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# PROVIDING PUBLIC HEALTH INFORMATION TO PREVENT SKIN CANCER

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*Review of effectiveness and cost-effectiveness*

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## Executive Summary

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## West Midlands Health Technology Assessment Collaboration

The West Midlands Health Technology Assessment Collaboration (WMHTAC) is an organisation involving several universities and academic groups who collaboratively undertake research synthesis to produce health technology assessments. Most of our members are based in the Department of Public Health, Epidemiology & Biostatistics, University of Birmingham, however other members are drawn from a wide field of expertise including economists and mathematical modellers from the Health Economics Facility, University of Birmingham.

WMHTAC produce systematic reviews, health technology assessments and economic evaluations for NHS R&D HTA programme (NCCHTA), the National Institute for Health and Clinical Excellence (NICE), and for the health service in the West Midlands. WMHTAC also undertakes methodological research on research synthesis, and provides training in systematic reviews and health technology assessment.

### Name of other institution(s) involved

WMHTAC work in close collaboration with the Peninsula Technology Appraisal Group (PenTAG) with respect to providing support to the CPHE.

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## Executive Summary

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The National Institute for Health and Clinical Excellence ('NICE' or 'the Institute') has been asked by the Department of Health (DH) to develop guidance on public health interventions for the NHS and local authorities aimed at preventing skin cancer, specifically: the provision of information, physical changes to the environment and the supply of sun protection resources. This referral is being undertaken in several phases and the current phase focuses on provision of information. Physical changes to the environment and the supply of sun protection resources will be covered in later phases.

This report details two systematic evidence reviews on the effectiveness and cost-effectiveness of the provision of information to prevent skin cancer. A second evidence report focuses on qualitative evidence related to information provision and a third report outlines de novo economic analyses on the cost-effectiveness of methods of information provision.

The objectives of this report are to address the following elements of the referral:

What are the most effective and cost-effective ways of providing information to change people's knowledge, awareness and behaviour and so prevent the first occurrence of skin cancer attributable to UV exposure?

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

## Methods:

Methods were guided by the Methods for Development of NICE Public Health Guidance 2006. A protocol was developed by the research team in conjunction with the NICE project team, detailing the key elements of the systematic reviews.

### **Identification of Studies:**

A series of separate searches were undertaken for each review. Search were undertaken in bibliographic databases (including Cochrane Library, MEDLINE, EMBASE, CINAHL, NHS EED) and web resources (including EPPI-Centre, Public Health Observatories, Cancer Research UK). The key concepts of the search of bibliographic resources were the combination of search for 'skin cancer' and 'methods of primary prevention' and where possible the use of methodological filters to target specific study designs. The following limits were placed on search strategies: published from 1990 onwards; published in English language. Searches were undertaken up to end August/Beginning September 2008.

In addition to the review of effectiveness and cost-effectiveness primary studies, systematic reviews were identified to facilitate the identification of further primary studies in addition to those found through the targeted searches. References submitted by stakeholders were also used.

### **Study Selection:**

For each review the title and abstract of identified studies were screened for relevance using pre-specified checklists. Full copies were sought for all articles considered relevant and these copies were then assessed for adherence to the full inclusion criteria for the appropriate review.

The inclusion criteria were the same for both the effectiveness and cost-effectiveness reviews except that different studies designs were included. The criteria were:

- Populations:
  - Everyone

- Interventions (universal and targeted) aiming at primary prevention of skin cancer were:
  - One-to-one or group-based verbal advice (with or without use of information resources)
  - Mass-media campaigns
  - Leaflets, other information or teaching resources or printed material including posters
  - New media: the Internet (including social networking sites), emedia and text messaging

These could be delivered in various settings (such as the NHS, schools and workplaces) or by a range of people (such as general practitioners, practice nurses, pharmacists, early childhood services, and teachers).

- Comparator:
  - Current information provision, do nothing or any other intervention listed above
- Locations:
  - Developed/OECD countries
- Time period considered:
  - 1990 onwards

Studies of the following designs were included in the effectiveness review:

- Randomised controlled trials (RCTs)
- Longitudinal intervention studies (i.e. there was at least one follow up measure after baseline) such as controlled before and after, cohort, case control, before and after, and interrupted time series

Studies of the following design were included in the cost-effectiveness review:

- Randomised controlled trials (RCTs) with cost-effectiveness, cost consequences, cost-benefit analysis, cost-utility, cost-minimisation or net monetary (cost) and benefit data – the perspective adopted (employer, societal, governmental) will not affect include/exclude decisions
- Longitudinal intervention studies (i.e. there is at least one follow-up measure after baseline) with cost-effectiveness, cost-consequences, cost-benefit, cost-utility, cost-minimisation or net monetary (cost) benefit data
- Decision analytic models and any other econometric and/or epidemiological models that contain relevant effectiveness and/or economic data or methods of analysis

#### **Quality assessment:**

Quality assessment of studies meeting the inclusion criteria was undertaken using the appropriate assessment tool from the NICE methods manual. Two reviewers independently assessed the quality of each included study. Each study was given a summary quality rating (++ , + or -).

#### **Data Extraction:**

Data extraction was undertaken using formats outlined in the NICE methods manual, adapted to reflect the parameters relevant to the reviews. One reviewer extracted data for each full paper and a second reviewer checked a proportion of the data extraction tables for accuracy.

Data on primary and secondary outcomes relevant to each review were extracted.

For effectiveness studies primary outcomes were:

- Reduction in the incidence of morbidity and mortality from non-melanoma and malignant melanoma skin cancer attributable to natural and artificial UV exposure. This may be measured in terms of a reduction in the incidence of sunburn or cumulative sun exposure etc.

- Increase in knowledge and awareness that can lead to a reduction in the incidence of exposure/over-exposure to natural and artificial UV.
- Changes in behaviours that can lead to a reduction in the incidence of exposure/over-exposure to natural and artificial UV.
- Increase in knowledge and awareness of the ways to prevent non-melanoma and malignant melanoma skin cancer attributable to natural and artificial UV exposure.
- The contents of an intervention that is effective and cost-effective.
- Any adverse or unintended (positive and negative) effects of the intervention

For the cost-effectiveness review primary outcomes were broadly any related to the economic assessment of interventions.

For both reviews, if study a study met the inclusion criteria, then data on any other outcomes considered relevant were extracted. As such, secondary outcomes were decided iteratively on a case by case basis.

### **Reporting Framework:**

Studies were grouped by intervention category (verbal, mass media, new media, printed materials or combinations thereof) and comparator (current provision/do nothing, or one of the intervention categories) combinations. Each of these themes were then subdivided into children or adults. Each of these subcategories was further divided by the interventions setting (e.g. school, university, workplace). In the case of a school setting there were further subdivisions, where possible or evidence allowed, by age bands corresponding approximately to UK school age ranges.

**Volume of evidence:**

For the effectiveness review over 34000 articles were identified and 136 articles met the inclusion criteria. However, 34 of these evaluated an intervention containing elements not relevant to this referral and where relevant data could not be disaggregated.

Forty-nine RCTs, 18 controlled before and after studies and 26 before and after studies were available for analyses.

The before and after studies were not analysed in this report due to the availability of the other study designs and the time available for the review. A brief summary of these studies may be made available at a later date.

Of the controlled before and after studies only 10 were analysed in this report as the remainder covered combinations of population, intervention, comparator and settings for which RCTs were available with similar or longer follow up.

Of the RCTs included a number had one or more arms that were considered to contain interventional components outside of the referral. For these, where possible, those arms relevant to this referral were used.

The heterogeneity between studies with regard to study design, population, intervention, duration of intervention, outcomes measured, duration of follow up etc, in addition to under-reporting of studies in published articles, precluded combining data even at the smallest sub-theme level. As such, a narrative description of each study within a (sub) theme was undertaken and summary statements made where possible.

For the cost-effectiveness review a total of 1288 articles were identified, 48 of them were considered relevant and, of these, three papers satisfied the inclusion criteria but only two contain relevant analysable data.



## Findings: Effectiveness

### **Theme 1: Verbal advice vs. Current provision of information/ do nothing**

#### ***Studies on prevention in children***

##### *School based studies in children aged four to seven years*

Two randomised trials (Buller 2006a, rated - and Loescher, rated +) and one controlled before and after study (Kidskin, rated +) evaluated group-based verbal advice in children aged four to seven years in a school setting. In all studies interventions were cluster allocated. The number of participants in this age group was unclear in Buller 2006a. It was 150 in Loescher and 1221 in Kidskin. Both randomised trials were set in the USA – Buller 2006a in Arizona and there were no details provided for Loescher. Kidskin was conducted in Perth area, Australia. All studies evaluated a school curriculum, but they differed with regard to the time over which it was delivered. Loescher investigated an intervention delivered in three sessions of approximately 45 to 50 minutes. In Buller 2006a a curriculum was taught over six weeks. Kidskin investigated an educational intervention taught over the longest period of time - four years (four to six sessions each spring) and it also had the longest follow-up of six years. In the randomised studies participants were followed-up for seven weeks (Loescher) and from February to April or May the same year (Buller 2006a).

The evidence from randomised studies seems inconsistent. Both assessed changes in knowledge and while in Loescher there was a significant increase in the intervention arm compared to the control group (both at two and seven weeks after baseline), in Buller 2006a there was also a significant difference in changes, but in the opposite direction. Loescher additionally evaluated comprehension (understanding instructions) and application (ability to transfer concepts learned in one situation to another situation or setting). For comprehension there was a significantly higher increase in the intervention group compared to controls at both two and seven weeks. For application there was no significant difference between groups and only at seven weeks did it appear that the application score adjusted for baseline differences was marginally higher in the intervention group. Buller 2006a assessed changes in skin tone using a colorimeter but there was no significant difference between study arms (however for children in the control group there appeared to be less skin darkening and redness).

In the Kidskin study there was no significant difference between groups in sun exposure and suntan (measured by skin reflectance) at two years, however both appeared to be marginally lower in the intervention group compared to controls.

At four years this study evaluated the impact of the curriculum on the number of naevi developed. There was no significant difference between groups, but the number of naevi was lower in the intervention group for each anatomical site examined.

At six years there was some statistically significant evidence of reduced naevus development in the intervention group compared with controls in a pre-specified, sub-group analysis of boys chests. A post-hoc, sub-group analysis of boys backs also revealed significantly lower naevus development in the intervention group compared with controls. A post-hoc, sub-group analysis of boys at the composite anatomical site of the face and arms revealed lower levels of naevus development in the intervention group compared with controls but the results were not statistically significant.

There was no statistically significant evidence of reduced naevus development, at six year follow-up, in the intervention group compared with controls in post-hoc, sub-group analyses of girls at the backs, and the composite of face and arms.

#### School based studies in children aged seven to 11 years

Four RCTs (Buller 1994, rated -, Buller 1997, rated -, Buller 2006a, rated -, and Hornung, rated +) and one controlled before and after study (Hewitt, rated -) investigated the effectiveness of group-based verbal interventions in a school setting in children aged seven to 11 years. All were cluster-allocated. In Buller 2006a the number of participants in this age group was unclear. The numbers in remaining studies were: 130 in Hornung (for this comparison), 139 in Buller 1994, 209 in Buller 1997 and 454 in Hewitt. Different curricula were evaluated in all studies apart from Buller 1997 assessed on an interactive sun safety fair. In this study children were educated both on how to prevent and detect skin cancer. Buller 1994 investigated the effectiveness of “*Sunshine and Skin Health*”, which was an earlier version of “*Sunny Days Healthy Ways*” evaluated in Buller 2006a. All randomised studies were set in Arizona, USA apart from Hornung which was carried out in North Carolina, USA. The only non-randomised study was set in Nottinghamshire, UK. The period during which the intervention was delivered was not clear in two studies (Buller 1997 and Hornung) evaluating curricula and in the remaining was five (Buller 1994) and six (Buller 2006a) weeks. The health fair was held during a single day and classes visited it for 45 to 90 minutes. Follow-up differed across studies and ranged from six weeks (Hewitt) to seven months (Hornung). The remaining studies reported a follow up of: eight weeks (Buller 1994), three months (Buller 1997) and from February to April or May (Buller 2006a).

All randomised studies evaluating curricula (Buller 1994, Buller 2006a and Hornung) reported a statistically significant increase in knowledge in intervention groups compared with controls. In the controlled before and after study there was also a significant positive effect on knowledge compared to the control group, but only in children whose education was based on a workbook and not on a computer program (there was however a non-significant increase). In two randomised trials the change in self-reported behaviours was not significant (there was no obvious direction of effect in Buller 2006a and in Hornung it appeared that the score in the control group was more favourable). In Buller 1994 there was a significant improvement in the curriculum arm in five of 11 evaluated behaviours, this was however not consistent across immediate post-test and the end of the study. Buller 2006a measured changes in skin tone using a colorimeter, there was however no consistent direction of effect.

The sun safety fair (Buller 1997) was reported to increase children's knowledge compared to the control condition. There was no significant difference for self-reported sun protective behaviours. Child-reported parent behaviours adjusted for baseline were significantly more sun protective in the sun fair arm immediately after the intervention, but not three months later.

#### School based studies in children aged 11 – 16 years

Six cluster randomised studies (Buller 2006b, rated +, Girgis, rated -, Hughes, rated -, Kristjánsson, rated +, Mermelstein, rated – and Syson-Nibbs, rated -) were found to evaluate curricula in children aged 11 to 16 in a school setting. Two studies were set in the UK – in Liverpool, Rotherham, Rugby, London, Essex and Kent (Hughes) and in Derbyshire (Syson-Nibbs) and the latter utilised materials evaluated in the first one. Two studies were conducted in the USA – Buller 2006b in Colorado, New Mexico and Arizona and Mermelstein in Chicago. The remaining trials were set in Australia (Girgis) and Stockholm County, Sweden (Kristjánsson). The numbers of participants were: 145 in Syson-Nibbs, 184 in Kristjánsson, probably 543 in Hughes (not entirely clear), 612 in Girgis, 1703 in Mermelstein and 1788 in Buller 2006b. The period over which the intervention was delivered varied from a single-session class (Kristjánsson, Mermelstein) to four (Girgis) and six weeks (Buller 2006b). The shortest follow-up was two weeks (Mermelstein) and the longest eight months (Girgis). In remaining studies follow-up was not always clearly stated, but was approximately three to five months.

An important issue when analysing these studies is that not all of them measured or accounted for baseline data in the analysis (Hughes, Mermelstein). Syson-Nibbs measured outcomes at baseline, however it performed only analyses of within-group changes over time. Girgis only reported a regression analysis to identify predictors of solar protection.

The trials which compared an increase in knowledge between study arms (Buller 2006b and Kristjánsson) reported a significant positive effect of the intervention. Syson-Nibbs provided information of a significant increase in knowledge within the intervention arm (and no significant change in the control arm). Hughes and Mermelstein did not take into account baseline scores and these studies reported significantly higher levels of knowledge in the curriculum condition compared with controls.

Sun protective behaviour was evaluated in various ways in four trials. Girgis found, in a regression analysis, that the intervention was a predictor of solar protection both at five weeks and eight months after baseline. The difference between intervention and control groups in behaviour assessed in self-reports indicated a significant beneficial effect in Buller 2006b and was not significant in Hughes (and authors did not provide further details). Buller 2006b however also assessed participants' sun protective behaviour at school using diary reports and found no significant difference between groups (no direction of effects was observed).

Sunburn in the previous month was assessed only in Buller 2006b and was not found to significantly differ between study arms.

#### Community based studies

Two controlled before and after studies assessed provision of verbal advice in a community setting (Reding and Rodrigue, both rated -). Reding included children aged five to seven years (number of participants was not reported) and Rodrigue 66 mothers of children with mean age of 6.4 years. They were both set in the USA – Reding in Wisconsin and Rodrigue in Florida. The first study investigated an intervention delivered directly to children during summer camps and spring monthly meetings of a children's association. The second one tried to educate Caucasian mothers to better protect their children (90-minute educational sessions) were delivered during evening meetings held at two schools. This study had two intervention groups: a comprehensive prevention programme and information only arm. In both studies the control group received no intervention. Reding assessed outcomes immediately after completion of the intervention and Rodrigue followed-up participants for two and 12 weeks.

In Reding children provided with the intervention had answered seven out of ten questions testing knowledge significantly better compared to the control group. For the remaining questions there was a non-significant difference in favour of the intervention group. In Rodrigue for mothers provided with verbal advice (in both intervention groups) there was a significant increase in knowledge and protection of their children from the sun compared with the control arm.

Studies set in the place of domicile

One American RCT (Turrisi, rated ++) evaluated verbal advice in the place of domicile in 469 parent-child pairs (children were aged nine to 12). In this study parents taught their nine to twelve year old children about skin cancer prevention. Parents were given materials at the start of the study, and were then asked to read them and implement the intervention with their children (for which they were given 30 days). The control group received no materials. Children were post-tested 45 days after distribution of the materials.

This study compared only post-test results between groups. Children in the experimental group were found to report less sunburns and less severe ones than in the control group. There was also a significant difference indicating less sunbathing tendencies in the intervention group.

**Studies on prevention in adults**Studies in a university/ college setting

Three randomised studies were identified to evaluate verbal advice in university or college students. Two studies evaluated a group-based intervention (Jackson, rated ++ and Katz, rated -) and one an individual nurse-led session (Mickler, rated ++). All studies were carried out in the USA – only Jackson provided a more exact location Arizona. Katz analysed 40 participants (age was not reported), Mickler analysed 69 participants (aged 17 to 31 years) in this comparison and Jackson 211 participants (aged 18 to 25 years). Katz and Mickler reported that interventions addressed both prevention and detection of skin cancer. Some participants in Mickler had a history of skin cancer, however exact data was not provided. Jackson included only female students. Katz used a “do nothing” control group and the remaining two trials delivered interventions not relevant to skin cancer (stress management in Jackson and peer leadership in Mickler). In Mickler participants were followed-up for three weeks, while in the remaining two trials they were tested immediately after completing the intervention (in Katz there was a two-week follow-up, but the control group was given the intervention after the first post-test). Only Jackson measured outcomes at baseline.

Jackson provided evidence of a higher adjusted post-test mean level of knowledge in the intervention group compared with controls. The remaining two trials indicated a higher post-test level of knowledge in the intervention arm compared to controls (baseline data was not collected).

Studies in a hospital/ medical practice setting

One controlled before and after study (Jones 2007, rated -) evaluated verbal advice in a hospital setting in 200 patients (mean age 51.2 years). At the time of their review in clinic, patients were given a written education sheet outlining cause, misconceptions, and general information about skin cancer and sun protection. They were also given verbal information from a doctor in the dermatology clinic. The control group received no information.

There was weak evidence that the intervention may increase patient's knowledge at three months follow-up. Against some initially high levels of knowledge statistically significant improvements were seen in only three of seven areas tested for those in the intervention group compared with controls.

There were no statistically significant improvements in sunscreen use, at three months follow-up, amongst the intervention group compared with controls, nor was there any discernable trend.

Studies in a sports venue setting

One American RCT (Parrott, rated -) in 12 soccer coaches aged 33 to 64 years evaluated verbal advice in a sports venue. A seminar about sun protection was conducted and a booklet was distributed to soccer coaches. There was no description of the control group. Follow-up was not reported.

No differences between intervention and control arms were found – the study measured knowledge and sun protective behaviour

**Theme 2: Mass-media vs. Current provision of information/ do nothing****Studies on prevention in children**

There were no studies that evaluated mass-media interventions in children.

### **Studies on prevention in adults**

#### Studies in a university/ college setting

Three randomised studies (Cody, rated -, Mahler 2007, rated + and Mickler, rated ++) evaluated mass-media interventions using videos in students of a university/ college setting. One of them used cluster allocation (Cody). There were 68 participants (aged 18 to 44 years) in Mahler in this comparison, 75 (aged 17 to 31 years) in Mickler and 114 (aged 17 to 48 years) in Cody. Cody was set in Newcastle, Australia and the remaining two in the USA. Intervention times were similar in Cody and Mahler 2007 (11 to 12 minutes) and 15-20 minutes in Mickler. The Australian study used two different types of a video: an emotional and informational one. In two studies the control group received information irrelevant to skin cancer: on dietary recommendations to prevent heart disease (Cody) and on peer leadership (Mickler). Mahler 2007 probably used a “do nothing” control group. Participants were tested immediately upon completion of the intervention (Mahler 2007) or followed up for three (Mickler) to ten weeks (Cody). Some of the participants had a history of skin cancer in Cody (8%) and Mickler (not clearly stated). These two studies addressed both prevention and detection of skin cancer. None of the studies assessed or accounted for baseline outcome measures.

In Mahler 2007 results were not provided for study arms and therefore are not reported. In the remaining two trials there was a significantly higher post-test knowledge level in the intervention compared to the control arm. In Cody this was however only true for participants shown an informational video. Amongst the group receiving the emotional video there was also a higher knowledge level, but it was not statistically significant.

### **Theme 3: Printed materials vs. Current provision of information/ do nothing**

#### **Studies on prevention in children**

##### Studies set in the place of domicile

One German RCT (Bauer, rated +) evaluated printed materials in the place of domicile. Parents of 1210 children (aged two to seven years) in both the intervention and control group were given an initial educational session. Afterwards only parents in the intervention arm received educational

letters three times a year. Participants were tested at baseline. Children were followed-up for three years.

This study provided no evidence of a difference in the number of incident melanocytic naevi after three years. There was also no clear direction of effect. The interview with parents about child protection and sun exposure did not indicate a consistent trend.

#### Studies in a hospital/ medical practice setting

One American controlled before and after study (Bologna, rated -) in 275 mothers evaluated printed materials delivered on the maternity ward to mothers to protect their newborn children.

It provided evidence of statistically significant improvements amongst the intervention group in comparison with controls for some of the behavioural practices examined at seven month follow-up. Compared with the control group, the infants and their mothers spent significantly less time in direct sunlight and less time outdoors. The number of mothers who used sunscreen was similar in both groups. But, when the groups were controlled for sunscreen use, the intervention group spent significantly less 'unprotected' time in the sun. The use of sun protective clothing and equipment for the infants was not significantly different between the groups and there was no discernible trend.

### **Studies on prevention in adults**

#### Studies in a workplace setting

Two randomised trials assessed printed materials in a workplace setting (Hanrahan, rated + and Rasmussen, rated -). Hanrahan was carried out in Newcastle, Australia and covered a wide range of occupations. Rasmussen was set in industrial companies in Scotland, UK. There were 368 participants (aged 45 to 65 years) in Hanrahan and 171 (aged 18 to 73 years) in Rasmussen. Participants in Hanrahan were provided with materials aimed at males over 45 years. Rasmussen evaluated positive and negative messages. Control groups in both studies did not receive any information relevant to skin cancer (not entirely clear in Hanrahan and information describing the characteristics of a common cold). The Australian study followed-up participants for 20 weeks and the British one did not report follow-up. Hanrahan was both on prevention and detection of skin cancer and included some participants with a history of skin cancer (exact numbers were not reported).



None of the studies compared differences between groups, but rather within-arm changes were analysed. Hanrahan reported that participants in the intervention, but not in the control arm significantly increased their level of knowledge. Rasmussen reported that likelihood of using sunscreen significantly increased in participants provided with the intervention (both positive and negative information), but not in the control group.

#### Studies in a university/ college setting

Three randomised trials (Castle, rated +, Mahler 2007, rated + and Mickler, rated ++) and a controlled before and after study (Greene, rated -) evaluated printed materials in university and college students. Castle was set on the south coast of England, UK and the remaining studies in the USA. There were: 69 participants in Mahler (aged 18 to 44 years), 71 (aged 17 to 31 years) in Mickler, 99 (aged 16 to 19 years) in Castle and 141 (aged 19 to 26 years) in Greene. Castle and Mickler evaluated leaflets or brochures containing information on skin cancer and its prevention. Mahler 2007 assessed the influence of UV facial photographs (showing damages to the skin caused by sun exposure, invisible in natural light). Greene evaluated printed materials with messages focusing on problems associated with tanning beds presented either in a statistical or a narrative format. Studies differed on the type of the control group with Mickler providing participants with information on peer leadership and the remaining studies probably using a “do nothing” control group. Castle and Greene included only female participants. Follow-up ranged from an immediate post-test (Mahler 2007) to one week (Castle) and three to four weeks (Mickler, Greene). Only Castle and Greene assessed outcomes at baseline.

Mahler 2007 did not present results for the arms to which participants were randomised and therefore these results are not analysed in this review. The remaining two RCTs indicated a significant increase in knowledge in the intervention group compared to control group (Castle) or a higher post-test knowledge level in the brochures arm (Mickler). Castle assessed sun-protective behaviour, but no results were provided. Other primary outcomes were not assessed.

The controlled before and after study provided evidence of a significant decrease in tanning bed use in participants given statistical information compared to the control group. There was no significant effect of the narrative message compared to the control group.

#### Studies in a hospital/ medical practice setting

One American cluster RCT (Prochaska, rated -) in 3834 patients with mean age of 44.7 years (number only of participants in which the skin cancer prevention intervention was evaluated) from primary care practices investigated the effectiveness of three computer generated reports that were

mailed “at 0, 6, and 12 months”. They included participant’s stage of change and readiness to change and encouraged to change sun protective behaviour. The control group received no intervention. Questionnaires were mailed to participants at 12 and 24 months (the intervention group additionally got a questionnaire at six months to generate the intervention report).

This study indicated that participants in the intervention arm avoided the sun and used sunscreen more.

#### Studies set in the place of domicile

One French RCT (Richard, rated -) evaluated three different leaflets (neutral, worrisome and humoristic) on prevention and detection of skin cancer sent to 900 adults. The control group (300 participants) was sent no leaflet. Age was not reported. Two weeks after mailing the leaflets, a telephone interview was conducted with participants.

This study provided evidence of a higher level of knowledge about melanoma definition, early signs and risk factors in the intervention arms compared to controls. A serious limitation of this study is that in intervention arms only participants who read the leaflet were analysed. No baseline testing was undertaken.

#### Studies on airports and/or flights

Two cluster randomised studies assessed the effectiveness of leaflets distributed to passengers departing for holiday (Dey and Segan, both rated -). In Dey leaflets were distributed in Air UK Leisure flights departing from Manchester. Participants in Segan were departing for the south or north coast of Queensland. The control groups in both studies received no information. In total 12385 passengers (aged 0 to 97 years, median 32 years) were analysed in Dey and 373 (mean age 32.2 years in the intervention and 33.4 in the control group) in Segan. Follow-up was unclear in both studies – in Dey questionnaires were distributed on return flights to a cross-section of participants (no indication of time) and in Segan they were sent for participants to complete after returning home.

Both studies assessed sunburn during holidays and none of them found a statistically significant difference between groups (however in Dey there appeared to be less sunburns in the intervention group). Segan also asked participants about their sun protective behaviours. A composite measure of behaviour did not indicate a significant difference between groups (and no direction of effect) and out of six behaviours assessed, only for number of days outside for at least two hours between

10 am and 2 pm was there a significantly more positive result in the intervention arm. There was no trend observed for the remaining five behaviours.

## **Theme 4: New media vs. Current provision of information/ do nothing**

### **Studies on prevention in children**

#### *School based studies in children aged seven to eleven years*

One American RCT (Hornung, rated +) evaluated a computer program used in the classroom setting via large-screen projection with student volunteers asked to take turns navigating through the program for the class. The control group received no intervention. One hundred and fifty six participants were included in this comparison. Participants were tested at baseline and final scores were adjusted for baseline results. Participants were first post-tested immediately after the intervention and then seven months later.

Adjusted knowledge level was significantly higher in the intervention group both immediately and seven months after baseline. There was no significant difference in self-reported behaviours at both follow-ups, although it appeared that there was a positive trend in the intervention group in the immediate follow-up.

### **Studies on prevention in adults**

#### *Studies in a hospital/ medical practice setting*

One British study (Glazebrook, rated +) in 589 patients (mean age 38.2 years in the intervention and 38.4 in the control group) evaluated in patients a computer program designed to be completed in a single sitting (10-15 minutes) available in a medical practice. It presented messages on both prevention and detection of skin cancer. Outcomes were measured at baseline. Participants were followed-up for six months.

The study provided evidence of an increase in knowledge in the intervention group compared to controls, as the mean difference in knowledge between groups adjusted for baseline scores was significant. There was also evidence on a positive influence on skin protective behaviour in the intervention group compared to controls and the mean difference between groups adjusted for baseline scores was statistically significant.

## **Theme 5: Combination interventions vs. Current provision of information/ do nothing**

### **Verbal advice and printed materials in children**

#### School based studies in children aged seven to eleven years

One Italian RCT (Naldi, rated +) in 11230 children evaluated the effectiveness of “*distribution of educational material to parents and their children, the development of a short curriculum at school, based on a resource developed for health teachers, and the projection of a short video at school.*” The control group was given no intervention. Participants were tested at baseline and followed-up for 14 to 16 weeks.

It provided no evidence of a difference in adjusted OR of any sunburns experienced during the previous year and there was no clear direction of effect. There was no significant difference in sun protective behaviours and it is difficult to indicate any trend in the data, as groups were compared only for “sometimes” or “occasionally/ never” behaving in a certain way (“always” was considered a reference category). The adjusted OR of intense sun exposure in the previous year indicated less sun exposure in the intervention group, but was not statistically significant. The adjusted odds ratio of parents believing that children were adequately protected from the sun during the previous year indicated less sun protection in the intervention group, but was not statistically significant. The ratio of relative change in the number of melanocytic naevi measured in a convenience subsample of the population indicated more naevi in the intervention group.

Studies set in the place of domicile

One American RCT (Benjes, rated +) assessed in 108 mother-child pairs the effectiveness of a telephone call and two newsletters. Before the baseline questionnaire both groups received verbal advice from a maternity nurse. The control group received no information beyond that. Participants were followed-up for 12 months starting with a baseline questionnaire (children aged six months) and finishing with a follow-up questionnaire (children aged 18 months).

This study provided no evidence of more sun protective behaviour in the experimental arm compared to control. Results for individual behaviours did not appear to follow any trend. Mothers in the intervention arm reported a higher post-test level of vigilant protection of their children (no baseline measurements were taken). There was also a smaller increase in child skin damage and sunburn and a higher increase in child tanning in the intervention group, significance levels were however not provided.

Studies set in a recreation site

One American RCT (Mayer, rated +) in 169 children (six to nine years old) evaluated a UV reduction curriculum that was presented at poolside during the first five minutes of aquatic classes by YMCA instructors and home-based activities for children and their parents. The intervention was delivered over six weeks to children aged six to nine years. The control group was not provided with information on sun protection. Participants were tested at baseline and followed-up for six to eight weeks.

This study provided evidence that in the intervention group the adjusted score for frequency of wearing a hat was higher than in the control group. In the intervention group there was a slightly higher adjusted score for frequency of using sunscreen with SPF 15+, but the difference was not statistically significant. The intervention group had a higher adjusted solar protection score than the control group (the difference was not significant). There was a non-significant positive trend in the intervention group compared to controls in the change of skin colour.

**Verbal advice and printed materials in adults**Studies set in workplace

One American RCT (Glanz, rated -) evaluated an intervention in staff (mean age 20.9 years) of recreation sites who were later to deliver education to children. There were 176 participants in the

study which included a mixed-intervention arm (further details were not provided). Participants were given a “60-90 minute staff training, a leader’s guide for staff, on-site activities, and educational materials for children aged six to eight years and their parents”. The control group received no intervention. Participants were tested at baseline. All staff were followed-up for eight weeks and staff who agreed to be mailed a questionnaire – for three months.

It did not provide evidence of any effect of the intervention compared to control on knowledge, sun protection habits and sunscreen use. Only for knowledge there was a consistent pattern with an increase in the intervention group and a decrease in the control group (reported as non-significant) at eight weeks. At three months there was a decrease in knowledge in both groups, but the knowledge level in the intervention arm was still higher than at baseline.

#### Studies set in the place of domicile

One American cluster RCT (Geller 2006, rated -) in 494 siblings (55.7% of the intervention and 60.6% of the control group were aged 50 years or less) of melanoma patients investigated the effectiveness of “computer-generated tailored print materials (...) sent at 1, 3, and 5 months after randomisation” and telephone calls. The information provided covered both prevention and detection of skin cancer. Current practice was the comparator. Participants were tested at baseline. Follow-up tests were carried out six and 12 months after baseline.

At six months there was a significant increase in the intervention compared to control group in the percentage of participants providing correct responses to two questions about melanoma. For two remaining questions there was no significant difference between groups and no consistent trend. The study did not provide evidence of a difference between groups or a visible effect direction at 12 months in change in routine use of SPF 15+ sunscreen. There was a decrease in the percentage of participants who reported being tanned at the end of last summer in the intervention group compared to controls, but there was no statistically significant difference between groups.

### **Verbal advice and new media in children**

#### School based studies in children aged seven to eleven years

One American cluster allocated controlled before and after study (Geller 2003, rated -) evaluated the effectiveness of a cross-curricular classroom based intervention including group based verbal advice and access to a website for 4<sup>th</sup> and 5<sup>th</sup> grade students (mean age ten years). The control

group was not provided with an intervention. The number of participants in this study was not clearly stated. Participants were followed-up for four to five months.

There was evidence indicating knowledge was more likely to increase amongst children receiving the intervention in comparison with controls.

### **Mass-media campaigns and printed materials in adults**

#### Studies set in workplace

One Australian cluster RCT (Borland, rated +) in outdoor employees evaluated a campaign combining materials supplied to depots (four posters and a video “Goodbye sunshine”) with individual folders with printed materials and lapel buttons for employees. The campaign lasted for approximately three months. Standard practice was the control group. Baseline and three months follow-up evaluations were carried out as direct observations of a cross-section of the study population. Numbers of employees in each sample as well as age were not reported.

This study provided evidence, that *“before the campaign the intervention group had a significantly higher protection index than the control group (...); the intervention group significantly increased their superiority in protection after the campaign as compared with the control group.”* The intervention group had a higher hat use before and after the intervention; and there was no change in any of the groups at follow-up. The intervention group increased shirt cover relative to the controls after the campaign; the interaction between group and time of survey was significant. *“There was no significant change in use of shade as a function of experimental condition.* Participants were not followed-up in this study, but two cross-sectional samples were taken.

#### Studies in a university/ college setting

A mass media intervention together with printed materials in a university setting was evaluated in two RCTs (Mahler 2005 and Mahler 2007, both rated +). In Mahler 2005 there were 100 participants (aged 17 to 44 years) and in Mahler 2007 64 (aged 18 to 44 years) in arms relevant to this comparison. Both trials were located in California, USA. In both studies participants were first shown a video on photoaging (11 to 12 minutes) and then a UV facial photograph was taken. Control groups were probably given no intervention. Participants were post-tested immediately after completion of the intervention. 1.4% of participants in Mahler 2005 had a history of skin cancer.

No primary outcomes of this review were assessed in Mahler 2005 and Mahler 2007 did not provide results for study arms.

### **Verbal advice, mass-media and printed materials in adults**

#### Studies in a university/ college setting

One American RCT (McClendon, rated ++) assessed in 61 college students (age was not reported) a combination intervention delivered in two sessions (60-75 minutes) separated by 48 hours. The intervention included participants being asked to read essays, watch a video, work in groups and being given a lecture. Participants in the control group received no intervention before the post-test. Participants were tested at baseline and immediately after the intervention.

None of this review's primary outcomes was reported.

### **Verbal advice, printed materials and new media in adults**

#### Studies based in a recreation site

One cluster RCT (Walkosz, rated ++) set in ski resorts in USA and Canada evaluated a combination intervention aimed at changing the sun protective behaviours of adult guests in ski resorts. Messages were primarily targeted at employees, but some were communicated to guests as well. "*Guest materials included posters and brochures for ski and snowboard schools, signage at the base of chairlifts and on chairlift poles, electronic signs and grooming reports, brochures, and table tents and posters in lodges.*" The control group received no intervention. Participants were not followed-up, but cross-sectional samples were taken in January to April 2001 (2991 participants) and in January to March 2002 (3525 participants).

This study provided no evidence of increased sun protection in guests staying in areas assigned to the intervention, as authors report that the hypothesis that guests in the intervention areas would report more sun protection was not supported.



## **Theme 6: Head to head comparisons between intervention types**

### **Verbal advice vs. Mass-media in adults**

#### Studies in a university/ college setting

One American RCT (Mickler, rated ++) compared a nurse-led one-to-one training (on how to perform skin self-examination and recognise skin cancers; participants were also provided with two brochures) with a video in 72 undergraduate students (aged 17 to 31 years). The first post-test was carried out immediately after completion of the intervention and the second three weeks later.

It provided evidence that the knowledge level was higher in the video group compared to the nurse-led group in the immediate post-test. At seven months the score in the video group was still higher, however authors provided no indication if the difference was statistically significant. No baseline measurement of outcomes was carried out.

### **Verbal advice vs. Printed materials in children**

#### School based studies in children aged seven to eleven years

Only one Canadian controlled before and after study (Barankin 2001, rated -) compared the effectiveness of group-based verbal advice and literature (intervention) with the provision of literature only (comparator) in 509 children aged 9-10 years.

There was no evidence that the provision of group –based verbal advice along with literature provided statistically significant improvements in the knowledge in comparison with the provision of literature only, although there were improvements in both groups. There was no evidence that the provision of group –based verbal advice along with literature provided statistically significant improvements in behaviours in comparison with the provision of literature only. No differences were observed amongst the groups or time periods. There was no statistically significant evidence of a reduction in the number of sunburns amongst children receiving group-based verbal advice along with literature in comparison with the provision of literature only. However surveys of both children and parents reported the number of children without sunburns improved to a greater extent amongst those receiving the verbal intervention (non-statistically significant trend). At four month

follow-up, data from parental reports indicated there was no significant difference in the number of multiple sunburns ( $\geq 2$ ) amongst the groups, however there was a higher incidence amongst the group receiving the verbal intervention.

### **Verbal advice vs. Printed materials in adults**

#### *Studies in a university/ college setting*

Only one American RCT (Mickler, rated ++) in 68 students (aged 17 to 31) compared a nurse-led one-to-one training (on how to perform skin self-examination and recognise skin cancers) together with two brochures with brochures only. The first post-test was carried out immediately after completion of the intervention and the second three weeks later.

This study found that the mean knowledge level was higher in the brochures group than in the nurse-led group in an immediate post-test. At seven months participants in the brochures group still had a higher mean level of knowledge, significance of the difference was however not provided. No baseline measurement of outcomes was carried out.

### **Verbal advice vs. New media in children**

#### *School based studies in children aged seven to eleven years*

One American cluster RCT (Hornung, rated +) in 132 third and fourth grade children compared sun protection taught by group teachers with a computer program used in the classroom setting via large-screen projection. Participants were first post-tested immediately after the intervention and then seven months later.

Adjusted mean knowledge level was significantly higher in the computer intervention group both directly after the intervention and seven months after baseline. In the first test those receiving the computer intervention had a significantly higher mean score for self-reported behaviours and this difference was still present after seven months it was however not significant.

### **Mass-media campaigns vs. Printed materials in adults**

#### Studies in a university/ college setting

Two randomised studies compared videos with brochures (Mickler, rated ++) or a UV facial photograph (Mahler 2007, rated +) in a university setting. Mahler 2007 evaluated these interventions in 69 participants aged 18 to 44 years and Mickler in 72 participants aged 17 to 31 years. Both were American studies and Mahler 2007 was reported to be carried out in California. Mickler provided participants with information on both prevention and detection and some of the students had a history of skin cancer. Mahler 2007 had an immediate post-test and Mickler followed- up participants for three weeks.

Mahler 2007 did not report results for study arms. Mickler provided no indication if a significantly higher knowledge level was observed in any group.

### **Verbal advice and printed materials vs. Verbal advice in adults**

#### Studies in a hospital/ medical practice setting

One American RCT (Clowers-Webb, rated +) in 202 transplant patients (aged 18 to 76 years), some with history of skin cancer, compared a session with a physician followed by mailing of printed materials with a session with a physician only. Three and ten months after recruitment all patients were sent a questionnaire.

This study did not provide evidence of a significant difference in knowledge between the two groups and mean scores in the two follow-up tests did not follow a uniform pattern. It provided evidence of more sun safe behaviour in the group which was additionally mailed printed materials both at three and ten months.

### **Mass-media campaigns and printed materials vs. Mass-media campaigns in adults**

#### Studies in a university/ college setting

Only one American RCT (Mahler 2007, rated +) compared a videotaped slide show on photoaging together with a facial UV photograph to a video on its own in 64 undergraduate students (aged 18 to 44 years). Participants were tested immediately after the intervention. This study did not provide results for groups that participants were randomised to.

## **Mass-media campaigns and printed materials vs. Printed materials in adults**

### Studies in a university/ college setting

Only one American RCT (Mahler 2007, rated +) compared a videotaped slide show on photoaging together with a facial UV photograph to a UV photograph on its own in 65 undergraduate students (aged 18 to 44 years). Participants were tested immediately after the intervention.

This study did not provide results for groups that participants were randomised to.

## **Theme 7: Head to head comparisons within the same intervention type**

### **Verbal advice in children**

#### School based studies in children aged four to eleven years

One American controlled before and after study (Buller 2006a, rated -) in 435 children compared curricular based advice delivered in one school year, with provision over two successive years.

There was evidence of a statistically significant improvement in knowledge, at 15 months follow-up, for children in grades 2-5, amongst the group receiving the extended two year curriculum compared with the group receiving the intervention for one year only. There was no evidence of a statistically significant improvement in knowledge, at 15 months follow-up, for children in grades K-1, amongst the group receiving the extended two year curriculum compared with the group receiving the intervention for one year only.

#### School based studies in children aged seven to eleven years

One UK controlled before and after study (Hewitt, rated -) compared the effectiveness of computer-based and workbook based teaching, designed for use in topic work, for children aged 10-11 years at school (number of children in these two arms was unclear).

There was no statistically significant evidence, at six week follow-up, of increased knowledge amongst the group receiving the computer-based intervention in comparison with the group receiving the workbook based intervention. However knowledge increased significantly in both groups with a higher increase evidenced in those receiving the workbook based intervention.

#### School based studies in children aged 11 to 16 years

One British cluster RCT (Hughes, rated -) in children (numbers of participants in relevant arms were unclear) aged 12 to over 16 years evaluated verbal advice together with different types of educational materials: (i) a leaflet; (ii) a workbook; (iii) a video. The first intervention group read through the workbook and took home probably the leaflet, but was not clearly stated. Interventions in the following groups included the same components as in the first group and additional materials or activities: watching the video, being given homework to design posters for public education and having a discussion later in the week about the issues raised. The study commenced in May (there was no baseline survey) and post-tests were carried out in July and September.

Authors reported that there was no difference between groups in knowledge (and no direction of effect indicating superiority of one group was observed) and behaviour (no further details for behaviour were provided). An important limitation of this study is lack of any baseline assessment.

#### Community based studies

One American controlled before and after study (Rodrigue, rated -) evaluated the effectiveness of group-based verbal advice, provided in a community setting to 66 mothers who were targeted as agents of change for their children. Participants were assigned to a comprehensive prevention programme (CPP) intervention, an information only condition (IOC) intervention or a no information control (NIC). Knowledge scores were marginally higher amongst the CPP group in comparison with the IOC group at the two and 12 week follow-ups (and at baseline). The statistical significance of the small difference was not commented on.

There was statistically significant evidence, at the two and 12 week follow-ups, of a greater improvement in sun-safe behaviour amongst the CPP group in comparison with the IOC group.

### **Mass-media campaigns in adults**

#### Studies in a university/ college setting

One Australian RCT (Cody, rated -) in 222 psychology students compared an informational video with an emotional video. Participants were assessed at baseline, immediately after watching the video and ten weeks later.

No significant differences between groups in the mean knowledge score were reported and no obvious direction of effect was present.

### **Printed materials in children**

#### Studies set in the place of domicile

One American RCT (Buller 1998, rated -) assessed in 768 parents the effects of high and low intensity printed materials (they also varied on the logical structure of arguments, but results for this factor were not reported for children) sent in spring and summer in changing sun-protective behaviour relating to children. Mail was sent to participants from March to August. Participants were first post-tested in September and October and then in February 1996 a short post-test was conducted to assess winter sun protection.

No difference between study arms was found for summer protection, although for most behaviours there was more improvement in the high intensity group: frequency of applying sunscreen with SPF 15+, applying sunscreen before school, wearing protective clothing and telling children to play in the shade. For winter protection in five out of seven items there was a significantly higher improvement in the high intensity arm compared to the low intensity arm: frequency of applying sunscreen, applying sunscreen with SPF 15+, applying sunscreen before school, wearing protective clothing and limiting exposure to midday sun. For the remaining two behaviours (wearing a hat and telling children to play in the shade) there was a non-significantly higher increase in frequency in the high intensity group. There was no significant difference in the average time a child spent outside, but it decreased more in the low intensity group.

## **Printed materials in adults**

### Studies in a workplace setting

One British RCT (Rasmussen, rated -) compared the effects of positive and negative information in 117 employees of industrial companies in Scotland (aged 18 to 73 years). Follow-up was not reported.

This study provided evidence that individuals in the group receiving negative information indicated a lower likelihood of using sunscreen than individuals in the positive group. Later there was a decrease in the likelihood in the negative group.

### Studies in a university/ college setting

Seven randomised studies (Boer, rated ++, Cho, rated -, Jones 1994, rated -, McMath, rated -, Prentice-Dunn, rated -, Rothman, rated + and Stephenson, rated -) and one controlled before and after (Greene, rated -) compared different types of printed materials in university or college students. The numbers of participants in studies and their age varied and they were: 92 participants in Stephenson (median age 21 years), 96 in Greene (aged 19 to 26 years), 136 in Jones 1994 (age 17 to 23), probably 140 in Prentice-Dunn (unclear; age not reported), 146 in Rothman (age not reported), 159 in Boer (aged 17 to 27), 208 in McMath (age not reported) and 274 in Cho (aged 18 to 37). Apart from Boer which was set in the Netherlands, all were American studies. Five studies assessed outcomes in an immediate post-test, one three to four weeks after baseline (Greene) one four weeks after baseline (Cho) and one did not report follow-up (Boer).

Although all used interventions which can be classed as printed materials, they varied both in terms of the format and content. Three studies reported evaluating essays (Jones 1994, McMath and Prentice-Dunn), two reported using "messages" (Cho and Stephenson), one pamphlets (Rothman) and one booklets containing 12 public service announcements (Boer). The issue of content tends to be more complicated, as studies had three or four arms comparing different combinations of investigated factors. For example Prentice-Dunn looked at four essays highlighting either high or low benefits of a tan and high or low efficacy of sun protection.

Five studies did not report or assess primary outcomes of this review or did not report outcomes for arms to which participants were randomised.

Boer (comparing four announcements with or without pictures and with or without textual arguments) did not report significance levels for comparisons of post-test knowledge scores. Only for announcements that did not use picture and textual arguments did the knowledge score appear to be lower.

Cho reported that participants provided with high threat messages were significantly more likely to use sunscreen four weeks after being given the intervention than those who were given low threat messages.

Greene provided evidence that participants who were given information in a statistical format reduced sunbed use significantly more than those who were given information in a narrative format.

#### Studies set in the place of domicile

Four randomised studies compared different content and types of printed materials in the place of domicile (Buller 1998, rated –, Branström, rated +, Gerbert rated – and Richard, rated -). Materials were mailed to 768 participants in Buller 1998, 900 in Richard (age was not reported), 981 in Gerbert (aged 20 to 89 years) and 1743 in Branström (aged 18 to 37). Buller 1998 and Gerbert were set in Arizona and San Francisco Bay Area, USA, Branström in Stockholm County, Sweden and Richard in south of France. Studies differed with respect to the factors the impact of which they tested – it was for example language intensity, source or type of message. Therefore the comparability of their results is seriously limited. Follow-up was clearly stated only in Richard where participants were tested two weeks after being sent leaflets. In Buller 1998 participants were followed-up from January/February to February of the following year and in Branström from May until autumn of the same year. Gerbert did not report follow-up.

Although Branström measured knowledge and frequency of sunbathing, sunburn and sun protection – no information was provided if results were significantly different between groups. Groups received: two brochures and a UV intensity indicator, one brochure and a UV intensity indicator, two brochures and the fourth group – only one brochure. It appears that participants who were given two brochures had the highest level of knowledge and sun protection and the lowest sunbathing frequency. The lowest sunburn frequency was observed in the group which was given one brochure and a UV intensity indicator.

Buller 1998 randomised participants to four groups which received messages with different language intensity (high or low) and argument structure (inductive or deductive). This study indicated that out of six summer protective behaviours participants who received high intensity messages limited their exposure to midday sun compared to participants who received low intensity messages – this did not take into account argument structure. In the remaining behaviours there was a tendency for more sun protection in the high intensity group. For six winter protective behaviours there was no significant difference with respect to language intensity (although the high intensity group tended to report more sun-protective behaviours). Low intensity inductive messages tended to be associated with more sun protective behaviours than high intensity inductive messages (significance not reported). Participants receiving high intensity deductive messages



compared to low intensity deductive messages were reported to have significantly increased the frequency of applying sunscreen, applying sunscreen with SPF 15+ and wearing protective clothing. It was reported that there was no significant difference between groups in the overall change of SPF of sunscreen used (however in the low intensity group the score was marginally higher).

Gerbert measured activation of participants to start sun protective behaviour as dialling a toll-free number (messages varied on the source and content) and found no significant differences between study arms. The highest percentages of activated participants received a message from their own physician (as compared to received from their own Health Maintenance Organisation and a junk mail organisation) and highlighting the risk of skin cancer (compared to ageing and wrinkling with or without a book on the topic).

Richard indicated that participants provided with a humoristic leaflet had a significantly lower knowledge of the definition of melanoma compared to participants who were sent neutral or threatening materials. There was however no significant difference between groups in knowledge of early signs and risk factors of melanoma.

### **New media in adults**

#### Studies set in workplace

One Australian RCT (Dixon, rated -) investigated emails containing weather and/or UV forecast and/or behaviour recommendations sent before weekends to employees of consulting firms and a university. Five hundred fifty seven participants (13% aged less than 25 years) were followed-up for 20 weeks (with a two-week break).

There was no evidence of a statistically significant difference between study arms in sunburns and no direction of effect was observed. There was a significant difference between the groups in sun protection in response to forecasts and the group which received weather and UV forecast with recommendations reported the highest sun protection. Of five sun protective behaviours there was a significant difference for lower body cover on Saturdays (however the group which had the most positive results was not obvious) and none on Sundays. There was no obvious trend in results.

Studies in a university/ college setting

One American RCT (Bernhardt, rated +) in 83 undergraduate students (aged 19 to 30 years) compared a webpage tailored for participants with a generic one. Participants were followed-up for four to five weeks.

This study provided no evidence of a difference between participants who accessed tailored or standard websites with regard to sunscreen use behaviours (exact results and significance level were not provided).

## Findings: Cost-effectiveness

An Australian study (cost-minimisation analysis, cost-benefit analysis; rated - ) reported that an educational approach involving provision of material (videos and posters) to outdoor workers accompanied by information provided by nurses is potentially cost saving compared to talks delivered by occupational health nurses, under certain assumptions about unit costs and size of targeted population. The results of the cost benefit analysis show that the cost per outdoor worker exceed the benefits to the company due to reduced compensation, resulting in a net present value of – AUD \$126 (- £93) (Hocking)

There is evidence from one US-based economic evaluation (cost-effectiveness analysis, cost-benefit analysis; rated +) that a classroom lesson results in improved effectiveness and reduced cost compared to no intervention, because of treatment costs saved in terms of cancers averted. (Kyle)

## Conclusions:

The objectives of the evidence reviews in this report were to address questions relating to what are the most effective and cost-effective ways of providing information to change people's knowledge, awareness and behaviour and so prevent the first occurrence of skin cancer attributable to UV exposure. It was also the purpose to identify what is the content of effective and cost-effective primary prevention messages.

It is clear from the studies identified that a large body of research has been undertaken on the effectiveness of the provision of information to prevent the first occurrence of skin cancer. However, this body of evidence is also spread across a breadth of combinations of populations, interventions, comparators and settings. Furthermore there are issues relating to the quality and reporting of the available evidence and potentially about the relevance of some of the outcome measures used. This variety places limits on the conclusions that can be drawn. It is evident however that verbal interventions applied to children might lead to an increase in knowledge about exposure to, and protection from, UV. Whether such knowledge is retained and/or leads to protective behaviours is unclear.

Given the heterogeneity of evidence and that much of it has been undertaken in countries with greater potential for UV exposure than the UK, applicability is also an issue.

The possible harms from UV exposure reduction messages have not been reported and remain unknown.

Very limited evidence is available on the cost-effectiveness of the provision of information to prevent the first occurrence of skin cancer.

Further, and more robust, studies are required which build on the current evidence base.