coupled with newsletters. No significant difference in mothers' self reported sun protection behaviours was found at 12 month follow up, and no trend in individual behaviours, however mothers reported more vigilant protection of children. The study provides limited demographic data and the exact methodology is unclear, therefore the reason for no significant differences between the intervention and control groups and the lack of clear trend data cannot be determined.

The Attew et al. (1999) study involved a small (22) sample of friends of the researchers and used both one-on-one advice and leaflets delivered in-home to mothers of babies and pre-school children, but reported only increases in correct answers to a knowledge questionnaire rather than actual behaviours.



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Given the methodological shortcomings such as short term focus, lack of detail and probable contamination effects, and the lack of significant differences in sun protection behaviours, lack of identifiable trends in individual behaviour and reliance on self reporting regarding protection of children (with possible socially desirable responding), this set of studies are likely to be applicable only to the populations or settings studied.

Printed materials

Five RCT studies (reported in six papers) were identified as relevant to this category:

- Turrisi et al. (2004 & 2006): Bois Idaho and Johnson City Tennessee, USA: (rated + quality)
- Bränström et al. (2003): Stockholm County, Sweden: (rated + quality)
- Gerbert et al. (1997): San Francisco, USA: (RCT rated - quality)
- Bauer et al. (2005): Germany: (RCT rated + quality)
- Richard et al. (1999): Region Provence-Alpes Côte d'Azur, France: (rated - quality)

The studies are summarised in Table 3.2 (Appendix 1) and represent a diverse range of approaches. There are limitations to all studies.

The Turrisi et al. study (2004 and 2006) used handbooks supplied to parents to enable them to teach their children about sun protection and relied on self reporting by the children aged 9-12 years. Children reported significantly less sunburn and sunbathing tendencies at 45 day follow up but statistical significance data was not provide. This study was short term in focus and may have compared groups who were not similar on key characteristics, as well as possibly being impacted by children giving responses to please parents and researchers rather than reporting actual behaviours.

The Bränström et al. (2003) used different combinations of brochures with or without UVR intensity indicators with adults from general population and reported a significant increase in sun protection knowledge and decrease in sunbathing frequency (follow-up period unclear). The study does not provide sufficient detail to enable the combination of material that may have been most effective to be identified. Additionally, there may have been contamination effects from widespread media reporting of the UV index.

The Gerbert et al. (1997) study tested 9 different combinations of print information sent via mail to patients registered at general practices, with an invitation to call a toll free number and receive a free sun cream sample post delivery of the intervention. This phone number operated with restricted times in which respondents could call a designated number which may have resulted in bias as may the provision of sun cream samples. While higher responses came from people receiving a pack with a letter from their physician and from a pack emphasising skin cancer risk, there is insufficient information on the significance of the responses to enable the effectiveness of the intervention to be assessed.



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The Bauer et al. (2005) study sent print material to parents, with educational letters sent three times a year, then assessed children (aged 2-7 years) for three years for newly developed naevi. The study authors found an “unexpectedly high proportion of children already using sunscreen” but found no significant difference in number of naevi between the intervention and control groups.

The Richard et al. (1999) study compared three different types of information delivery including humour and alarm-based messages sent via leaflets mailed to adults in the home, and reported significant increase in knowledge of skin cancer risk and sun protection strategies two weeks after the mailing for the intervention groups compared to the control group but not between the different intervention groups, but provided insufficient information regarding the number of participants actually reading (as opposed to merely receiving) the material. The use of fear appeals is discussed in Section Three ; in addition humour is known to be influenced by culture (Alden et al., 1993), making it difficult to assess how effected humour-based approaches may be in other settings (see Section Three for further information).

Given the limitations noted above, the studies in this category are probably applicable only to the population and settings studied.

Evidence statements: Home Settings

Mixed Methods

ER2.13 There is missed evidence from 2 RCTs (reported in three papers) one CBA and one B&A regarding mixed method interventions in home settings:

- Verbal advice coupled with videos shown to USA mothers of young children resulted in statistically significant differences in self reported knowledge of sun protection and self-reported sun protection behaviour at 12 week follow up but the sample was self –selected, white, well educated and well motivated (via affiliation to parent-teacher associations (Rodrique, 1996, CBA, USA [-]).
- There is evidence of only limited increase in self reported knowledge and no evidence of increased use of sun protection at 6 and 12 month follow up from a USA RCT based on telephone sessions with a health educator supported by (unspecified) print material targeting adult siblings of melanoma patients; significance data was not provided (Geller & Gilchrist, 2006 and/ Geller et al., 2006, RCT, USA [-]).
- There is no evidence of increased sun protection behaviours among mothers of young (age unspecified) children who were counselled by a nurse via telephone and sent newsletters; further, there was no trend evident in individual behaviours although higher self-reported vigilant protection of children was noted at 12 month follow up (Benjes et al., 2004, RCT, USA [+]). Similarly, there is no evidence of increased sun protection behaviours among mothers of young children following one-on-one advice and leaflet provision - although some increases in knowledge were reported (Attew et al., 1999, B&A, England [-]).

Printed material

ER2.14 There is mixed evidence from 5 RCTs drawn from 4 countries regarding the effectiveness of printed material in home settings:

- Handbooks supplied to parents to enable them to teach their children about sun protection in a USA RCT resulted in children (aged 9 – 12 years) reporting less sunburn and sunbathing at 45 day follow up but the study authors noted that the children may have wanted to please parents and researchers rather than provide accurate feedback (Turrisi et al., 2004 & 2006, USA, RCT [+]).
- Brochures mailed were used with and without UVR intensity indicators in a Swedish RCT found mean self reported knowledge of skin cancer risk increased and mean sunbathing frequency decreased at follow up periods ranging from 4 to 7 months (means of assessing these factors unclear), but the available data does not allow the most effective combination of material to be identified (Bränström et al., 2003, Sweden, RCT [+]).
- A USA RCT using 9 different combinations of print material sent via mail with an invitation to call a toll free number to receive a free sun cream sample found the highest response rate associated with a pack which contained a letter from a physician and a pack emphasising skin cancer risk, however no significance data was provided and there is probable bias from the provision of the sun cream sample for callers (Gerbert et al., 1997, USA, RCT [-]).
- There was no evidence of significant difference in number of naevi counted on children aged 2 – 7 years assessed over a three year period following print material sent to parents with additional educational letters three times a year over the study period (Bauer et al., 2005, Germany, RCT [+]).
- There is evidence of statistically significant increased in self reported knowledge of skin cancer risk compared to the control group from leaflets mailed to adults; the leaflets used three different message types involving humour, threatening and neutral approaches, but there was no significant difference between the intervention groups at 2 week follow up (Richard et al., 1999, France, RCT [-]).

Recreational Settings

Six RCTs and two B&As are relevant to this category, four in sports setting directed at adults, two in airport settings and once each in swimming pools (targeting children) and one in outdoor venues targeting adults who supervise children.

Sports Settings

Two American RCTs, one American B&A and one Welsh B&A studies in sports settings are relevant to this subcategory:

- Parrott et al. (1999): Georgia, USA : (RCT rated - quality)
- Walkosz et al. (2008): USA (exact location not specified): (RCT rated ++ quality)
- Fielder et al. (1996): Wales (exact location not specified): (B&A rated + quality)
- Jungers et al. (2003): Indianapolis, USA (B&A rated – quality).

These studies are summarised in Table 3.3. Note: the Walkosz et al. (2008 study was classified by WMHTAC as New Media but involved the use of electronic signage at a ski resort as well as print and verbal advice and therefore has been reclassified as a mixed method intervention.

Mixed Methods

The Parrott et al. (1999) study used a seminar about sun protection coupled with a booklet giving information on sun burn prevention strategies. It focussed on only 12 sports coaches, with contamination effects likely and found no significant difference between intervention and control groups using self-reported knowledge/ of sun protection (timing not specified). The Walkosz et al. (2006) study used a series of print, electronic and interpersonal messages in rotation at ski fields and found no evidence of increased sun protection behaviour (follow-up period unclear – presumed to be at end of day) (no statistical test reported), with the probability that regular skiers would have had high baseline knowledge.

The two B&A studies were based on the provision of information (and for one of these studies sunscreen samples) at sporting events. Fielder et al., 1996 used a health education trailer which was staff by a trained dermatologist, nurses and volunteers at beaches and parks which was advertised by press and radio coverage. The Jungers et al., 2003 used an educational booth staff by dermatologist at a baseball game. The two studies provided mixed results, for example, the Fielder et al. 1996 study reported a significant (20%) increase in referrals to a pigmented lesion clinic but also that more people enjoyed sunbathing at follow up ($p<0.01$), and that also more people always or sometimes using protective measures ($p<0.02$). The Jungers et al., 2003 study reported no significant differences between those who completed baseline only and baseline plus follow up, although the 40 people who indicated sun exposure recreation at both time points reported significantly lower hours per week of sun exposure. Both involved self-selected samples and provide inadequate reporting of actual behavioural changes.

As none of these studies demonstrated any evidence of improvements in sun protection knowledge or behaviour, they must be considered as applicable only to the population and setting studied.

Airports / Flights

Two RCT studies focussed specifically on air passengers and are also included as a subsection of Table 3.4 (Appendix 1):

- Dey et al. (1995): flights from Manchester, UK (rated - quality)
- Segan et al. (1999): Flights departing to Queensland from Melbourne, Australia (rated - quality)

Printed materials

Both used leaflets distributed on selected flights; neither found significant differences in self report behaviour between the intervention and control groups (follow-up periods not specified – presumed to be at the time of return flight); and suffered from severe methodological limitations and inadequate reporting of data collection. Both studies are probably applicable only to the populations / settings studied.

Swimming Pools / Outdoor Venues

Two RCT studies investigated interventions delivered in other recreational settings:

- Mayer et al. (1997): San Diego, California, USA: (rated +)
- Glanz et al. (2001): Hawaii, USA: (rated -)

These are summarised in table 3.5 (Appendix 1).

Lesson Based

The Mayer et al. (1997) RCT study relied on a brief (5 minute) lesson targeting children and parents before aquatic classes and found no significant difference in self reported sun protection behaviours among children at 6 – 8 week follow up.

Mixed Methods

The Glanz et al. (2001) RCT study examined the effect of using verbal advice and printed material to influence knowledge of sun protection behaviours among trained recreational leaders responsible for supervising children (aged 6-8 years) at outdoor venues. A significant increase in self reported knowledge was found compared to the control group at 8 weeks, but knowledge had decayed at 3 months (staff turnover may also have been a factor in this but is not discussed).

The two studies are probably applicable only to population/ setting studied, however the Glanz et al. (2001) study should be considered in relation to studies relating to 'Pool Cool' (see Escoffery et al. (2008); Geller et al. (2001) and Glanz et al. (2002) studies listed in the references) which has taken this type of intervention considerably further.

Evidence statements: Recreational settings

Sports settings: Mixed method delivery

ER2.15 Evidence from 2 American RCTs and one Welsh and one American B&A studies involving mixed method delivery in sports settings demonstrated some increases in knowledge no significant effect on either self reported sun protection behavioural outcomes:

- A USA seminar and booklet based intervention about sun protection targeting sports coaches of children found no significant difference in self-reported sun protection behaviour (Parrott et al.,1999, RCT[-]).
- Similarly, rotation of print, electronic and interpersonal messages to adults at USA ski resorts also showed no evidence of self-reported sun protection (Walkosz et al., 2008, RCT [++]).
- Two display facilities at sporting events attracted staff by dermatologists some interest and some change in attitudes, but mixed results regarding actual sun protective behaviours (Fielder et al., 1996, B&A, Wales,[+]; Jungers et al., 2003, B&A, USA [-]).

Airports / flights: printed materials

ER2.16 There is no evidence of significant differences in sun protection behaviours or sunburn frequency from two RCTs, 1 from the UK and one from Australia, involving leaflets distributed on airline flights (data collection methodology unclear) (Dey et al., 1995, UK RCT [-] and Segan et al., 1999, RCT Australia [-]).

Swimming pools: lesson based

ER2.17 There is no evidence of significant improvement in sun protection behaviours among children in a USA RCT where children and parents were given 5 minute sun protection lessons prior to aquatic classes (Mayer et al., 1997, RCT, USA [+]).

Outdoor venue: Mixed method delivery

ER2.18 There is evidence from one RCT involving delivery of verbal advice and printed materials to trained recreational leaders who are responsible supervising children in Hawaiian outdoor settings to suggest that children's self reported knowledge of sun protection behaviours significantly increased at 8 week follow up but not at 3 months (Glanz et al., 2001, RCT, USA [-]).

Workplace Setting

Four RCT studies were identified as relevant to this category:

- Borland et al. (1991): Melbourne, Australia (rated + quality)
- Dixon et al. (2007): Melbourne, Australia (rated - quality)
- Hanrahan et al. (1995): Newcastle, Australia (rated + quality)
- Rasmussen (2005): Scotland (rated – quality)

One study used mixed methods, 1 used new (electronic) media, 1 used printed material and 1 intervention does not provide sufficient information regarding the exact method of information delivery. These are summarised in Table 4.1 (Appendix 1).

Outdoor Workers

Mixed method

The only study (from Australia) in this category (Borland et al, 1991) involved posters, a video of a man dying from melanoma and individual folders containing a range of printed material provided to individual workers. While the intervention group was observed to make greater use of sun protective clothing (but not use of shade areas) the study has several significant limitations. The main limitation relates to the fact that the intervention group had a significantly higher protection index than the control group prior to the intervention commencing, therefore the two groups were not equivalent. There is also the possibility of the ‘Hawthorne Effect’ with the intervention group possibly increasing sun protection behaviours because they had been selected for study rather than as a result of the impact of the intervention itself and because of the use of ‘senior line staff’ as ‘observers’ to report on actual behaviours.

Additional confounding effects are likely to have been due to the effects of state-wide SunSmart activity and other sun protection interventions and the fact that the employer of these workers already operated a sun protection programme for employees – this intervention was run in addition to the main programme.

While the paper describes the availability of the material, it does not describe the actual usage of any or all of the components. It is therefore not possible to separate out the effects of individual components of the intervention (e.g. video versus leaflets) and there is no information allowing message framing effects or readability / ease of comprehension of the various components to be assessed.

This study is also somewhat dated and was conducted before two legal test cases involving outdoor workers who successfully sued their employers after developing skin cancers led to changes in legislation in Australia. Employers of outdoor workers



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are now required to provide a range of sun protection measures for their employees who are required to cooperate by using these measures².

General Workplaces

Electronic Media

One Australian workplace-based intervention (Dixon et al., 2007) compared the impact of weekly emails containing weather forecasts alone, with forecast information in conjunction with UV forecasts and then with protection recommendations also included. Results are somewhat mixed, with no statistically significant differences in reported sunburn levels detected via post-weekend questionnaires emailed to participants, but some evidence of higher sun protection behaviours for those receiving the largest set of information. As with all other studies conducted within the Australian environment, knowledge of sun exposure dangers and of sun protection strategies is likely to be high and there is the potential for confounding effects of exposure to previous interventions such as state-wide or community-based interventions. Limitations acknowledged by the authors in regard to self-selection, low participation rates and the lack of demographic breakdown or other relevant respondent characteristics makes the assessment of the potential generalisability of this intervention to other populations and settings impossible.

Printed materials

One Australian study (Hanrahan et al., 1995) compared two forms of print-based information delivery to male employees of a large mining company and, while the study found a significant increase in knowledge relating to melanoma and melanoma detection between the intervention and control groups at 10 week and 20 week follow up, the study is inadequately reported and suffered from a high loss of participants at follow up. Demographic information is lacking and no actual attitudinal or behavioural changes are reported. Given the lengthy history of central government and state-sponsored mass media-based information campaigns run in Australia over time, there is likely to have been a high existing level of knowledge at baseline.

Information delivery type – not identifiable

A third study (Rasmussen 2005) was conducted in Scotland among employees of two (unspecified) industrial companies. While the study suggests that it compared positive and negative message framing (see discussion of this topic in Section Three), it was not a true test of this as information was presented about the efficacy of, versus problems with, sunscreens. There was a significant increase in self-reported likelihood of using sunscreen among the intervention groups compared to the control group and the negative information group reported a significantly lower likelihood of using sunscreen than the positive message group (the timing of the follow up is unclear). The study was reliant on self-reporting of likelihood of using sunscreen rather than actual behaviour, with insufficient information provided re the profile or past sun

² For examples of Work and Employer guides to the provisions of Australian legislation regarding skin cancer risks for outdoor workers, see Cancer Council (Australia) and Work Cover New South Wales (www.workcover.nsw.gov.au)



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protection behaviour of participants. Prior knowledge about skin cancer protection was also not detailed and the study authors note that groups were not similar at baseline regarding sunscreen use. In addition, there was possible contamination as participants within the same company were allocated to different interventions.

All four workplace-based interventions reported are probably applicable only to population/ setting studied.

Evidence statements: Workplace settings

ER2.19 There is some evidence from a mixed methods RCT study of outdoor workers exposed to posters and video and provided with individual folders of printed material of some increased sun protection behaviour in form wearing sun protective clothing, measured via observation by senior line managers (follow-up period unclear). (Borland et al., 1991, Australia, RCT [+]).

ER2.20 There is some evidence of higher self reported sun protection behaviours but no statistically significant difference in reported sunburn evidence (post weekend) or identifiable trend from the most comprehensive of three sets of information (weather forecasts combined with UV forecasts and protection recommendations) sent to employees via weekly email. Less comprehensive information sets were advice regarding weather information alone or in conjunction with UV forecasts (Dixon et al., 2007, Australia, RCT [-]).

ER2.21 There is evidence of a significant increase in self reported knowledge of skin cancer risk with male employees of a mining company at 10 and 20 week follow up, although actual behaviour was not reported, from a second Australian RCT involving print media (brochures) illustrating melanoma and providing information regarding self-examination (Hanrahan et al., 1995, Australia, RCT [+]).

ER2.22 There is evidence from one Scottish RCT which compared positive information about sunscreen use with information about problems regarding sunscreen delivered to employees of industrial companies that indicates a significant increase in self-reported likelihood of using sunscreen among the intervention groups, with higher likelihood among those receiving positive information and among females (Rasmussen, 2005, Scotland, RCT [-]).

Medical Practice Settings

Only two RCTs, one using New Media technology, and one printed material mailed to patients from general practices were identified as occurring within a medical practice:

- Glazebrook et al. (2006): Nottinghamshire, UK (rated + quality)
- Prochaska (2005):USA (rated – quality)

New Media (Electronic Delivery)

A UK-based study (Glazebrook et al., 2006, summarised in Table 5.1a in Appendix One) investigated a computer-based intervention within family practices. The intervention used animation, photographs and simple text content. While significant increase in self-reported knowledge regarding sun protection behaviour and in self-reported skin protection behaviours are reported at 6 month follow up, the study has significant limitations. Male participant numbers were extremely low; there is no information on the participant profile in terms of demographic or past skin protection behaviours. The authors also note the potential for selection bias. While the intervention has some potential merit, more information is needed before its generalisability can be completely assessed.

Print Material

The Prochaska (2005) study (summarised in Table 5.1b in Appendix One) targeted patients at primary care practices and involved mailing of reports giving the ‘pros’ and ‘cons’ of behaviour change strategies in relation to sun exposure. The study provides only limited findings from questionnaires mailed at 6 and 12 month follow up intervals which appear to indicate that the intervention groups used more sun screen and avoided sun exposure more than the control group, but no statistical test data is reported. Demographic data is also not provided. A further issue in relation to this study – and to studies in other health areas is that it used the Stages of Change model as the basis for encouraging small steps towards changing sun exposure / protection behaviour. This model has received an increasing amount of criticism and a brief review of the key aspects of the debate is presented in Section Three of this report.

Evidence Statements: Medical Practice Setting

ER2.23 There is evidence from a UK RCT of a statistically significant increase in self reported knowledge regarding sun protection-related behaviours via the use of a computer based programme used within a medical practice, however significance values were not provided and actual sun protection behaviours were not assessed (Glazebrook et al., 2006, RCT, UK [+]).

ER2.24 Evidence from a series of mailed printed materials giving ‘pros’ and ‘cons’ of behaviour change strategies and advice for taking small steps to change behaviours is limited. While there is some evidence of increased sun avoidance and increased use of sunscreen among patients in a primary care practices, no significance test data is provided (Prochaska, 2005, USA, RCT [-]).

Hospital Settings

One RCT study, 2 CBA and 3 B&A studies delivered in hospital setting were identified (four involved mixed methods and the other printed material):

- Jones et al. (2007): Rogheda, Ireland (CBA rated – quality)
- Clowers-Webb et al. (2006): USA (RCT rated + quality)
- Bologna et al. (1991): New Haven Connecticut, USA (CBA rated - quality)
- Brandberg et al. (1992): Sweden (B&A rated – quality)
- Geller et al. (1999): Massachusetts, USA (B&A rated – quality)
- Robinson & Rademaker (1993): Chicago, USA (B&A rated – quality)

Mixed Methods: Verbal Advice and Printed Materials

The four studies using both verbal and written information are summarised in Table 5.2a in Appendix One.

Jones et al. (2007) used written educational sheets coupled with verbal advice from a doctor to target dermatology patients, with significant improvements in self reported knowledge of only 3 of 7 items. While improvement in self-reported sun protection is noted at 3 month follow up, significance data is lacking. Given the weak evidence of intervention effects and the specialist group targeted, this study is probably applicable only to the population and setting studied.

Clowers-Webb et al. (2006) used similar methodology to the Jones et al. (2007) study to target transplant patients presenting for dermatology consultations. As for the Jones et al (2007) study, there is limited evidence of effectiveness in improving sun protection behaviours (at 3 and 10 month follow up) and baseline self reported knowledge is noted by the study authors as having been high. This study is probably applicable only to the population and setting studied.

Brandberg et al. (1992) did not focus on sun protective knowledge, attitudes or behaviours, only on the psychological effects of participating in a programme, delivered via discussions with medical staff and assessment by psychologists for individuals with increased risk for malignant melanoma. Geller et al. (1999) focussed on knowledge recall at one year follow up of information provided, via discussions and educational kits, to mothers of new borns, and did not measure actual sun protective behaviours. This study reported acceptance and recollection of sun protection education materials and sun protection practices for their children. These two studies are also probably applicable only to the population and setting studied.

Robinson & Rademaker (1995) used an educational discussion, supported by written material (unspecified) regarding skin cancer risk and prevention. Discussions were led by a physician and were held with both with patients who had had non-melanoma skin cancer surgery and a relative or friend nominated to help with post operative care. Analysis focussed on comparison of those who changed behaviours and those that did



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not (burning susceptibility $p = 0.0001$) and general comparisons: women increased likelihood of taking precautions against sun burn ($p = 0.001$) and men increased likelihood of wearing hats ($p = 0.001$). This study is probably applicable only to the setting studied.

Print Material

The Bologna et al. 1991 study (summarised in Table 5.2b in Appendix One) is the only study in this subcategory. It focussed on the provision of simple guidelines regarding minimising sun exposure for newborn infants. While significantly less sun exposure and time without sunscreen was noted for the intervention versus control group at 7 month follow up, there was also no significant difference in the self reported use of sun protective clothing or equipment. Further limitations for the study include the possibility that self-reported behaviours / recall may be inaccurate and that there may have been possible social acceptability bias via the methodology (telephone follow-ups). Additionally, the study authors report a non-random allocation to groups, resulting in possible selection bias.

Evidence statements:

Hospital Settings

ER2.25 There is weak evidence from an Irish CBA study combining physician's verbal advice and print material, to suggest significant improvements in dermatology patients' correct responses for only 3 of 7 knowledge based question at 3 month follow up. Improvement in self-reported sun protection behaviour was also noted but significance data was not provided (Jones et al., 2007, Ireland, CBA [-]).

ER2.26 There is weak statistically significant evidence from a USA RCT comparing verbal advice to organ transplant patients from a physician coupled with printed material compared to the provision of print material alone, although there is some evidence of more self reported sun safe behaviour among those receiving both verbal and print advice (Clowers-Webb et al., 2006, USA, RCT [+]).

ER2.27 As the Brandberg et al. (1992) B&A Swedish study [-] did not focus on sun protective behaviours, it provides no contribution to extant knowledge.

ER2.28 The Geller et al. (1999) B&A USA study [-] focussed only on recall of material at 1 year post delivery and did not provide any data on sun protective behaviours either for the infants or their mothers.

ER2.27 There is limited evidence from Robinson & Rademaker (1995) USA B&A study of likelihood of taking precautions against sunburn among women and of wearing hats among men, but not of an overall likelihood of taking precautions against excess sun exposure.

ER2.28 There is mixed evidence from a USA CBA which involved provision of simple printed guidelines to mothers of newborn infants, to suggest significantly less self



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reported sun exposure and less time without sunscreen but no significant difference in use of sun protective clothing or equipment (Bologna et al., 1991, USA, CBA [-]).

SECTION THREE: Supplementary Factors

The following supplementary factors should also be considered in assessing the relative effectiveness of the available interventions. Please note that the papers referenced in this section are derived from the synthesis author's topic expertise and have not been subject to the same literature searching, data extraction and quality assessment processes used to for the intervention studies presented in previous section.

Message Framing

Both the way in which persuasive communication messages are framed and the medium by which the communication occurs can have a significant impact on the effectiveness of the communication.

Positive framing emphasises the positive outcomes of a given action and appear to be stronger for preventative behaviour such as sun protection (Detweiler et al, 1999) and health affirming messages, particularly if there is no perceived risk from undertaking the behaviour. The level of personal involvement in a message topic also impacts on the type of framing that is more effective. Evidence suggests (Donovan & Jalleh, 1999) that in low involvement conditions positive messages are more effective, whereas the reverse is true for high-involvement conditions. Again, this may support why for example positive framing appears to have been effective in the past for sunscreen use, i.e. that messages framed as:

"If you use sunscreen with SPF or higher, you increase your chances of keeping your skin healthy and your life long"

"Using sunscreen decreases your risk for skin cancer and prematurely aged

were more effective than:

"If you don't use sunscreen with SPF 15 or higher you increase your chances of damaging your skin and bringing on an early death"

"Not using sunscreen increases your risk for skin cancer and prematurely aged skin" (Detweiler et al., 1999).

However, positive message framing may have a boomerang effect if the message conflicts with pre-existing knowledge, attitudes and beliefs or with behavioural norms (Stuart & Blanton, 2003). The perceived risk resulting from the Vitamin D media coverage may also alter perceived risk of sun protective behaviours.

Negative framing

Conversely to positive message framing, negative message framing has been found to be more effective for illness-detecting behaviour (Rothman et al., 1999), where there is uncertainty about the outcome of the behaviour, but awareness of the danger of not getting a problem detected early, for example for screening programmes that prevent a



more serious outcome. However, there is also evidence of significant barriers to these types of messages among adolescents and young adults (Miller et al., 2007).

Often, negative framing relies heavily on the usage of fear appeal, such as the fear of dying from a specific cause. It has been suggested (Rothman et al., 1999) that, if such a condition is high-involvement, fear of also dying from the same cause may have a highly motivating and behaviour changing effect. Fear appeals are least effective with people with low self-efficacy (Hastings et al., 2004).

There appears also to be cultural (Orth et al., 2007), context and situation variations, and additional confounding factors including whether new behaviour is being promoted or whether ceasing current behaviour is targeted (Snyder et al., 2004). Table 5 summarises the existing state of knowledge regarding the situations in which positive or negative framed messages have been found to be most effective.

Table 1 Summary of Generalisations regarding Positive / Negative Framing

Positively framed messages more effective	Negatively framed messages more effective
Low motivation	High motivation
High perceived efficacy No risk in behaviours Certain outcomes Acceptable in relation to perceived behavioural norms	Low or uncertain perceived efficacy Uncertain outcomes
Prevention focus (maintaining good health, appearance)	Detection / early diagnosis

An additional factor is the possible erosion of the effectiveness of fear appeals over time. The ongoing usage of fear appeals can in fact lead to complacency as people start to no longer respond with fear, but rather with indifference to social marketing campaigns (Hastings et al, 2004).

Conversely, the usage of fear appeals may well lead to heightened anxiety in some individuals, which in turn may cause additional burden on the health system that has to deal with those individuals. Stronger negative emotions or concerns may be more evident in those not in the priority target group (Jones & Owen, 2006; Cho & Salmon, 2007). A well known example of this are “worried well” patients who may attend screening clinics for reassurance rather than because they have symptoms of a potential medical problem (Weatherhead & Lawrence, 2006).

Reactance Effects

The theory of psychological reactance (Ringold, 2002; Brehm & Brehm, 1981) states that direct or potential perceived threats to personal freedom, such as consumption of specific products or engaging in particular behaviours, may be resisted. People become motivated by the perceived threat itself, rather than the actual consequences of the threat, to reassert and regain control of their freedom. Engaging in the threatened



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behaviour is one means of re-establishing this freedom (Rummel et al., 2000). Reactance effects appear to be strongest when the threatened freedom is perceived as important and the affected individual perceived that their 'counterforce' efforts will achieve personal control.

In terms of persuasive communication such as mass media public health intervention programmes, reactance may generate actions that resist or are the opposite of those desired by the individuals or organizations seeking to influence both attitudes and behaviours. Reactance effects explain not only why some public health interventions, including those focused on sun protection, may not be effective, but also why they may produce effects contrary to those intended (Buller et al., 1998).

Barriers to communication effectiveness - adolescents and young adults:

Normative beliefs

Strong normative beliefs exist, particularly among young people, about the social value of suntans and prevailing social norms regarding the attractiveness of suntans and acceptable behaviours modelled among peers (Lower et al, 1998). Numerous studies indicate that adolescents are aware of risks but that social norms and perceptions override consideration of personal actions if they are not compatible with peer behaviour (Lowe et al., 1999; Hillhouse et al., 1997; Branstrom et al., 2004). These studies all highlight the weaknesses inherent in basing interventions primarily on rational aspects without considering the impact of emotional factors.

Social norms cannot be changed in the short term. Therefore, a coordinated, long-term, national, regional and local strategy that addresses the role of popular media and the influence of organisations such as the fashion industry needs to be developed (Eagle et al., 2009).

Unrealistic Optimism / Personal Risk Denial

An additional challenge to effective communication of health risks from excessive sun exposure relates to unrealistic optimism, bias and denial of personal risk. These effects are also referred to as optimistic bias or disengagement beliefs (Kleinjan et al., 2009) in which individuals estimate their own risk of negative health outcomes as lower than the wider population, a topic well-documented in the literature (Sjoberg et al., 2004, McMath & Prentice-Dunn, 2005; Luo & Isaacowitz, 2007).

Thus, people may be aware of the risks of excess sun exposure but may fail to use the knowledge in a consistent way to reduce their own personal risk (Branstrom et al., 2006). Similar to social norms, unrealistic optimism is resistant to change and information provision alone, such as through mass media, has generally little impact (Morton & Duck, 2001). The literature indicates that interventions focussing specifically on skin cancer risk and detection should stress both the high risk of skin cancer and also the personal risk – and the benefits of using effective sun protection strategies

Children's cognitive development

Many reported interventions have taken place within a school environment, but do not explicitly acknowledge that children's cognitive abilities are not yet fully developed and that children are influenced by advertising in different ways to adults (Friestad & Wright, 2005; Moses & Baldwin, 2005; Mallalieu et al., 2005).

While there are wide variations in children's abilities at any specific age and also variations across socio-economic and cultural dimensions that have not been adequately explored, in general there appear to be relatively clear differences between two age groups. Children between the ages of seven and eleven need to be prompted to retrieve and use information previously gained, such as through sun protection education; they are unable to link such information to current situations without some form of reminder (Moses & Baldwin, 2005; Neeley & Schumann, 2004). Children under the age of seven are unable to use prior information even when prompted; their undeveloped cognitive skills equate to a lack of effective cognitive defences (John, 1999). School-based interventions will benefit from reinforcement in the home and via staff at sports and related facilities.

Criticism of the Stages of Change Model

This model was developed in the 1980s by Prochaska and Diclemente and subsequently refined in later years (see, for example, Prochaska et al., 1991) to explain chronic behaviour, specifically smoking. The theory suggests that individuals pass through the following stages sequentially, but also return to prior stages before moving on to permanent behaviour change stages:

Pre-contemplation: not thinking about ceasing behaviour / adopting new behaviour
Contemplation: thinking about ceasing behaviour /adopting new behaviour
Preparation: planning to stop behaviour / adopt new behaviour in near future
Action: stopped behaviour / initial behaviour change made in recent past
Maintenance: stopped behaviour / maintained new behaviours for more than 6 months
Termination: permanently stopped old behaviour, adopted new behaviour

It has been claimed that interventions tailored to the particular stage of the individual behaviour will be effective (Glanz & Maddock, 2000). However, considerable confusion exists due to different versions of this model being used, some with additional stages or different definitions of stages, together with differences in questionnaires used to measure stages; the result is a lack of comparability across studies (Etter & Perneger, 1999; Littell & Girvin, 2002). More seriously, critics suggest that there are major flaws in the model, including arbitrary boundaries between stages, the assumption that plans are logical and unwavering (West, 2005). Additionally, critics claim it neglects the deep-rooted and relatively non-conscious nature of many behaviours (Robinson & Berridge, 2003).



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The harshest critics of the model suggest that it simply states the obvious, i.e. that people who want or specifically plan to change behaviours are most likely to be successful than those who do not (West, 2005). Further, it is claimed that evidence put forward in support of the model owes more to rhetoric than quality evidence and that the model does not translate readily to behaviours other than smoking, i.e. it lacks external validity (Whitelaw et al., 2000). These critics assert that the model has some use as a descriptive tool but does not provide superior predictive power compared to other behaviour theories. For example, in a study of the promotion of exercise behaviour, stage-based interventions were not found to be more effective than other interventions (Naylor et al., 1999). There is some evidence that, even for interventions targeting smokers, stage-based interventions are also no more effective than other interventions (Quinlan et al., 2000).

This debate does, however, raise the issue of the importance of sound theoretical frameworks for the development and implementation of interventions. Evidence of this was far from explicit in most of the studies reviewed in this report. We have therefore provided an overview of the rationale and recent debate regarding theoretical foundations for the type of behaviour change that is the focus of sun protection / skin cancer detection interventions in the following section.

Theoretical Foundations

Theories have limitations; due to the complexity of human behaviours, most major theories predict only 40 – 50% of behaviour (Armitage & Conner, 2000 & 2001). However, theory-driven approaches to intervention development have been found to lead to more persuasive messages across the range of demographic and socio-economic groups (Schneider, 2006) and there is substantial evidence that, when theories are used to inform the development of interventions in practice, the interventions have proven more successful than interventions based on “practical experience” alone (Fishbein et al, 2001, 2002).

“Theories of behavioural prediction and behaviour change are useful because they provide a framework to help identify the determinants of any given behaviour, an essential first step in the development of successful interventions to change that behaviour. Clearly, the more one knows about the determinants of a given behaviour, the more likely it is that one can develop an effective communication or other type of intervention to reinforce or change that behaviour” (Fishbein & Capella, 2006: 1).

The decision to change behaviours is influenced by a complex range of factors and different population segments may be influenced to a greater or lesser extent by social norms, beliefs or perceived ability to change their behaviour (Fishbein & Capella, 2006). Psychosocial variables, including attitudes, beliefs and norms, underpin behaviour differ across cultures, and also change over time (Zinkhan & Hirschheim, 1992).

“The relative importance of these psychosocial variables as determinants of intention will depend upon both the behaviour and the population being considered”*“one behaviour may be primarily determined by attitudinal*



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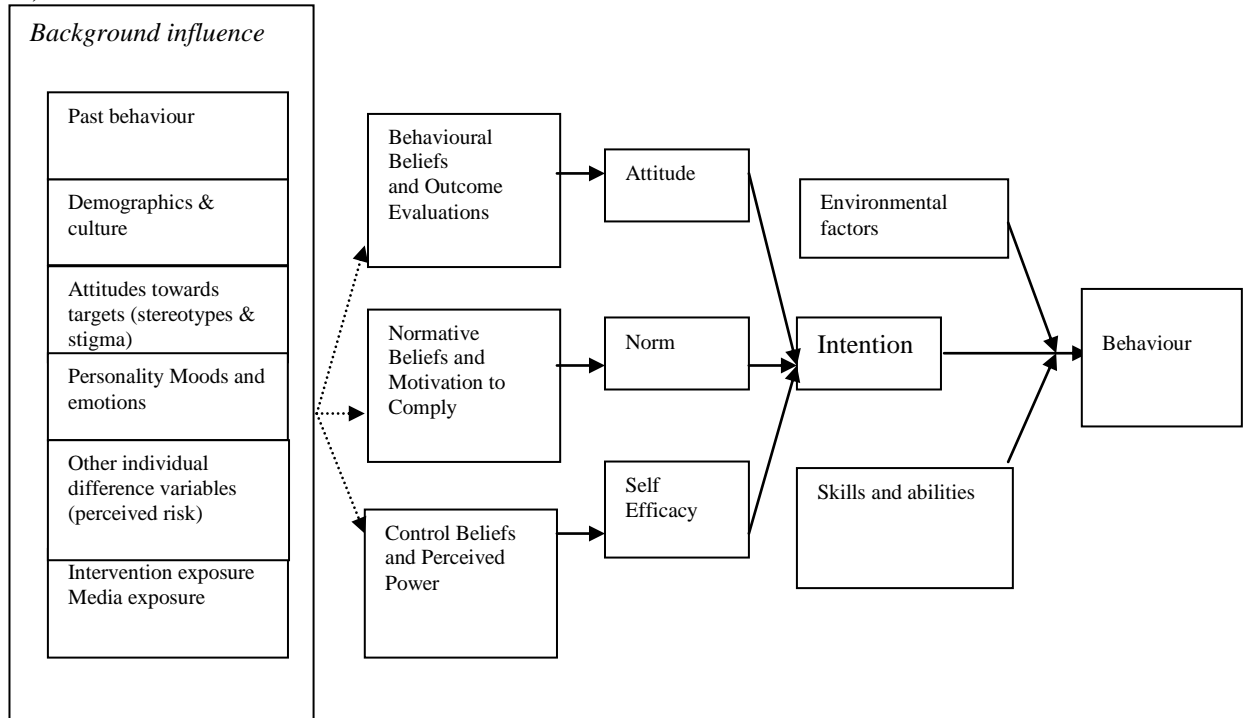
considerations, whereas another may be primarily influenced by self-efficacy. Similarly, a behaviour that is attitudinally driven in one population or culture may be normatively driven in another” (Fishbein & Capella, 2006: 3).

We illustrate the complexity of factors influencing behaviour change by the use of one theoretical model shown in Figure 1. The Integrative Model of Behaviour Change is a development of earlier work on the Theory of Reasoned Action (Ajzen & Fishbein, 1980) and the Theory of Planned Behavior (Ajzen, 1991) and contains three fundamental propositions. Firstly, behaviour is most likely to occur if willingness, intention or commitment to attempt the behaviour is strong. Secondly, self-efficacy, i.e. the necessary skills and abilities required to perform the behaviour must exist or support given to gain them. Finally, attempts to change behaviour will be most successful if there are no environmental or other constraints preventing effective behaviour occurring (Fishbein et al, 2002; Fishbein & Capella, 2006). As beliefs underpin attitudes, norms and self-efficacy, the role of interventions, particularly their communication components, is to attempt to increase the strength of beliefs that will promote desired behaviours and reduce the strength of beliefs that support behaviours seen as problematic.

The effective use of theories such as this is dependant on research to understand what attitudes and beliefs may underpin or inhibit particular behaviour and their relative strengths across different population segments.

We note that NICE guidance exists on the general area of planning, delivering and evaluating interventions or programmes which aim to support attitude and behaviour change (<http://guidance.nice.org.uk/PH6/Guidance/doc/English>) and recommend that this guidance document be used in conjunction with any depth analysis of the applicability of relevant theoretical concepts.

Figure 1: Integrative Model of Behavioural Prediction and Change (Fishbein, 2000)



What is lacking in the literature is a systematic review of the main behavioural theories as they have been specifically applied to sun protection and skin cancer prevention and detection. This should be considered in the wider context of encouraging those implementing interventions to structure descriptions of the foundations on which interventions are planned and implemented in ways that enable the contribution of concepts and theories to be evaluated.

It should be noted that the factors identified in this model are compatible with recent policy statements calling for recognition of the impact of the context of people's lives and the environment in which they live, work and relax, e.g.:

“Tackling today’s threats to health means examining the way we live. This is a challenge that we have to embrace. We have to see the world as it is. We have to understand the reality of how people live their lives, not make assumptions about how things are. We must be sensitive to people’s needs and work with them to make the changes that they can and want to. Why? Because once we do this, we really are better equipped to support people in changing their lifestyles for the better. Without such a people-centred approach we are blind to the challenges people face and risk providing support that is inappropriate and ineffective” (Department of Health, 2006).



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Additionally, we must recognise that interventions do not appear in isolation – there are a number of competing and confounding factors that may reinforce or counter intervention activity. These are discussed in the next section.

Confounding Factors: Communications reinforcing or countering intervention exposure

Editorial e.g. Vitamin D / coverage of celebrities / portrayal of sun protection behaviours

The Vitamin D debate is prominent in consumer media, with headlines such as those shown in Table 1 below – which covers only the month of May 2009.

Table 1: Sample of Consumer Media and Internet Site Headlines Regarding Vitamin D

1 May 2009	Brown, D. W.	Aid could be found in Vitamin D	The Boston Globe http://www.boston.com
5 May 2009	Searing, L.	No proof: Study could not link low Vitamin D to colds	The Washington Post (via http://www2.journalnow.com)
12 May 2009	-	Is there a link between Vitamin D, flu immunity?	Virgo Publishing www.vpico.com
13 May 2009	-	Vitamin D helps reduce diabetes risk	Private Healthcare UK
13 May 2009	-	Vitamin D deficiency common in premenopausal women with breast cancer despite supplementation	http://professional.cancerconsultants.com
14 May 2009	-	Wrong sunlight can lower your Vitamin D levels	www.thehealthierlife.co.uk
15 May 2009	-	High Doses of Vitamin D may prevent relapses	http://ms.about.com
16 May 2009	Hope, J.	Millions face serious health risks over lack of Vitamin D in diets	www.dailymail.co.uk
16 May 2009	-	Elderly need more ‘sun vitamin’	http://newsvote.bbc.co.uk
21 May 2009	-	Vitamin D ‘key to healthy brain’	http://newsvote.bbc.co.uk
22 May 2009		New model of Cancer development: Low Vitamin D levels may have role	Science Daily www.sciencedaily.com
25 May 2009	Bakalar, N.	Nutrition: Vaginal Infection Tied to Low Vitamin D	The New York Times www.nytimes.com
26 May 2009	-	Vitamin D may lessen Age-related Cognitive Decline	http://www.medicalnewstoday.com
26 May 2009		Vitamin D doesn’t protect against cancer	Doctor NDTV http://doctor.ndtv.com
29 May 2009	-	Low Vitamin D levels may impair thinking	www.reuters.com
31 May 2009	Chandhoke, H.	Boosting levels of Vitamin D ‘could cut cancer by up to 25%’	www.dailymail.co.uk



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The link between Vitamin D levels and a wide range of medical conditions tends to be somewhat more cautiously reported in the academic literature than in the consumer media (see, for example, Kimlin, 2008) and academic studies that have failed to find a direct relationship between Vitamin D levels and cancer prevention tend not to be reported at all by consumer media (Youll et al., 2009).

The impact of the consumer media coverage cannot be ignored. In Australia, a large-scale survey of Queensland residents (Youll et al., 2009) found significant increases since 2004 in the percentage of the population believing that the use of sun protection creams increases the risk of Vitamin D deficiency and that Vitamin D helps prevent cancer. Many respondents also significantly overestimated the amount of sunlight needed to maintain healthy Vitamin D levels. While the impact of consumer media editorials has not yet been directly investigated, the authors of the Queensland study suggest that misconceptions regarding Vitamin D and sun exposure may influence people to reduce existing sun protection behaviours (Youll et al, 2009).

Editorial and Programme content e.g. holiday / beach activity and celebrity portrayal

The portrayal of sun-related behaviours in television programmes and in print media is also likely to impact on the effectiveness of interventions. We cannot locate any specific content analyses for television programmes, however two major content analyses of print media (Dixon et al., 2007, Miner & Baker, 1994) indicate that deep tanning is glamorised, poor sun-protective behaviours are common and a substantial quantity of implicit messages are misleading or contradictory.

Preadolescent girls use media images as a basis for deciding on ideal physical attractiveness, even though the images portrayed are unrealistic or represent poor role models and unwise behaviours (Fabrianesi et al., 2008). Celebrity role models such as Paris Hilton and Jessica Simpson who maintain year-round tans and who openly endorse the use of sunbeds are known to influence the tanning behaviours of teenage girls (Rawe & Scully, 2006).

There have been calls to encourage producers / editors to improve the portrayal of sun protection behaviours, given the positive impact of entertainment-based education strategies in areas such as cardio-vascular health and immunization (McDermott et al, 2005).

Commercial media (sun cream manufacturer and key retailers)

A further consideration is the impact of commercial organisations, including advertising and public relations. The theme identified as common to all major suncare manufacturers in recent years is to be safe in the sun (Bainbridge, 2009). Commercial organisations spend a substantial amount promoting this message as part of the promotion of their own products as shown in Tables 2 – 4 below. The expenditure indicates that these organisations consider suncare to be an important market. There are obvious potential synergies if partnerships or collaborative activity could be established with one or more of these organisations – and potential dangers if official



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health messages and those being promoted by commercial organisations are not integrated and consistent with each other.

Table 2: Suncare Manufacturers: Value and share (2006 – 2008)

	2008		2007		2006		% change
	£m	%	£m	%	£m	%	2006-08
Boots Soltan	62	24	60	+12.7	55	23	+12.7
Garnier Ambre Solaire (L'Oréal)	57	22	57	+3.6	55	23	+3.6
Nivea Sun	44	17	42	+7.3	41	17	+7.3
Piz Buin	18	7	17	-5.3	19	8	-5.3
Avon	18	7	15	+5.9	17	7	+5.9
Solar Expertise (L'Oréal)	5	2	5	-	5	2	-
Johnson's	3	1	2	+50.0	2	1	+50.0
Own-label	28	11	27	+16.7	24	10	+16.7
Other	23	9	22	+4.5	22	9	+4.5
Total	259	100	248	+7.9	240	100	+7.9

Source: Mintel estimates, as reported in Marketing magazine via Bainbridge, 2009

Table 3: Suncare Retailers: Value and share (2006 – 2008)

	2008		2007		2006		% change
	£m	%	£m	%	£m	%	2006-08
Boots	109	42	107	43	108	45	0.9
Multiple grocers	54	21	50	20	41	17	31.7
Drugstores	34	13	32	13	29	12	17.2
Other chemists	21	8	20	8	22	9	-4.5
Department Stores	18	7	17	7	17	7	5.9
Direct sellers	18	7	17	7	19	8	-5.3
Johnson's	3	1	2	+50.0	2	1	+50.0
Others including online	5	2	5	2	5	2	0
Total	259	100	248	+7.9	240	100	+7.9

Source: Mintel estimates, as reported in Marketing magazine via Bainbridge, 2009

Table 4: Suncare Advertisers by Adspend

	2008	2007	2006
Garnier	3,745,532	5,862,963	3,602,991
Boots	3,079,593	2,577,489	1,613,928
Belersdorf UK	2,330,005	2,517,037	2,103,204
L'Oréal Paris	2,124,462	2,036,378	2,398,331
Keyline Brands	733,884	578,513	481,851
Johnson & Johnson	525,678	553,884	829,786
Playtex	310,334	106,521	77,268
Coty	180,156	393,256	249,330
Superdrug	168,987	140,907	1,014,258
Clarins	4,532	275,010	434,030

Source: The Nielsen Company as reported in Marketing magazine via Bainbridge 2009

New Media and Simultaneous media use

The above data provide estimates of the impact of traditional mass media but cannot provide any estimates of the impact of new and emerging media forms (Rice, 2005). Traditional media still appears to play a significant role in people's lives (Looker et al, 2007) but increasingly media are used simultaneously (Pilotta et al, 2004; Pilotta & Schultz, 2005), such as radio listening and internet-based activity occurring at the same time, with the prospect of conflicting or confusing messages if messages gained from these sources are not consistent.

Source Credibility: Formal versus informal information sources

An additional factor is that people draw on a range of formal and informal sources for information (Buller et al, 1995). What is not known in the sun protection / skin cancer detection sector is which information sources are used and valued across different segments and how credible the different sources are seen to be. Of more concern is the lack of trust in government-originated information:

“Only 6% of the population trust and act on all government advice regarding diet. 37% said they did not trust any government advice and 20% said they completely ignored it”(National Social Marketing Centre, 2006: 18).

This study did not specifically examine the perceived trustworthiness of Department of Health, NHS and related organisations, however it is likely that the commercial organisations noted above have strong credibility.

Concern is evident regarding information provided by government sources, with the blunt question having been asked: “does government-sponsored health promotion have any chance of success where the government is the enemy?” (Callahan, 2001: 83).

Effectiveness of mass media interventions

Awareness and behaviour change.

The provision of information alone is insufficient; awareness is necessary, but not of itself sufficient (Capella, 2006; Smith, 2008); the literature contains several examples of sun protection interventions that have raised awareness in the short term but not changed behaviour (Melia et al, 2000). Information about sun protection and skin cancer is largely passively acquired via consumer media, with active searching occurring only when it is needed to resolve a specific problem (Eadie & MacAskill, 2007). Information must therefore be accessible, personally relevant, motivating and actionable (Gerteis et al, 2008).

Women have higher levels of knowledge about sun exposure risks and also higher levels of belief regarding personal susceptibility (Rasmussen & O'Connor, 2005). Men tend to be a more difficult group to reach and motivate, suggesting that exposure to mass media messages may be ineffective.

Community-based interventions

Community-based interventions employing multiple methods of delivery are viewed by policy makers as key to achieving population-level health-related behaviour change (Merzel & D’Afflitti, 2003). The involvement of multiple partners with different objectives, resources and competencies presents coordination and control challenges.

Evaluation of the impact of a multi-component, multi-level intervention presents specific methodological challenges. Secular trends and variations in local conditions, community penetration and variations in intervention delivery present additional challenges (Gabriel, 2000). Controlling for confounding factors at a community level is impossible (Mistral et al., 2008).

Readability Issues

In addition to decisions regarding the type of messages to be communicated, there are concerns with the style of information delivery used currently and with readability issues for the significant proportion of the population who have literacy issues. The implications of low functional literacy have been extensively researched in the context of health over the last thirty years (Rudd et al, 1999; Adkins et al, 2001) with consistent findings that most written material is at a level well beyond the ability of many people to understand it. Almost four out of ten adults in some parts of the UK struggle with literacy (Basic Skills Agency, 2000) and it was estimated that in 2006, up to 16 million adults, nearly half the UK workforce, have reading skills no better than that of children leaving primary school (Smithers, 2006). Table 2 presents the adult reading skill levels for the UK in relation to the primarily American literature (see, for example, Hoffman et al. 2004; Wallace and Lemon 2004; Mumford 1997) and the National Standards for Literacy (Department for Education and Skills – DfES, 2003).



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Table 6: Reading Skill Level by Age Cohort as indicated in the literature and the National Standards for literacy (see, for example, Hoffman et al. 2004; Wallace and Lemon 2004; Department for Education and Skills – DfES, 2003).

<i>School level</i>	<i>Approximate Age</i>	<i>Approximate Grade/ Reading Skill Level Expected</i>	<i>UK National Curriculum Level</i>	<i>UK Adult Literacy Level</i>	<i>UK Population %</i>		
<i>Nursery Junior / Primary School</i>	3-5	1	1	Entry Level 1	3		
	6	2	1				
	7	3	2	Entry level 2	2		
	8	4	2				
	9	5	2				
<i>Secondary School</i>	10	6	2	Entry level 3	11		
	11	7	3				
<i>Further Education</i>	12	8	3			Level 1 Upper secondary attainment	40
	13	9	3				
	14	10	3				
	15	11	4	Level 2 or above	44		
	16	12	5				
	17	13	5				
<i>Higher Education (College / University)</i>	18	14	6 to 8	Level 2 or above	44		
	19	15					

The average reading skill level of the overall adult population is often overestimated and is some 3 - 5 grades below the level likely to have been achieved at completion of formal education (Shea et al., 2004; Brownson et al, 1999). Thus, an adult who left secondary school at age 15 (after 10 – 11 years of formal education) can be expected to have a post-education reading level of a person completing 8 years of formal education and a person with a tertiary undergraduate degree a level of 10 - 12.

However, most health-related information material assumes a higher reading ability than actually exists (Mumford, 1997; Wallace & Lemon, 2004). Thus material aimed at the general population should ideally be written at the reading level of a person completing 8 – 9 years of formal education.

Supplementary Factors: Summary

- Several studies reviewed in the synthesis section indicated promise for message framing and related strategies, however this field requires a systematic review of evidence and guidance regarding evidence collection and presentation for future studies in the area. The available evidence indicates that positive-framed messages will be more effective in relation to prevention strategies and negative –framed messages more effective for detection strategies. However whether this can be generalised across all sectors of the population is unclear and the potential impact of the current Vitamin D debate suggests that the issue may now be more complex.
- Fear appeals should be used with caution as their effectiveness erodes over time; additionally fear appeals may lead to heightened anxiety among some groups, even if they are not the primary target.
- Messages that contain actual or perceived threats to freedom or which contradict perceived social norms may result in active ‘reactance’ effects, with the message being actively opposed and behaviours contrary to those intended possible.
- The normative beliefs regarding the social value of acquiring a sun tan means that rational understanding of health risks may be overridden by more emotional factors; social norms cannot be changed in the short term and messages that appear to challenge these norms are likely to be ineffective.
- Unrealistic optimism and denial of personal risk is associated with social norms; knowledge may not be used in a consistent way to reduced personal risks.
- Interventions directed at children must take into account the limitations of children’s cognitive development at different age groups. Children under seven cannot use prior information in different settings even when prompted; children aged 7 – 11 need to be prompted to use information, such as that gained in a classroom situation, in settings other than those in which the information was gained.
- The use of theoretical models to guide intervention development, while supported by evidence of improved effectiveness is problematic. For example the Stages of Change Model, used in two of the reviewed interventions, has been severely criticised. Other models, such as the Integrative Model of Behaviour Prediction and Change offer promise through consideration of a wide range of background factors known to influence attitudes, norms and self-efficacy beliefs.

Confounding Factors: Summary

- There is evidence from Australia that the current Vitamin D debate may impact on sun protection message reception; a review of recent media headlines suggests that similar effects may occur here.
- Media portrayal, both in editorial and programme content, of sun-related behaviours such as holiday / beach activity and the glamorising of celebrity tanning is likely to influence preadolescent girls in particular and dialogue with the media would appear warranted.
- The impact of the substantial advertising expenditure by commercial sun cream manufacturers and retailers must also be considered. The current message from this sector is to be safe in the sun; given their substantial marketing communication investment, there are potential synergies if partnerships can be established – but also dangers if official health messages are not consistent with the message themes of the commercial organisations.
- The need for integration and consistency is also evident from the growth of new media and simultaneous media use – with the prospect of conflicted or confusing messages from various sources.
- Given evidence that government-originated information is not trusted by a majority of the population, there is a clear need to determine what information sources are used and valued in relation to sun protection and skin cancer prevention / detection.
- While mass media interventions have been proven successful on raising awareness levels, they are rarely sufficiently strong to generate behaviour change, suggesting other information sources should be investigated for the latter.
- Community-based interventions present specific challenges in terms of variations in local conditions and, if multiple partners are involved, also issues relating to coordination and control.
- A long-neglected factor is the provision of a large proportion of health-related material in language more complex than the average person can comprehend. Some 40% of the population have some degree of literacy problems and it is recommended that material should be written at the reading level of a person just entering secondary school.

Summary and Conclusions

There were several major challenges in assessing the available studies. Firstly, the methodology used in several studies was unclear, making it difficult to assess the effect of the medium versus the material used. Secondly, the reporting of the impact of several studies was deficient with inconsistent, minimal or no statistical data available. Additionally, the majority of the studies placed emphasis on assessing knowledge rather than actual behaviour change, particularly in the longer term. Furthermore, very few used validated outcome measures, rather self reported outcome measures were used.

None of the studies reviewed offers sufficiently robust evidence to enable them to be considered applicable to a wide range of targets and settings without considerably more information being provided on detailed methodology and strength of findings. The evidence base may be considerably stronger than indicated by the available material.

The original review was intended to provide evidence to support recommendations regarding the following questions.

- 1. What are the effective and cost effective ways of providing information to change people's knowledge, awareness and behaviour?*
- 2. What content do effective and cost effective primary prevention messages contain? What is the most effective and cost effective content?*

A number of studies suggested evidence of effectiveness on knowledge-related outcomes, however very few demonstrated effectiveness relating to sun protection or skin cancer prevention behaviours. Very few studies provided sufficient detail of the content of the intervention or were not designed in such a way as to enable comparison of different components or content. Consequently, it was not possible to determine what content or component of the intervention was the most effective. There is therefore insufficient evidence available to enable a definitive answer to be provided to either question.

Although aspects of message framing do show promise and this area is recommended as requiring further investigation. However the lack of evidence of control for potential confounding factors appears to be a widespread limitation within the studies reviewed.

Finally, the supplementary factors and additional confounding factors discussed in Section Three must be considered in assessing the extant evidence and in guiding the design, implementation and evaluation of future interventions.

SECTION FOUR: Recommendations for Future Reviews and Research

It is recommended that greater dialogue be commenced with news / consumer media and commercial sun care product manufacturers and retailers regarding accurate portrayal of effective sun protection and skin cancer prevention / detection issues. In addition, such dialogue should endeavour to ensure greater integration of future intervention messages with the commercial sector. It is also likely that these organisations may be able to provide access to data that would enable a systematic review of the impact of their activity to be measured and input into future activity to be gained.

There are significant deficiencies in the structure and content of many of the intervention reports contained in the papers examined. This does not necessarily mean that the studies themselves were deficient, merely that there is a lack of key information provided, particularly in relation to the details of the methodologies used to enable identification of exactly which component of interventions had what effects. Lack of intervention detail in relation to prior or other interventions occurring at the same time also inhibits recommendations regarding potential transferability of studies beyond the populations and settings in which they occurred. Again, dialogue with researchers regarding reporting formats and evidence presentation is encouraged. This could extend to checklists for presentation of material across a range of intervention types (i.e. not restricted to RCTs and LIS based studies).

The complete absence of studies examining specific types of interventions targeting population segments such as children represents a significant gap in the knowledge base. There is likely to be a considerable volume of evidence available from organisations such as SunSmart in Australia, New Zealand and the UK regarding the nature and impact of interventions targeting children, but even if it is available, this may not be presented currently in a format that meets the original selection criteria for the WMHTAC review. It would be useful to approach these organisations in each of the Australian states (separate but linked activity is undertaken in individual states), and also in New Zealand and in the UK to identify what data is available and to potentially work with these organisations to obtain future data in a format that allows for direct comparison of effects and effectiveness to be made.

Also, liaison should be undertaken with health-based organisations such as the South West Public Health Observatory regarding the newly established Skin Cancer Hub which contains a growing range of case studies reporting on specific interventions to encourage inclusion of specific information in case studies that will aid in future reviews.

Note: this strategy was recently successfully used by the National Social Marketing Centre (NSMC). After several years of relatively free-form intervention reporting on their on-line social marketing case study database, a series of specific criteria were provided and existing case studies were revised and reformatted by NSMC staff in



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conjunction with the studies' original authors. Where key evidence criteria were not met, the case studies were not included on the new database.

There is also opportunity to provide advice and support to the research community, particularly in regard to controlling for confounding or contaminating factors. This support could extend to encouraging consistency and possibly collaboration between researchers in relation to research structures and the use of validated research instruments.

The impact of legislative or regulatory changes on specific segments of the population such as outdoor workers and also other segments such as those involving schools or sports clubs for children in regard to mandatory sun protection measures including clothing, sun screen use and other factors such as shade provision should be factored into future intervention consideration.

There is sufficient evidence in the studies that experimented with different forms of message framing to warrant this area being explored in more detail. The findings of the reviewed studies, while lacking generalisability due to reporting shortcomings indicate that this factor holds promise. This is also consistent with the material relating to message framing reviewed in Section 3, however the Australia experience in relation to the impact of the Vitamin D debate on sun exposure practices (Youl et al., 2009) suggests that messages should also contain clear information and guidance regarding the balance between Vitamin D requirements and sun exposure.

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Note:

- * indicates study reported by WMHTAC in main report;
- ** indicates study reported in WMHTAC supplementary report (one of two studies originally misclassified);
- # indicates Before & After study noted but not analysed in WMHTAC report

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