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Sunlight Exposure: Communicating the Benefits and Risks of Ultraviolet Light to the General Population: A Qualitative Documentary Analysis of UK Newspapers and Magazines (Print and Online)

Final Report

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INVESTORS IN PEOPLE

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Executive Summary

1. BACKGROUND

Stories about sunlight, exposure to the sun, skin cancer and vitamin D are often in the news, not only when new studies are published but also, often, in the lead up to the summer.

Research evidence shows that the media play an important role in shaping and influencing the general population's perceptions of public health issues, their understanding, beliefs and even behaviour in response to various public health issues, and the public acceptability of public health interventions. Mass media campaigns can influence the news agenda – and even legislative priorities - as they relate to public health issues, and can inform or educate the general population about public health issues and threats. Different emphases in how a particular public health issue is reported can serve to sensationalise, educate, or normalise certain activities or behaviours. The media is therefore powerful in responding to, directing, and informing public health issues, and also in educating and influencing health-related behaviours among the general population. This latter point means that the media can be used as a tool in the prevention of ill-health and the promotion of good-health. However, it is argued that people select the information, and therefore the media sources most aligned with the presentation of that information, which most closely reflect their existing beliefs, which in turn reinforce their point of view. This may thus limit the extent to which the media can be expected to influence the beliefs and health-related behaviours of the general population. Sunlight exposure is a complex area. It is perhaps particularly difficult for the media to report stories or scientific findings that balance the potential beneficial effects of exposure to sunlight (building stocks of vitamin D) with the potential harmful effects of too much exposure to sunlight (skin cancer).

2. OBJECTIVES

The purpose of this work is two-fold. First, to examine the accuracy and comprehensiveness of UK national newspaper and magazine reporting of research evidence on the health benefits and risks associated with sun exposures. Second, to identify and describe how the UK media present the health benefits and risks associated with sun exposure.

There are two overarching research questions:

Research Question 1: How do the UK media report research findings or nationally agreed guidelines/consensus statements regarding the benefits and risks associated with exposure to sunlight?

Research Question 2: How are the health benefits and risks of sun exposure represented in the UK media? What risks and benefits of sun exposure are presented in UK media?

3. METHODS

The data for this study comprised articles published by UK national daily newspapers and monthly magazines (print and online versions).

For **Question 1,** articles published by a wide range of UK national newspapers and monthly magazines which reported three specific research stories and the national guideline/consensus statement regarding the health benefits or risks associated with exposure to sunlight were analysed. Moyer et al's(1) categorisation of errors/inaccuracies was used to assess the accuracy of the reporting of research by the newspaper articles, both against the research press release and published report/journal article. Articles were also subject to content and thematic analysis in terms of presentation of sun safety advice, the risk vs benefit issues associated with UV exposure and specific populations at increased risk of over- or under-exposure. A total of 37 articles were included in this analysis.

For **Question 2**, articles containing material related to the health benefits or risks associated with exposure to sunlight published by a sub-sample of UK national newspapers and monthly magazines (print and online versions) during 2013 were analysed. 112 articles published by 3 national newspapers and 6 monthly women's and specialist interest magazines were analysed. Quantitative content analysis was used to describe the volume of reporting (number of articles, word length) on the topics of risk and benefits of sunlight exposure and to describe and compare reporting within and across publications and publication genres. Qualitative thematic analytical techniques were used to explore the way exposure to sunlight, and its risks and benefits, were reported or presented by the UK print media.

4. FINDINGS

Review Question One: How do the UK media report research findings or nationally agreed guidelines/consensus statements regarding the benefits and risks associated with exposure to sunlight?

- How accurate and comprehensive is the reporting of research studies or nationally agreed guidelines/consensus statements?
- Is reference made to the role of individual risk factors?
- How is such evidence presented and framed?

Evidence Statement 1.1: Press releases – key findings

Journalists reporting on pieces of published research tend to only report from the press release associated with that published research. There is very little evidence of consulting the primary source. Analyses of the comprehensiveness and accuracy of newspaper reports vis-à-vis the published research presented some relatively mid to low scores. However, when the comparison was instead made between the press release and the newspaper articles, the comprehensiveness and accuracy of newspaper reporting was much higher. Thus, where a press release clearly, fully and accurately states the key messages emanating from published research, the ensuing newspaper coverage will

be more faithful to the study findings than if the press release omitted key messages or contained erroneous information. Further, where a press release introduces new information that is not contained or reflected in the published research, this new information may be reported in newspapers as if it were part of the study's findings.

Evidence Statement 1.2: Press release content and advice to spend limited time exposed to UV contained in news reports.

Newspaper reporting of advice to spend approximately 15 to 20 minutes in the sun with skin unprotected for the purposes of vitamin D production was again largely determined by the inclusion or exclusion of this advice in the press release. In most cases, if the press release referred to this advice, the newspaper articles tended to refer to it too; if the press release did not mention the advice then most, if not all, newspaper articles similarly did not refer to it.

Evidence Statement 1.3: Accuracy and comprehensiveness of newspaper reports of research genre

Whether measured against the published research or the press release, the comprehensiveness and accuracy of newspaper articles reporting on UV exposure research was generally greatest among the mid-market tabloids and weakest among the tabloids. Broadsheets lay somewhere in between.

Evidence Statement 1.4: Newspaper reporting on sun safety advice in articles reporting research findings.

The majority of newspaper articles (28/37) analysed for Review Question One did not contain any sun safety advice, despite reporting research on the risks and/or benefits of UV exposure. One explanation for this is that the associated press release did not typically offer sun safety advice.

Evidence Statement 1.5: Reference to individual risk factors or sub-populations at greatest risk in newspaper reports of research.

Newspaper articles typically did not make reference to risk factors or sub-populations at greatest risk of either developing skin cancer through exposure to UV or of developing a vitamin D deficiency through under-exposure to UV. Again, this reflects the absence of such reporting or inferences in the published research and press releases.

Evidence Statement 1.6: The reporting of risks and benefits of UV exposure within the context of presenting research findings.

The vast majority of newspaper articles did not report on both the risks and benefits of UV exposure. Instead they reported the information stated in the press release (and occasionally other information contained in the published research paper) which focused on the particular risks or benefits identified in the research findings. Thus, newspaper reports based on press releases indicating only risks of UV exposure themselves only reported risks; press releases reporting the benefits of UV exposure led to the vast majority of newspaper articles stating only the benefits; and those press releases reporting on research findings which highlighted some risks and benefits of UV exposure (but with a focus on the benefits) were followed by a roughly equal number of newspaper articles reporting both risks and benefits, and those focusing solely on benefits. Across the four stories, the vast majority of newspaper articles reported only the risks, benefits or risks and benefits outlined by the press release.

Evidence Statement 1.7: News media reporting of absolute and relative risk

None of the newspaper articles reported on absolute and relative risk (e.g. of developing vitamin D deficiency or rickets through under-exposure to UV, or of increasing one's risk of skin cancer from use of sunbeds primarily before a certain age). An explanation of the absolute and relative risks of an event (in this case illness) occurring or not occurring would help the public to assess their own personal level of risk. However, once again this was not reported in the newspaper as it was either not included in the published research or was omitted from the press release.

Review Question 2: How are the health benefits and risks of UV exposure conveyed by UK national newspapers and magazines?

- How are the health benefits and risks of UV exposure represented in the UK media?
- What risks and benefits of UV exposure are presented in UK media?
- How do the media frame, or what are the discourses used with respect to, the benefits and risks of UV exposure?
- What types of evidence sources are used?
- Do individual articles cover both the benefits and risks associated with exposure to UV? How are these risks and benefits presented?

Evidence statement 2.1: Differences in coverage by newspapers and magazines

National newspapers vary considerably in terms of the number of items published during the course of a calendar year which include some sort of reference to the risks and/or benefits of UV exposure. Coverage in monthly women's magazines and specialist interest monthly magazines appears low with many publications carrying no content on this topic during a calendar year. Summer appears to be the main season in which this topic is likely to receive most attention in news media.

Evidence statement 2.2: Location of material on risks and benefits within newspapers

Articles containing some sort of reference to the risks and/or benefits of UV exposure were found in a wide range of sections making up a daily or Sunday newspaper including: news reports, celebrity stories, features stories, opinion pieces, health and beauty columns and product reviews.

Evidence statement 2.3: Volume of reporting on risks and benefits

A greater volume of articles containing material on the risks of UV exposure were identified compared to those presenting the benefits. A very small proportion of articles set out to present and consider the risks and benefits of sunlight exposure. There were differences between newspapers in terms of the proportions of risk and benefit material.

Evidence statement 2.4: Types of risk associated with UV exposure presented

Skin cancer was the most frequently reported risk, presented in around three quarters of 'risk articles' analysed. A quarter of articles identified sunburn as a risk and a similar proportion reported skin ageing as a risk. A small proportion concerned risks to eye health. Around a half of articles which identified sunburn or skin ageing as a risk associated with UV exposure did also not refer to the risk of skin cancer.

Evidence statement 2.5: Benefits of UV exposure

The pre-dominant benefits of UV exposure presented in the material analysed related to Vitamin D production or levels. Articles reporting on the benefits of UV exposure did not typically refer to the risks.

Evidence statement 2.6: Presentation of UV, and distinction between UVA and UVB

Two-thirds of the articles analysed did not specify UV exposure beyond general phrases such as sunlight, sun's rays, sunshine or sunbeds. Less than one in ten referred to both UVA and UVB, with around half of these offering an explanation as to their different impact on the skin.

Evidence statement 2.7: Framing and presentation of sunbeds and sunbed use

A quarter of articles containing material on the risks of UV exposure were on the topic of sunbeds and/or sunbed use. Overall, the messages presented in these articles were uncompromisingly negative and explicit connections were made between sunbed use and risks to health and, possibly, life. This contrasts greatly with the discourse around sunbathing found in the articles analysed.

Evidence statement 2.8: Presentation of activities which increase risks of over-exposure to UV

The risks associated with sunlight exposure were almost exclusively presented in terms of sunbathing as opposed to exposure to sunlight in the course of work or outdoor leisure pursuits.

Evidence statement 2.9: Framing and presentation of sunburn

Sunburn was consistently portrayed as undesirable and harmful, and there was a discourse around self-responsibility which, for parents, included their children. However, as noted in Evidence Statement 2.4, the link between sunburn and the increased risk of skin cancer was not consistently portrayed.

Evidence statement 2.10: Framing and presentation of sunbathing

Discourses around sunbathing were complex and, to some extent, contradictory. A common discourse was 'safe sunbathing', with sunscreen presented as the means by which this could be achieved. Another common discourse was around the benefits of, and value placed on, a suntan (achieved through sunbathing) in terms of improved physical appearance and/or sense of well-being. Articles containing material about 'safe sunbathing' rarely referred to the risks of sun exposure. Negative discourses were unusual and suggested abnormal behaviour (for example, intense sunbathing) or sunbathing behaviour) or lack of personal responsibility by sunbathing 'without protection'.

Evidence statement 2.11: Reference to specific populations

Children, followed by individuals with red hair or fair skin, emerged as the sub-populations most frequently identified as being at increased risk by exposing their skin to UV. In terms of references to individuals at risk of under-exposure, this was most commonly found with reference to whole populations, due to gloomy weather, and children. Here, the risk was presented as being caused by over-protective parents and/or indoor leisure pursuits. A handful of articles referred to the increased risk of under-exposure for some minority groups.

Evidence statement 2.12: Presentation of sun safety advice

The majority of articles which included material on the risks associated with UV exposure provided no, or highly vague, advice on sun protection. Less than one in twenty articles directed the reader to further sources of information. The notion that sunscreens should not be treated as an alternative to clothing and shade was rarely expressed. No article provided presented complete and accurate guidance on sun safety as set out by NICE public health guidance.

5. CONCLUSIONS

The findings emerging from the analysis conducted for Question 1 highlight the importance of carefully prepared and comprehensive press releases as they are typically the only source of information used by journalists. The analysis revealed that press releases do not typically present the alternative risk/benefit evidence and thus, equally, newspaper articles reporting research on UV exposure do not usually alert readers to the fact that there are risks and benefits associated with UV exposure. In addition, and again as a result of the absence of this information within press releases, guidance for readers regarding sun safety is not typically presented. Together, these findings highlight issues in terms of researchers' responsibilities in the preparation of press releases, and also the need to consider whether guidance should be offered to researchers regarding the routine presentation of the risk/benefit issues in press releases as well as provision of sun safety information.

The analysis also revealed differences in the quality and comprehensiveness of reporting of research on UV exposure across genres. This will, to some extent be driven by differences in the average word length of articles between genres. In addition, there was no presentation of relative and absolute risk in the articles analysed. This highlights potential training needs of journalists, but also indicates the need for researchers to present such information clearly in press releases.

In terms of the findings from the analyses for Question 2, there are a number of implications. First, perhaps unlike other public health issues, messages about the risks and benefits of UV exposure are to be found in a number of different sections of daily and Sunday newspapers. Some journalists may not, therefore, perceive themselves as necessarily writing about a (public) health issue. In addition, it is important to highlight the explicit or implicit endorsement of this sunbathing identified in many of the articles and to note that journalists are part of a society in which suntanned (though not sunburnt) skin is seen as acceptable, and, among some groups, something valuable and to be aspired to. This contrasts with other public health issues (for example, smoking, obesity) were societal attitudes are generally more negative. There is, therefore, an additional challenge to public health professionals in finding effective ways to work with the media. The fact that UV exposure offers both risks and benefits to health adds a further layer of complexity. To date, there appears to be very little engagement by the news and magazine media in terms of reporting and weighing up these risks and benefits in the same piece of writing. As a result, the public is presented with information about risks and benefits separately and, typically, without any reference to the alternative position. Where articles presented risk and benefits, a critical discourse of confusing or conflicting messages emanating from public health professionals/government organisations was observed. Another clear implication from this set of analysis was the finding that news and magazine media do not provide comprehensive and accurate guidance on sun safety. Importantly, sunscreen is misleadingly presented as an effective method of sun protection on its own, this runs counter to advice that sunscreen should be used alongside using clothing to cover the skin and seek shade. Given the mass media's role, including print media, as a source of health information, this is significant issue.

There are limitations to this piece of work. Review Question 1 analysed the reporting of just four 'research stories'. However, we would note consistency of findings across stories. The analysis for Review Question 2 was limited to a single calendar year and confined to material indexed by Nexis UK. There are a number of ways this line of investigation could usefully be developed and extended; including conducting the analysis over a greater time period and extending the types of magazines examined in include weekly, further specialist interest magazines and publications for specific minority groups.

Section 1: Introduction

The National Institute for Health and Care Excellence (NICE) Centre for Public Health (CPH) contracted York Health Economics Consortium (YHEC) and the University of Leeds' Nutritional Epidemiology Group (NEG) to produce evidence reviews, a documentary analysis of UK media representations of the risks and benefits of sunlight exposure, and an economic model. The documentary analysis was undertaken to describe how the health benefits and risks of sun exposure have been conveyed to the UK general population via national newspaper and magazine media in the UK (print and online). This document reports on the documentary analysis.

1.1 BACKGROUND

Ultraviolet radiation is electromagnetic radiation given off by the sun. It spans 100nm to 400nm and can be subcategorised as Ultraviolet A (UVA), Ultraviolet B (UVB) and Ultraviolet C (UVC)(2). Exposure to UV radiation carries with it both positive and negative consequences for human health. Too much UV radiation is associated with an increase in the risk of developing a range of negative health conditions including, most notably, skin cancers, eye conditions including cataracts, and immunosuppression that can cause the reactivation of the virus herpes simplex(2, 3). Exposure to too little UV radiation can also lead to health problems. UVB radiation is an important source of vitamin D, which is produced in the skin through a photosynthetic reaction(3). It is an essential nutrient required to help maintain calcium and phosphate levels in the body and to maintain healthy bone and skeletal growth. Vitamin D deficiency can result in bones not forming properly and the development of rickets in children, which is characterised by growth retardation and skeletal deformities. In both children and adults, vitamin D deficiency can also result in bone pain, such as osteomalacia(2). Furthermore, there is increasing recognition that vitamin D may have an important role to play in human health, beyond its involvement in bone health. Poor vitamin D status has been linked with a range of chronic diseases such as cancers and cardiovascular disease (CVD) as well as markers of cardiometabolic health including obesity and Type 2 diabetes mellitus, although the evidence is generally insufficient to attribute causality(4).

Vulnerability to the health conditions associated with too much or too little UV exposure is complex and multi-faceted. Problems may arise as a result of exogenous factors (exposure levels that are too high or too low) or endogenous factors (variations in an individual's ability to utilise or withstand the amount of UV radiation received). Exogenous parameters include geographical variables such as latitude and climate(4), alongside cultural and behavioural considerations such as clothing practices, the amount of time spent outdoors, or the use of sun tanning beds (4). Endogenous factors include genetic characteristics such as skin pigmentation, age related changes, and gender specific circumstances such as pregnancy **and breast feeding (2)**

In the UK, attempts to proactively communicate the risks associated with too much or too little UV exposure have been made through various media. Sun protection messages have been advanced through the mass media (5), through workplace leaflets produced by the Health and Safety Executive (6), through checklists for school children and teachers produced by charitable organisations, and through the direct advice of health practitioners working in the NHS and local authorities, amongst others (7).

The overall efficacy of attempts to communicate the risks of UV exposure is unclear. While there is evidence that the awareness of the risks has increased, so has the incidence of skin cancer (8). This has been explained, in part, through the 'knowledge-behaviour gap' in which, for example, although individuals may have knowledge about the risks and benefits associated with certain actions (or the lack of such actions) they do not act upon that knowledge and adapt their behaviour accordingly' (9). Distinct agendas that seek to advise both more sun exposure, in the case of vitamin D deficiency, and less exposure, in the case of skin cancer avoidance, may have contributed to a confused message about a balance that may be difficult to understand and achieve (5).

1.2 THE CONTEXT OF THE DOCUMENTARY ANALYSIS

Stories about sunlight, exposure to the sun, skin cancer and vitamin D are often in the news, not only when new studies are published but also, often, in the lead up to the summer.

Research evidence shows that the media play an important role in shaping and influencing the general population's perceptions of public health issues(10, 11), their understanding, beliefs and even behaviour in response to various public health issues(12), and the public acceptability of public health interventions(13-15). Mass media campaigns can influence the news agenda – and even legislative priorities - as they relate to public health issues(12, 16-18), and can inform or educate the general population about public health issues and threats (12, 19). Different emphases in how a particular public health issue is reported can serve to sensationalise, educate, or normalise certain activities or behaviours(10). The media is therefore powerful in responding to, directing, and informing public health issues, and also in educating and influencing health-related behaviours among the general population. This latter point means that the media can be used as a tool in the prevention of ill-health and the promotion of good-health(12). However, it is argued that people select the information, and therefore the media sources most aligned with the presentation of that information, which most closely reflect their existing beliefs(20), which in turn reinforce their point of view(21, 22). This may thus limit the extent to which the media can be expected to influence the beliefs and health-related behaviours of the general population.

Sunlight exposure is a complex area. It is perhaps particularly difficult for the media to report stories or scientific findings that balance the potential beneficial effects of exposure to sunlight (building stocks of vitamin D) with the potential harmful effects of too much exposure to sunlight (skin cancer).

In the UK, NICE have published guidelines setting out the need to communicate the risks related to UV exposure from the perspective of skin cancer risk(7). The guidelines make recommendations for a national mass-media campaign alongside local information provision, and set out who should be involved and how; however the guideline did not make recommendations for the national press on how the risks and benefits of exposure to UV could best be balanced and reported. The guidelines promote an integrated message targeted at high risk population groups that acknowledges and challenges commonly held perceptions around UV exposure. They also acknowledge the need for a balanced message that incorporates an understanding of the health benefits of UV exposure. NICE will also publish guidelines to inform the implementation of existing guidance on the prevention of vitamin D deficiency in June 2014.

To complement these NICE CPH are developing further guidance on UV exposure focusing on communicating the risks and benefits to the general population. This analysis of newspaper and magazine representations of the risks and benefits of sunlight exposure, and the way that media report research evidence on this topic, will inform the development of that guidance.

1.3 OBJECTIVES

The purpose of this work is two-fold. First, to examine the accuracy and comprehensiveness of UK national newspaper and magazine reporting of research evidence on the health benefits and risks associated with sun exposures. Second, to identify and describe how the UK media present the health benefits and risks associated with sun exposure.

1.4 RESEARCH QUESTIONS

There are two overarching research questions:

1. How do the UK media report research findings or nationally agreed guidelines/consensus statements regarding the benefits and risks associated with exposure to sunlight?
    - How is such evidence presented and framed?
    - How accurate and comprehensive is the reporting of research studies or nationally agreed guidelines/consensus statements?
    - Is reference made to the role of individual risk factors?

2. How are the health benefits and risks of sun exposure represented in the UK media? What risks and benefits of sun exposure are presented in UK media? Has this changed over time?
    - How do the media frame, or what are the discourses used with respect to, the benefits and risks of sun exposure? Has this changed over time?
    - What types of evidence sources are used?

- Do individual articles cover both the benefits and risks associated with exposure to sunlight? How are these risks and benefits presented?
- Over the course of time, what is the balance of reporting/articles on the benefits and risks associated with exposure to sunlight within an individual publication?

1.5 IDENTIFICATION OF POSSIBLE EQUALITY AND EQUITY ISSUES

The news resources selected for analysis were broad and intended to span a range of demographics (see section on methodology for details). It was not possible to additionally target media aimed at specific demographics (e.g. young men, teenagers and BME populations), owing to limited resources and the fact that media aimed at specific ethnic groups were not indexed in the resources available to us. This is an identified limitation of the study.

1.6 REVIEW TEAM

Dr. Nicola Moran, Social Policy Research Unit, University of York (Research Fellow).
Professor Bryony Beresford, Social Policy Research Unit, University of York (Research Director).
Hannah Wood, York Health economics Consortium, University of York (Consultant).

Section 2: Methodology

2.1 DATA SOURCES

The data for this study comprised articles published by UK national daily newspapers and monthly magazines (print and online versions).

Articles eligible for **Question 1:** articles published by a wide range of UK national newspapers and monthly magazines which report specific pieces of research or a national guideline/consensus statement (chosen by the research team in conjunction with NICE) regarding the health benefits or risks associated with exposure to sunlight, during the period 1 January 2010 to 17 March 2014 (date searches completed).

Articles eligible for **Question 2**: articles related to the health benefits or risks associated with exposure to sunlight published by a sub-sample of UK national newspapers and monthly magazines (print and online versions) during 2013.

The sources of these articles were selected to represent two types of media widely read by the UK population: daily newspapers (including each daily newspaper's corresponding Sunday newspaper) and monthly magazines. Although weekly magazine titles, particularly those aimed at women, have high UK circulation figures, including them in this analysis was beyond the resource constraints of the project. These titles are not indexed by the database of news sources (Nexis UK) available to us and the content of the print versions of the most widely read magazines (e.g. Take a Break, Chat) are not available online or are behind a paywall. Purely online forms of news media, (e.g. BBC News website), were also beyond the scope of this study as the focus was on print media (including their online versions).

Newspapers can be categorised into one of three genres: serious, mid-market and tabloid (15) and we sourced material from across these genres using Nexis UK. Nexis UK is a comprehensive news and business database with an archive covering the last 35 years. The coverage of Nexis UK includes: 12,500 international newspapers, 750 global newswires, 7,000 business and trade publications, a range of popular monthly magazines, and a large number of influential web-sources and web-blogs.

The most recent 2012 – 2013 National Readership Survey statistics were used to identify the monthly magazines most appropriate to the research question. A wide range of women's, men's and general interest titles were investigated as a potential source of stories using the magazine's webpages. However, the majority of the titles did not provide access to more than a sample of stories printed in the magazine via their webpages, but instead used the website to complement the "brand" by providing additional free content such as blogs and news releases. The magazine webpages did not indicate which content was available to search, and for which date period, and therefore the webpages were not deemed appropriate as sources of news stories for this project. The exception was supermarket

monthly titles, specifically Asda and Tesco magazines, which were included as sources. These titles were available in full-text and searchable online back to mid-2012. They also had the highest circulation figures for all types of "women's magazines" (e.g. 15.2% Asda magazine vs 5.6% *OK*!; 3% Marie Claire) and readership demographics are broad in terms of age and socio-economic indicators(23, 24). Readership is also likely to include male members of the household.

The searches of the Asda and Tesco magazines were complemented by a search of 13 additional monthly magazines indexed in the Nexis UK Database. Accessing magazines via Nexis allowed the content of the printed version of the titles to be searched using the sophisticated search functionality provided by the database, and provided access to the full text of relevant stories. The titles included in Nexis UK (Figure 2.1) cover a wide range of readership demographics including those aimed at younger women, older women, men and a general audience(23, 24).

Nexis UK does not provide access to magazine titles specifically aimed at population groups of particular interest to NICE, including ethnic minorities (e.g. Asiana, Asian Image, Ebony, The Voice) and younger men (e.g. Zoo, Nuts, FHM). This may be considered a methodological weakness of this analysis; however obtaining and analysing hard copies of such titles could not be achieved within the resource constraints of the project

Figure 2.1: Relevant UK monthly magazines included by Nexis UK

Zest
Cosmopolitan
Company
New Scientist
Good Housekeeping
Harper's Bazaar
Prima
Prima Baby
Country Living
Esquire
Men's Health
Runner's World
Coast

The sources searched for each review question are as follows. The sources used for Question 2 are a sub-sample of those used for Question 1.

Question 1: A sample of 'broadsheet' UK newspapers including the print and online versions (Guardian and Observer; Daily Telegraph and Sunday Telegraph; Independent, Independent on Sunday and I; The Times and Sunday Times); mid-market tabloids (Daily Mail and Mail on Sunday; Daily Express and Sunday Express) and tabloids (Daily Mirror and Sunday Mirror; Sun and the Sunday Sun; Daily Star and Daily Star Sunday); two supermarket monthly magazines (Asda, Tesco) and 13 monthly magazines indexed by Nexis UK.

Question 2: Due to the resource constraints of this project, and the in-depth analysis required by this more qualitative aspect of the review, this question was explored by studying a smaller number of representative publications, over a period of one calendar year. Plans to analyse material from more than one year were revised once the searches had been completed and the volume of material eligible for inclusion apparent. The analysis was therefore limited to identify articles published between 1 January 2013 and 31 December 2013. This is the most recent full calendar year for which results were available. At the request of NICE, the searches were also carried out for the 2011 calendar year, and these records passed to NICE for possible future analysis to examine trends in reporting over time. The 2011 results are not part of the current analysis.

Titles searched were:

- the highest readership mid-market tabloid (Daily Mail);
- the highest readership "red-top" tabloid (The Sun);
- the highest readership broadsheet (The Daily Telegraph)(25)

The 13 relevant monthly magazines indexed by Nexis (Figure 2.1) and Asda and Tesco magazines were additionally searched.

This range covered a broad spectrum of media and readership demographic and could be expected to offer an accurate picture of UK print media portrayal of the risks and benefits of exposure to sunlight. Focusing on one calendar year provided a volume of data that was manageable in terms of the proposed content analysis plus a more qualitative analysis on the way messages were presented within the resources available to the research team. This time limited focus meant that, apart from analysis of how, if at all, time of year/season affects reporting, we would be unable to comment on how reporting of sunlight stories has changed over time. This may not be especially problematic as the focus on what is currently being reported (in 2013) may be of greater use than a longitudinal perspective in terms of guidance development. Despite the one year focus, we are still able to report on how the media frame, or what discourses are used, with respect to the benefits and risks of exposure to sunlight; whether individual articles cover both the benefits and risks associated with exposure to sunlight, and how these risks and benefits are presented; and the balance of reporting/articles on the benefits and risk associated with exposure to sunlight within an individual publication.

2.2 IDENTIFICATION AND SELECTION OF SOURCES

Question 1

The first stage of the search process was to identify research related to the benefits or risks associated with sunlight exposure that received high levels of interest from the UK press during the search period 1 January 2010 to 17 March 2014. The coverage and reporting of these studies provided the evidence to answer Question 1.

The NHS Behind the Headlines service (http://www.nhs.uk/news/), produced by NHS Choices, was used to identify research reported in the media related to the risks and benefits of sunlight exposure. Behind the Headlines selects and analyses news stories (including health alerts, scientific advances, promotion of lifestyle changes, and changes to evidence or official guidance) based on the level or significance of the coverage a piece of research receives, and so provides an indication of studies which have been heavily discussed in the news.(26)

NHS Choices does not provide the functionality to search Behind the Headlines via its webpages. The Google "site search function" was therefore used to pragmatically search the content. The search strategy is presented in Figure 2.2.

Figure 2.2: Search strategy used to identify stories in NHS Behind the Headlines using Google site search

site:http://www.nhs.uk/news/ (sun OR sunlight OR sunshine OR sunscreen OR sunblock OR sunbathing OR suntan OR tan OR tanning OR sunbed OR sunlamp OR sunburn OR solarium OR spf OR uv OR ultraviolet OR "vitamin d" OR rickets OR "skin cancer" OR melanoma) 948 results
Search tools: Limit date to 1 Jan 2010 to 31 Dec 2014 = 48 pages of results, no number given

All returned results (48 pages >948) were scanned for potentially relevant research in Google using the title and text provided. Choice of items to view and select for further consideration was based on the information specialist's judgement. Only those that made specific reference to sun light exposure, UV exposure, skin cancer, or vitamin D were selected; those that appeared to have returned only because of reference to The Sun newspaper were not chosen. Fifty-three results were selected and passed to reviewers.

Many of these could be immediately discarded as they were either not on topic (e.g. story was about new drugs/drug combinations that could be used to treat skin cancer), made very little reference to sunlight (e.g. focus was on vitamin D supplements), reported experiments that had been undertaken on animals but not on humans, or it was a piece of analysis undertaken by NHS Choices and thus not reported in the newspapers. This resulted in a 'long-list' of 13 possible research 'stories'.

The long-listed stories:

1. Sunbathing may reduce the risk of heart attacks and strokes
2. Sun and Vitamin D advice (the consensus statement)
3. Sunbeds, unsafe UV levels
4. Guidelines on sun cream
5. Sunbeds and non-melanoma skin cancer
6. Sunbeds and malignant melanoma
7. Rickets and Vitamin D
8. Fair skin and Vitamin D levels
9. Effects of Vitamin D on genes and links to auto immune diseases
10. Indoor tanning/sunbeds and the dangers of exposure to UVA as well as UVB (skin cancer)

11. Possible link between greater exposure to sunlight and reduced risk of breast cancer
12. Sunlight exposure during pregnancy and offspring's risk of MS
13. Possible link between genetic make-up of people with ginger hair and risk of skin cancer.

The 'long-list' of 13 stories was taken forward to the next stage at which point searches of a sample of national newspapers were conducted. Once the search results had been screened, 5 stories were discarded, primarily because of the very low volume of articles reporting on the story, and on closer scrutiny they were not wholly on topic.

Search strategies were then designed to identify press coverage discussing or referencing the eight shortlisted stories in the selected news and magazine sources using Nexis UK. Searches were constructed for each story and included search terms such as the name of the author, research centre, funder or journal title. The searches were limited by date to reflect the publication date of the research of interest; we searched back 12 months before publication, to capture any pre-publication coverage, to current. An example strategy, designed to identify coverage of the 2010 consensus statement on vitamin D(27) is presented in Figure 2.3. Full search strategies for each news story are reported in Appendix A.

Figure 2.3: Search strategy used to identify media coverage of Consensus Statement 2010 in Nexis UK

((“vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin” OR rickets OR osteomalacia) AND (“British Association of Dermatologists” OR “Cancer Research UK” OR “Diabetes UK” OR “Multiple Sclerosis Society” OR “National Heart Forum” OR “National Osteoporosis Society” OR “Primary Care Dermatology Society” OR “consensus statement” OR “position statement” OR "definitive statement" OR "joint guidance" OR "joint advice" OR “Rona Mackie” OR “Professor Mackie” OR ((seven OR 7) W/3 (charities OR “health groups” OR “organisations” OR expert*)))) and DATE (>=2009-12-17 and <=2014-03-18)

Key:
W/n: proximity searches. Terms must appear with n words of each other, in either direction.
*: truncation, finds one letter.

This produced greater depth and breadth of coverage and allowed us to make more informed decisions about which stories to take forward for full analysis. Results were downloaded into Word Documents in full text format. Obviously irrelevant records were removed (those that were obviously not concerned with sunlight exposure). Duplicate records, resulting from the publication of one story in different editions of the same news source were removed. Multiple occurrences of the same story across different news sources (often recurring as a result of syndication) were not treated as duplicates and so were retained.

At this point a further three stories were discarded owing to low volume of reporting on the research, and focus not directly on the risks and benefits of exposure to sunlight. Thus five stories were selected to take forward for potential full analysis for Q1.

Flowchart of decisions re stories to include for Q1:

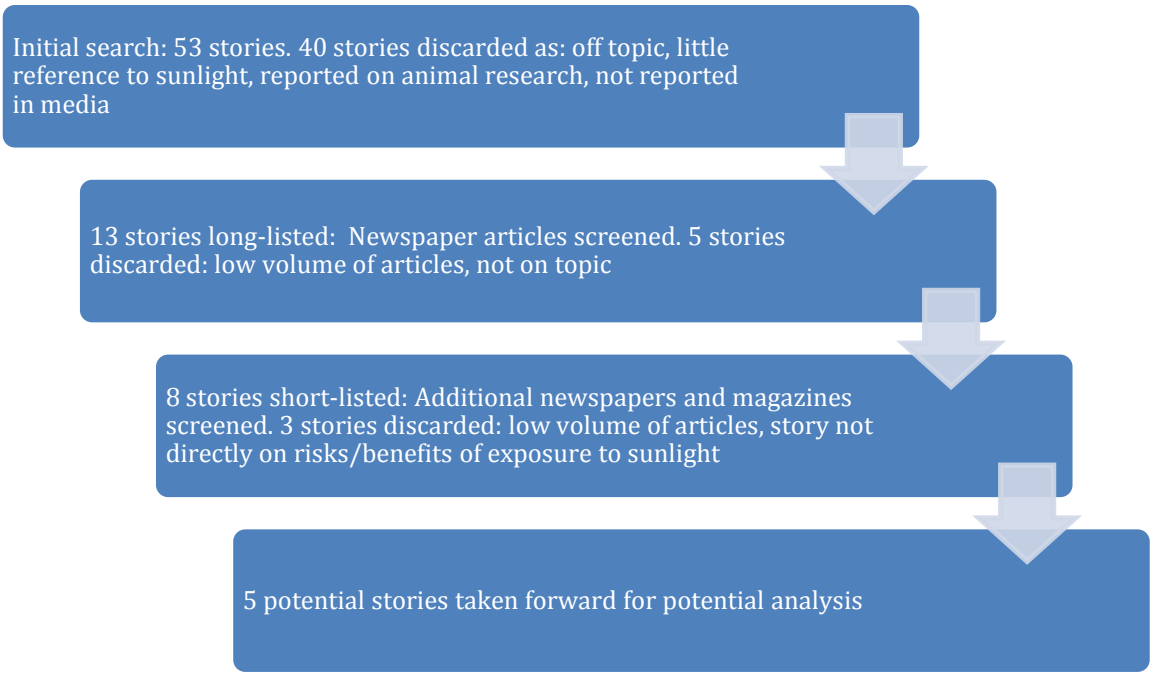


Table 2.1: The five potential stories to be analysed for Question One

Story	Research	Risk/Benefit story	No. of articles reporting the research
1	Pearce, S.H.S. and Cheetham, T.D. (2010) 'Diagnosis and management of vitamin D deficiency'. *BMJ* 2010; 340: b5664	Benefits: story states that exposure to sunlight helps combat rickets	10 plus further mention in a weekly review
2	British Association of Dermatologists, Cancer Research UK, Diabetes UK, the Multiple Sclerosis Society, the National Heart Forum, the National Osteoporosis Society and the Primary Care Dermatology Society (2010) 'Consensus vitamin D position statement'. *Cancer Research UK*, December 17 2010	Neutral: discusses risks and benefits of sunlight exposure	6
3	Boniol, M., Autier, P., Boyle, P. and Gandini, S. (2012) 'Cutaneous melanoma attributable to sunbed use: systematic review and meta-analysis'. *BMJ (*Published online July 24 2012)	Risks: skin cancer risk from exposure to sunbeds/UV rays	7
4	Drug and Therapeutic Bulletin (2011) 'Sunscreen SPFs: clear as daylight?' (editorial), *Drug and Therapeutic Bulletin*, June 2011; vol. 49, no. 6: 61; and 'Do sunscreens have a role in preventing skin cancer?' (evidence review), *Drug and Therapeutic Bulletin*, June 2011; vol. 49, no. 6: 69-72.	Risks: Looks at the risks associated with use of inadequate SPF sunscreen	12
5	Liu, D., Fernandez, B.O., Hamilton, A., Lang, N.N., Gallagher, J.M.C., Newby, D.E., Feelisch, M. and Weller, R.B. (2014) 'UVA Irradiation of Human Skin Vasodilates Arterial Vasculature and Lowers Blood Pressure Independently of Nitric Oxide Synthase'. *Journal of Investigative Dermatology* (Published online January 20 2014)	Benefits: story states that exposure to sunlight helps lower blood pressure	35

Unfortunately, resource constraints meant it was only possible to analyse four stories. It was decided to exclude Story 5 from the analysis as the paper reported trials on healthy volunteers and there was scepticism about whether the results were transferrable to those in high risk groups (e.g. those with high blood pressure).

The press release associated with each of the four stories (pieces of published research) was also retrieved.

Question 2

Searches of the selected titles were undertaken using Nexis UK to identify articles reporting on the risks and benefits of sun exposure. A wide range of search terms were used in Nexis UK including terms for sun-related behaviours such as sun-screen use, tanning and sun-bathing. Search terms for key consequences of too little or too much exposure to sunlight, specifically skin cancers and vitamin D deficiency, were also used. As the decision to include only articles from the 2013 calendar year was made after the searches were carried out, the date range of the searches was 1 January 2010 to current. The search strategy is presented in Figure 2.4, full search details are reported in Appendix A.

Results were downloaded into Word Documents in full text format. Obviously irrelevant records were removed (those that were obviously not concerned with UV exposure). Duplicate records, resulting from the publication of one story in different editions of the same news source were removed. Multiple occurrences of the same story across different news sources (often recurring as a result of syndication) were not treated as duplicates and so were retained.

Figure 2.4: Search strategy used to identify stories related to sunlight exposure from selected newspaper and magazine titles in Nexis UK

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risk! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets))

Key:
HLEAD: Searches for the terms in the headline and first paragraph/
W/n: proximity searches. Terms must appear with n words of each other, in either direction.
!: truncation, finds any number of letters.
*: truncation, finds one letter.

2.3 DATA ANALYSIS PROCESSES

Question 1

Data analysis for Question one consisted of three parts:

1. Assessment of the comprehensiveness of newspaper reporting of published research;
2. Assessment of the accuracy of the reporting of published research;
3. Analysis of the themes presented in the newspaper reports around the portrayal of risks and benefits of exposure to sunlight.

Assessment of the comprehensiveness of the newspaper reporting of published research:

To assess the comprehensiveness of the reporting of published research, one member of the review team (NM) read through the research paper and noted the dominant findings/messages. These were used as column headings on an Excel spreadsheet. Additional columns were set up to record whether the name of the author (s), the name of the research centre (s) and the name of the journal were reported in the articles. The number of columns necessarily differed for each 'story' (piece of published research) owing to the number of dominant findings/messages recorded. A response of 'yes' or 'no' was required for each column for each article. A 'completeness score' was ascribed to each article based upon the number of 'Yes' responses. Appendix C contains the column headings for each of the four stories analysed.

During the course of the analysis it became evident that the comprehensiveness of the press release associated with the published research had a substantial impact upon the completeness scores of the newspaper articles. Thus an additional row was added to the bottom of the tables reporting the completeness scores. The new row recorded the completeness score of the newspaper articles when measured against the press release. For each newspaper article, the completeness score increased by one where the 'Yes' or 'No' response for the article matched the 'Yes' or 'No' response for the press release. This was based on the recognition that in the majority of cases the newspaper article was based upon the press release rather than the published research, thus it made more intuitive sense to judge the newspaper article against the content of the press release.

Assessment of the accuracy of the reporting of published research:

After researching a number of alternatives (see Appendix D), and with agreement from NICE, the review team adopted Moyer et al's(1) categorisation of errors/inaccuracies to assess the accuracy of the reporting of research. The list of ten coding errors/inaccuracies was adapted by the research team who removed the tenth category, 'other miscellaneous inaccuracies'. This was defined by Moyer et al as general factual errors not related to the study. Thus, the research team adopted categories one to nine from Moyer's list.

Table 2.2: The accuracy assessment criteria used in the analysis

Accuracy assessment (Moyer et al. 1995)	
1. Misleading title (distorts/exaggerates meaning of the study)	
2. Shift in emphasis (more dramatic/optimistic, or risk is exaggerated)	
3. Treating speculation as fact	
4. Erroneous information (factual errors that distort the meaning)	
5. Omitting other important results (e.g. talks about the health benefits but not the risks)	
6. Omitting qualifications to findings (e.g. limited generalizability)	
7. Omitting important aspects of the research methods (integral to the study's meaning)	
8. Overgeneralising findings (generalising to a larger population than is reasonable)	
9. Inaccuracies due to obtaining information from personal communications	
Accuracy score (out of 9):	

Two columns per category were set up in Excel: one to record a 'yes' or 'no' answer, and one to allow the insertion of explanatory information if the response was 'yes'. The accuracy score was arrived at by counting up the number of 'no' responses as a 'no' response indicated that the information for a category was accurate.

As with the analysis of the comprehensiveness of newspaper reporting of published research, it was similarly the case that the accuracy of the newspaper articles was correlated with the accuracy of the associated press release. Thus an additional row was also added to the bottom of the tables reporting the accuracy scores. The new row recorded the accuracy score of the newspaper articles when measured against the press release. For each newspaper article, the accuracy score increased by one where the 'Yes' or 'No' response for the article matched the 'Yes' or 'No' response for the press release. Thus, even where the press release had reported something inaccurately, the newspaper article was counted as accurate on that particular finding if it had accurately reported the inaccuracy contained in the press release (as this meant it was an accurate reflection of the content of the press release).

Analysis of the themes presented in the newspaper reporting of each story for Question One :

In addition to analysis of the comprehensiveness and accuracy of newspaper reporting of the published research, this review also looked at the themes presented in the newspaper articles around how the risks and benefits of exposure to UV were presented. A more coarse-grained version of the data extraction framework (developed for Question Two) was used for this analysis (see Appendix E).

Question 2

Quantitative content analysis(28) was used to describe the volume of reporting (number of articles, word length) on the topics of risk and benefits of sunlight exposure and to describe and compare reporting within and across publications and publication genres. Qualitative thematic analytical techniques(29) were used to explore the way exposure to sunlight, and its risks and benefits, were reported or presented by the UK print media. A data extraction framework was created which allowed relevant data to be organised and classified (see Appendix G). Relevant text from the articles was extracted and summarised (including verbatim extracts) onto 'charts' (Excel spreadsheets), with a separate chart for each theme/topic of the data extraction framework. Data was entered onto the spreadsheets in such a way as to allow comparison within and across publications.

The final stage of the thematic qualitative data analysis involved 'reading' of the charts, composing 'analytical notes' which described the data. These notes were used to develop ideas and test observed patterns in the data (for example differences between publications in discourses about sunlight exposure) and to explore connections between themes. Detailed written summaries of the material contained in each chart, and observed patterns and connections, were then prepared and these formed the basis of the report of the findings.

Section 3: Results

This section begins with a detailed analysis of newspaper reporting of the four research stories selected for Question One. It is followed by a cross-cutting analysis of the way the newspapers reported these stories. The section continues with a report of the analyses of data reviewed for Question Two which examined the way UK newspaper and magazine media portrayed the risks and benefits of UV exposure during 2013.

3.1 QUESTION ONE

Review Question One: How do the UK media report research findings or nationally agreed guidelines/consensus statements regarding the benefits and risks associated with exposure to sunlight?

The more specific research questions were:

- How accurate and comprehensive is the reporting of research studies or nationally agreed guidelines/consensus statements?
- Is reference made to the role of individual risk factors?
- How is such evidence presented and framed?

This section begins with an analysis of the material for each of the four stories. For each story, there is a brief outline of the research findings, an analysis of the completeness of reporting of the research by the newspaper articles as measured against the published research and against the press release, an analysis of the accuracy of the reporting of the research measured against the published findings and the press release, and a review of the themes evident in the newspaper reporting of the research. Following the analysis of each individual story, section 3.2 provides a cross-cutting analysis of emerging themes and issues.

Story One

This story reported a clinical review of evidence around vitamin D deficiency, conducted by Pearce and Cheetham (University of Newcastle) and published in the British Medical Journal(30). The published research stated that the main source of vitamin D is UVB. The review reported the effect of a lack of vitamin D on bone deformity (rickets), hypocalcaemia, infections and respiratory symptoms in children and musculoskeletal pain and weakness in adults. Other conditions found by the review to be associated with vitamin D deficiency were cardiovascular disease, type 1 and 2 diabetes, cancers, MS, and some autoimmune conditions. Risk factors for vitamin D deficiency were: skin pigmentation (darker skin), the use of sunscreen/concealing clothing, old age or living in institutions, having renal or liver disease, and use of anticonvulsants. The authors note that while several hundred children

are treated for rickets each year in the UK, this is only a small proportion of those with vitamin D deficiency. Further, fifty per cent of adults were believed to have insufficient vitamin D; with sixteen per cent expected to have a severe deficiency during winter and spring months. Greater prevalence of vitamin D deficiency was noted in more northern parts of the country. The authors recommended that those with fair skin spend around 20-30 minutes in the midday sun with face and forearms exposed and without sunscreen, two to three times per week in the summer months. They argued that the public should be made aware of the need for exposure to sunlight, the availability of vitamin D supplements, and the vitamin D benefits of eating oily fish. They also recommended that milk and some foods be supplemented with vitamin D. The authors also noted a problem with low levels of calcium in children's diets.

Completeness

Table 3.1: Completeness of reporting of research Story One

Article	**Newcastle University Press**	**The Guardian (32)**	**Daily Mirror (33)**	**Daily Mail (34)**	**Daily Telegraph (35)**	**Guardian Unlimited(36)**	**Daily Mirror(37)**	**The Sun(38)**	**Guardian Unlimited(39)**	**The Express(40)**	**The Independent(41)**	**The Times(42)**	**Total number of articles reporting**
Type of publication*	P.R.	B	T	M	B	B	T	T	B	M	B	B	**12**
Author named?	Y	N	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	**10**
Research centre named?	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**
Journal named?	Y	N	N	Y	Y	Y	N	N	Y	Y	Y	Y	**8**
Ref to other diseases?	Y	N	N	Y	N	N	N	N	N	N	N	Y	**3**
Ref to no. with rickets being very small proportion of those deficient?	N	N	N	N	N	N	N	N	N	N	N	N	**0**
Recommendations for unprotected exposure 20-30 minutes 2-3 times per week?	N	N	N	Y	N	Y	N	N	Y	N	N	N	**3**
Ref authors' calls for vitamin D supplementation	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**

Article	**Newcastle University Press**	**The Guardian (32)**	**Daily Mirror (33)**	**Daily Mail (34)**	**Daily Telegraph (35)**	**Guardian Unlimited(36)**	**Daily Mirror(37)**	**The Sun(38)**	**Guardian Unlimited(39)**	**The Express(40)**	**The Independent(41)**	**The Times(42)**	**Total number of articles reporting**
of milk and foods?													
Ref to other risk factors/high risk groups?	Y	N	N	N	N	Y	N	N	Y	N	N	N	**3**
Completeness score against published research (out of 8)	**6**	**2**	**0**	**6**	**4**	**6**	**3**	**3**	**6**	**4**	**4**	**5**	**-**
Completeness score against press release (out of 8)	**-**	**4**	**2**	**6**	**6**	**6**	**5**	**5**	**6**	**6**	**6**	**7**	**-**

***Key**: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid

When newspaper articles were compared against the published research, their completeness scores ranged from 0 to 6 (maximum score 8). The most comprehensive coverage of the published research was found in the press release, a mid-market, and two broadsheets (score of 6); the least comprehensive coverage was found in a tabloid (score of 0). Ten of the twelve publications named the author of the research paper, 11 reported the research centre, and 8 identified the journal. Only three of the articles (the press release, a mid-market and a broadsheet) referred to other conditions (in addition to rickets) associated with vitamin D deficiency (cardiovascular disease, type 1 and 2 diabetes, cancers, MS, and autoimmune conditions). None of the articles made reference to the statement that the number of those with rickets is only a very small proportion of those with a vitamin D deficiency (i.e. the absolute risk). Only three of the twelve articles (a mid-market and two broadsheets) reported the authors' recommendations for unprotected exposure to sunlight for 20-30 minutes two to three times per week. Almost all (11 stories) reported the authors' calls for vitamin D supplementation of milk and some foods (all except one of the tabloids). Only the press release and two articles (two broadsheets) referred to other risk factors or groups at high risk of vitamin D deficiency.

The press release had a completeness score of 6 out of 8. When compared to the press release the newspaper articles all increased their completeness score by 2 points (the difference between the completeness score of the press release and the maximum score possible), except for three articles (highlighted). By comparison, the three highlighted articles each achieved the same score irrespective of whether they were measured against the press release or the published research. This is because, in each case, the articles did not report something that was mentioned in the press release, but countered this by reporting on something stated in the published research that was not mentioned in the press release (the study authors' recommendations for unprotected exposure to UV for 20-30 minutes 2-3 times per week). This balanced out the scores for these three articles.

Accuracy

Table 3.2: Accuracy of reporting of research Story One

Article	**Newcastle University**	**The Guardian (32)**	**Daily Mirror (33)**	**Daily Mail (34)**	**Daily Telegraph (35)**	**Guardian Unlimited(36)**	**Daily Mirror(37)**	**The Sun(38)**	**Guardian Unlimited(39)**	**The Express(40)**	**The Independent(41)**	**The Times(42)**	**Total number. articles reporting**
Type of publication*	PR	B	T	M	B	B	T	T	B	M	B	B	**12**
Misleading title	N	N	N	N	Y	N	Y	N	N	Y	Y	Y	**5**
Shift in emphasis	Y	N	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	**10**
Treating speculation as fact	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Erroneous information	N	N	N	N	N	N	N	N	N	N	N	N	**0**
Omitting important results	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Omitting qualifications	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Omitting research methods	N	Y	Y	N	N	N	Y	Y	Y	Y	Y	Y	**8**
Overgeneralisation	N	N	Y	N	N	N	N	N	N	N	N	N	**1**
Inaccuracies from personal communications	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**12**
Accuracy score against published research (out of 9)	**4**	**4**	**2**	**5**	**3**	**4**	**2**	**3**	**3**	**2**	**2**	**2**	**-**
Accuracy score against press release (out of 9)	**-**	**7**	**7**	**8**	**8**	**9**	**7**	**8**	**8**	**7**	**7**	**7**	**-**

*__Key:__ P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid

The accuracy score for newspaper articles, when measured against the published research, ranged from 2 to 5 (maximum score 9). Most accurate reporting was found in a mid-market newspaper (score of 5), with the least accurate reporting in two tabloids, a mid-market and two broadsheets (scores of 2). One reason for such low accuracy scores across all articles is that the press release included a quote (personal communication) from one of the researchers which did not reflect the findings in the research paper: *"Kids tend to stay indoors more these days and play on their computers instead of enjoying the fresh air. This means their vitamin D levels are worse than in previous years".* This quote is not backed up by any evidence presented in the research paper, but it was picked up and used in all of the newspaper articles. Thus, four of the articles had misleading headlines: *'Return of rickets in the computer generation'* (Broadsheet), *'Rickets hits indoor kids'* (Tabloid), *'Rise in rickets in children due to lifestyle change'* (Broadsheet) and *'Disease of the Victorian poor returns as children turn from sunshine to television'* (Broadsheet). A fifth newspaper article (Mid-market) reported the vitamin D deficiency story alongside a different study concerning cancer; the headline reflected the cancer story *'Sunshine vitamins cut risk of cancer'*, so was misleading in regards to the vitamin D story.

Ten of the articles (including the press release) shifted the emphasis of the story: in seven cases the focus (sometimes sole focus) of the story was on children being indoors playing computer games – which was not mentioned in the original research paper; one article mainly focused on the cancer story; and two articles focused on the changing ethnic make-up of the UK population, differences between ethnic groups and the effect this may have on levels of vitamin D deficiency in the UK (as those with darker skin need longer in the sunshine to produce vitamin D and are a higher risk group for becoming vitamin D deficient). The research paper did not make any reference to the ethnic make-up of the population; the newspaper articles seem to be referring to other studies conducted by the same authors that were reported elsewhere. The press release also printed additional information (not contained in the research paper) about the number of cases of rickets diagnosed each year in Newcastle, and made reference to poverty, starvation, Victorian times and the developing world (none of which were mentioned in the research paper, but which could influence media coverage). All twelve articles effectively treated speculation as fact by asserting that children were vitamin D deficient because they stayed indoors playing computer games rather than playing outside in the sunshine. All twelve articles also omitted at least one set of important findings: 9 failed to report the author's advice around unprotected exposure to sunlight for 20-30 minutes two to three times per week; 9 did not report associations between vitamin D deficiencies and other diseases; 9 omitted to report risk factors for vitamin D deficiency or identify groups at highest risk of vitamin D deficiency, while one other noted only a small number of those risk factors; and one article did not mention the authors' calls for vitamin D supplementation of milk and some foods. In total, 1 article omitted one of those pieces of information, 6 articles omitted 3 pieces, 2 articles omitted 2 pieces of information, and 3 articles omitted just one of those pieces of information. All articles also omitted the authors' comment that children with rickets are only a small proportion of those with a vitamin D deficiency. Four articles referred to the paper as a 'clinical review' without giving any details about the number of studies or date range included, while eight articles made no reference to the type of paper or research method. One article, from a tabloid, overgeneralized the findings in that the focus of the article was exclusively about children being indoors. As

reported above, all articles reported the quote from one of the authors about children staying indoors playing computer games. This was not contained in the research paper but was in the press release. It is an inaccurate reflection of the content of the research paper. Further, two editions of the same broadsheet newspaper reported additional data from one of the authors: *"Most commonly affected, he [Professor Pearce] said, are those of Asian or African descent who live in northern cities. He has examined cases among young Somali speakers who live in east Newcastle."* Again, such data was not contained in the research paper in question.

Against the published research the accuracy score ranged from 2-5, but against the press release the accuracy score increases to 7-9. This is perhaps so marked because the press release itself only gained an accuracy score of 4 against the published research. However, while the articles rather accurately reported what was stated in the press release, the press release itself was not very accurate thus the newspaper articles do not accurately report the key messages of the published research. This results from a failing of the press release.

Themes presented in the newspaper reporting of Story One

This section (for each of the four stories) looks at the themes presented in the newspaper articles and at how the risks and benefits of exposure to UV were presented and framed in the reporting of the story.

The dominant discourse among the press release and newspaper articles was the increase in vitamin D deficiency and the re-emergence of rickets in children resulting from a lack of unprotected exposure to sunlight. The main 'cause' of this lack of sunlight was argued to be the greater time spent indoors by children playing on computer games or watching television. This was not reported in the research paper but, as discussed above, was presented in the press release as a quote from one of the report's authors. Thus, the newspaper articles were accurately reporting what was stated in the press release; the issue is that the press release did not accurately reflect what was stated in the published research. The quote significantly influenced the discourse around the reporting of vitamin D deficiency in the UK:

> *'The many hours children spend indoors playing computer games or watching television may be to blame for a resurgence of rickets.'*
> (Broadsheet)

> *'Kids' indoor lifestyles have led to a boom in rickets, say experts. Youngsters spend so much time playing computer games that they are not getting enough vitamin D from the sun to protect them from the bone-softening condition.'*
> (Tabloid)

In addition, four of the articles (the press release, a mid-market, a tabloid and a broadsheet) referred to the impact of children's poor diet on increasing levels of vitamin D deficiency, and three different articles (from three editions of the same broadsheet) sought to blame *'over-anxious parents who slap on excessive sunscreen [for] contributing to a sharp rise in cases*

of the bone disease rickets'. All twelve articles (including the press release) focused on the benefits of exposure to sunlight to increase production of vitamin D and the risks associated with a lack of exposure to sunlight: vitamin D deficiency and the associated increase in rickets amongst children and the link with a range of other diseases in adults, including cardiovascular disease, type 2 diabetes, some cancers, bone weakening and some autoimmune conditions (adult conditions were reported in four articles including the press release). Seven also reported authors' calls for the fortification of milk and some foods with vitamin D. Only one article (from a mid-market newspaper) reported the opposite risk, that *'too much sun can trigger skin cancer'* and also that *'Scientists warn against buying vitamin pills as it is not clear whether large doses are safe'*.

None of the articles displayed any confusion about the risks and benefits of exposure to sunlight, but two articles (in different editions of the same broadsheet) reported a degree of scepticism about the risks of exposure by one of the report's authors who was quoted as saying: *"Some people are taking the safe sun message too far*". Additional risks (i.e. risks other than rickets in children) were only presented in two articles. A mid-market reported that vitamin D deficiency is linked to a higher risk of other diseases such as bowel cancer, heart disease, ageing, brittle bones and MS; while a broadsheet linked a vitamin D deficiency to cardiovascular disease, type 2 diabetes, cancers and bone weakening in adults, particularly those adults who live in the North of England or Scotland, and those who cover their skin.

Advice was implicit in ten of the articles, most regarding the need for children to play outside more (10 stories), for milk to be fortified with vitamin D (10 stories), for adults to undertake greater exposure to sunlight (3 stories), and for children to play outside without sunscreen (1 story). Explicit advice regarding exposure to sunlight was presented in five articles. A tabloid stated '*Children need to play outside more and absorb more sunlight to prevent against rickets'*; one mid-market newspaper presented a "factfile" on rickets which included the advice '*In summer, 15 minutes' daily exposure to sunlight of the arms, head and shoulders enables the body to make enough vitamin D for good health'*. Another mid-market reported: '*Although too much sun can trigger skin cancer, most experts agree that a 10 to 15 minute walk in the sun will boost vitamin D levels without causing skin damage. During these outings, people are advised to avoid sunscreen and expose as much of their body as possible to the UV rays'*. Two articles (two editions of one broadsheet) reported sun safety advice provided by the researchers *'it's good to have 20 to 30 minutes of exposure to the sun two to three times a week, after which you can put on a hat or sunscreen*'. Ten articles, including the press release, did not provide any sun safety advice (e.g. use of sunscreen, concealing clothing, seeking shade, etc.). The authors' calls for fortification of milk with vitamin D was mentioned in 11 articles and a reference to other foods containing vitamin D was also mentioned in one of those 11 articles.

Each of the articles made specific reference to one or more groups. All referred to children (12 stories), with some also referring to adults in general (7 stories), those living in northern parts of the UK (5 stories), people in high risk groups (4 stories), and those with bowel cancer (1 story). The proportion of text relating to children was the greatest in all but two articles, ranging from 0.13 to 1.0 of the full text of the article (full details presented in Appendix F).

Six of the articles referred to additional sources of information. Four reported on a separate study linking vitamin D with a reduction in the risk of bowel cancer; two provided a history of rickets; two referred to other work undertaken by the same researcher about the vitamin D levels of young Somali speakers who live in east Newcastle; and one reported that the Food Standards Agency had resisted calls for mandatory supplementation with vitamin D but did advise pregnant and breastfeeding women and people over 60 to take a vitamin D supplement. None of the articles distinguished between UVA and UVB.

Story Two

This story is the 'Consensus vitamin D position statement'(27) published jointly by the British Association of Dermatologists, Cancer Research UK, Diabetes UK, the Multiple Sclerosis Society, the National Heart Forum, the National Osteoporosis Society and the Primary Care Dermatology Society in December 2010.

The statement explains that vitamin D is essential for good bone health (low levels are associated with rickets in children and osteomalacia and osteoporosis in adults) and that for most people sunlight is the most important source of vitamin D. It reports that the time required to make sufficient vitamin D varies according to a number of environmental, physical and personal factors, but is typically short and less than the amount of time needed for skin to redden and burn which raise the risk of skin cancer. It notes that Vitamin D supplements and specific foods can help to maintain sufficient levels of vitamin D, particularly in people at risk of deficiency. It also reports there is still a lot of uncertainty in terms of: what levels qualify as "optimal" or "sufficient", how much sunlight different people need to achieve a given level of vitamin D; and the benefits and risks of widespread supplementation. The statement describes evidence that vitamin D protects against cancer, heart disease, diabetes, MS and others as inconclusive. Production of vitamin D soon plateaus; additional UV exposure provides no additional vitamin D but does increase levels of DNA damage and risk of skin cancer. However, regularly going outside at midday without sunscreen for a few minutes should be enough to produce sufficient vitamin D. The more skin that is exposed, the better. Groups identified as being at high risk of vitamin D deficiency are: pregnant and breastfeeding women, young children, older people, darker-skinned people, those wearing concealing clothing, people living in institutions, skin cancer patients and those who avoid the sun. The statement refers to government recommendations that those at risk of low sun exposure take vitamin D supplements of 10 microgram per day (7 mg for children aged 6 months to 5 years). However, it states there is not sufficient evidence to support a recommendation for food fortification or widespread vitamin D supplementation for the general population as not enough is known about the possible risks of raised vitamin D blood levels. Finally, the statement notes that, whilst UVB exposure via sunbeds can increase vitamin D production, they are linked to high frequency of sunburn and risk of melanoma

Completeness

Table 3.3: Completeness of the reporting of research Story Two

Article ID	**Cancer Research UK(43)**	**Daily Mail(44)**	**Daily Telegraph(45)**	**The Express(46)**	**The Express(47)**	**Daily Mirror(48)**	**Daily Mail(49)**	**Independent(50)**	**Total number of articles reporting**
Type of publication*	P.R.	M	B	M	M	T	M	B	**8**
At least one of the organisations named?	Y	Y	Y	Y	Y	Y	Y	Y	**8**
All of the organisations named?	Y	Y	Y	N	N	N	N	N	**3**
Sunlight most important source of vitamin D noted?	Y	Y	N	Y	Y	Y	Y	Y	**7**
High risk groups (re vitamin D deficiency) named?	N	N	N	N	N	N	N	N	**0**
Recommendations for vitamin D supplements for those in high risk groups?	N	N	N	N	N	N	N	N	**0**
Ref to benefits of sun exposure (vitamin D production)?	Y	Y	Y	Y	Y	Y	Y	Y	**8**
Ref to risks of too much sun exposure (skin cancer)?	Y	N	Y	N	N	Y	Y	N	**4**
Recommendation to spend a few minutes in the sun 2-3 times p/w with unprotected skin?	Y	Y	Y	Y	Y	Y	Y	Y	**8**
Fortification/supplementation with vitamin D not yet recommended as query toxicity risk?	Y	N	N	N	N	N	N	N	**1**
Production of vitamin D soon plateaus, additional exposure leads to DNA damage and risk of skin cancer, not further vitamin D production?	N	N	N	N	N	N	N	N	**0**

Article ID	**Cancer Research UK(43)**	**Daily Mail(44)**	**Daily Telegraph(45)**	**The Express(46)**	**The Express(47)**	**Daily Mirror(48)**	**Daily Mail(49)**	**Independent(50)**	**Total number of articles reporting**
Sunbeds: production of vitamin D plateaus rapidly, risks outweigh benefits?	N	N	N	N	N	N	N	N	**0**
Inconclusive re vitamin D role in preventing or reducing risk of other diseases (cancers, MS, diabetes, etc.)?	Y	?	?	Y	Y	N	N	N	**3**
Completeness score against published research (out of 12)	**8**	**5**	**5**	**5**	**5**	**5**	**5**	**4**	**-**
Completeness score against press release (out of 12)	**-**	**9**	**9**	**9**	**9**	**9**	**9**	**8**	**-**

*__Key__: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid.

When measured against the published research, completeness scores for the newspaper articles ranged from 4 to 8 (maximum score of 12). The press release was the most comprehensive with a score of 8, but did not name the groups at high risk of vitamin D deficiency or state the recommendations for them to take vitamin D supplements, and did not report that production of vitamin D (from sunlight or sunbed use) soon plateaus with additional exposure simply risking DNA damage and risk of skin cancer rather than producing additional vitamin D.

The least comprehensive report was published by one of the broadsheets, whilst all other publications (1 broadsheet, 3 mid-markets, and 1 tabloid) each scored 5. Each of the four pieces of information not reported in the press release was similarly not reported by any of the newspapers, possibly suggesting that newspaper journalists used only the press release as their information source. All publications (8 stories) named at least one of the organisations which produced the consensus statement, typically Cancer Research UK (7 articles) and/or the British Association of Dermatologists (6 publications), with the others only named in 3 or 4 articles. All publications mentioned the benefits of exposure to sunlight and all also reported the recommendation to spend a few minutes in the sun with unprotected skin on a regular basis. Interestingly, only four of the eight articles also reported the risks of over exposure to sunlight (risk of skin cancer). Only the press release noted that fortification or supplementation of food and milk products with vitamin D was not recommended for the whole population as it was not fully known what, if any, toxicity risk may be associated with high blood levels of vitamin D. The press release and two other articles reported that any link between vitamin D and the prevention or reduction of other diseases (such as cancers, MS and diabetes) was inconclusive, one article made no mention of any link, two articles were ambivalent in reporting that vitamin D deficiency had been *'linked with'* or *'linked to'* certain diseases, another explained that *'recent research has shown that'* there is a link, and another article reported that *'several new studies had suggest[ed] a link between various illnesses and a chronic lack of the vitamin'*. Reporting of this 'inconclusive' evidence was very mixed.

For story two, the press release itself only had a completeness score of 8 out of 12 (and thus was 'incomplete' in four areas). This meant that the newspaper articles were far more comprehensive (received a higher completeness score) when compared to the press release as compared to the published research. In each case, the completeness score for the newspaper article increased by 4 points when measured against the press release - the same number (4) that marked the difference between the completeness score of the press release and the maximum score possible. However, none of the newspaper articles reported even half (one only a third) of the key messages from the published research findings.

Accuracy

Table 3.4: Accuracy of reporting of research Story Two

Article ID	**Cancer Research UK(43)**	**Daily Mail(44)**	**Daily Telegraph(45)**	**The Express(46)**	**The Express(47)**	**Daily Mirror(48)**	**Daily Mail(49)**	**Independent(50)**	**Total number. of articles reporting**
Type of publication*	P.R.	M	B	M	M	T	M	B	**8**
Misleading title	N	N	N	Y	N	N	N	Y	**2**
Shift in emphasis	N	Y	N	N	N	N	N	Y	**2**
Treating speculation as fact	N	N	N	N	N	N	N	N	**0**
Erroneous information	N	N	Y	Y	Y	N	N	N	**3**
Omitting important results	Y	Y	Y	Y	Y	Y	Y	Y	**8**
Omitting qualifications	N	Y	N	Y	Y	N	N	Y	**4**
Omitting research methods	N	N	N	N	N	N	N	N	**0**
Overgeneralisation	N	N	N	N	N	N	N	N	**0**
Inaccuracies from personal communications	N	Y	N	N	N	N	N	N	**1**
Accuracy score against published research (out of 9)	**8**	**5**	**7**	**5**	**6**	**8**	**8**	**5**	**-**
Accuracy score against press release (out of 9)	**-**	**6**	**8**	**6**	**7**	**9**	**9**	**6**	**-**

The accuracy score for newspapers, when measured against the published research, ranged from 5 to 8 (out of 9). Most accurate reporting was found in the press release, the only tabloid, and a mid-market (8), with the least accurate reporting found in two mid-markets and a broadsheet (5). Two of the articles had a misleading title: the mid-market headline, *'Why getting some sun is good for you'*, was categorized as misleading as there was no qualification to the title regarding how much time it was safe to spend unprotected in the sun; the broadsheet headline, *'Health bodies to acknowledge need to tan during peak hours'*, again was unqualified and linked sunlight exposure with a 'need to tan'. The same broadsheet was judged to have shifted the emphasis of the story. The article reported on a leaked draft of the consensus statement five months prior to its publication. It stated *'The wording of the draft document is being seen by some commentators as a tacit admission by Cancer Research UK that it had got it wrong in the past about telling people to avoid the midday sun, to apply sunscreen and to stay in the shade in order to avoid exposure to the cancer-causing rays of the sun'*. It is misleading to assert that past advice from CRUK was wrong as the revised advice is still to spend anything above 10-15 minutes outside in the shade, covered up, and wearing sunscreen. A different mid-market newspaper also shifted the emphasis of the story by focusing on spending time in the sun to produce vitamin D without balancing this with the need to take precautions to avoid the risk of skin cancer.

Three articles (a broadsheet and two mid-markets) presented erroneous information. The broadsheet reported *'Experts have overturned decades of advice by urging people to go out in the midday sun without sunblock because the dangers of missing out on vitamin D can outweigh the risk of cancer'.* This is clearly not what was stated in the consensus statement. Similarly, the mid-market newspaper (two editions) erroneously reported *'Experts now believe that cancer concerns associated with moderate levels of sunshine are wrong'.* The previous advice was not wrong; simply there is new awareness of the health benefits of vitamin D and the risks of underexposure to the sun in terms of its impact on vitamin D production.

None of the articles made reference to the groups at highest risk of vitamin D deficiency and consequently none reported the recommendation that these groups take vitamin D supplements.

Four of the newspaper articles (three mid-markets and a broadsheet) also omitted important qualifications: none of them were explicit about the need for people to cover up, seek shade, use sunscreen etc. after that initial 10-15 minutes of unprotected time in the sun, and were not explicit about the risks of DNA damage and skin cancer from over-exposure to sunlight. One mid-market newspaper quoted a member of Health Research Forum saying *'The public has been seriously misled by advice to avoid the sun'.* Again this is not entirely true. The public were not necessarily misled, rather advice has been amended. None of the articles treated speculation as fact, omitted research methods, or over-generalised.

Against the published research the accuracy score ranged from 5-8, whilst against the press release the accuracy score increased very slightly to 6-9. The accuracy score for each newspaper article increased by one when compared to the press release rather than the published research. This is because the press release itself scored 8 out of 9 against the

published research. Thus, in this case, the newspaper articles largely accurately reflected what was in the press release which itself was a rather accurate reflection of the research findings.

Themes presented in the newspaper reporting of Story Two

The dominant discourses within these newspaper reports of the consensus statement was the benefits of exposure to sunlight (i.e. the production of vitamin D); the need to balance this benefit against the risk of skin cancer associated with exposure to sunlight, and the revision of guidance around sun safety to attempt to achieve this balance. Most articles were relatively balanced, for example:

> *'Braving the midday sun is not such a crazy thing to do after all - in Britain… experts reckon that some unprotected sun exposure around noon is vital to health… But they stress that people should 'never be red' at the end of the day as sunburn could lead to skin cancer.'*
> (Tabloid)

However, a small number were more critical and tended to 'blame' past advice for a rise in the incidence of vitamin D deficiency:

> *'Experts now believe that cancer concerns associated with moderate levels of sunshine are wrong.'*
> (Mid-market newspaper)

> *'Going out in the midday sun without sunscreen is good for you, health experts have said… It runs contrary to previous warnings over the dangers of spending time in the sun when it is at its strongest… Experts have long warned the risk of skin cancer from UV rays outweighs any potential good. However, the latest advice from a range of health charities says exposure to the sun at midday during summer months can help build a store of the essential vitamin. And it reverses warnings about using suntan cream with a high sun protection factor before going outside and avoiding exposure between 10am and 2pm... Experts have reacted in responses to the growing number of children developing rickets, which is caused by a lack of vitamin D.'*
> (Mid-market newspaper)

> *'Paranoia about sun exposure has become so great among some parents that doctors are seeing a return of rickets in children. The bone disease was thought to have died out 80 years ago.'*
> (Broadsheet)

All eight articles reported the benefits of exposure to sunlight in the form of the production of vitamin D. Four balanced this with presentation of the risks of skin cancer, and one of those also discussed the risks associated with vitamin D deficiency. All except the press release also outlined the new recommendations around exposure to sunlight. The only other

additional risk presented - uncertainty about the safety of mass vitamin D supplementation - was reported in the press release but not covered by any of the newspapers.

All the newspaper articles advised the reader to expose unprotected skin to sunlight for a few minutes two to three times per week to increase production of vitamin D:

> *'Regularly going outside for a matter of minutes around the middle of the day without sunscreen should be enough. When it comes to sun exposure, little and often is best.''*
> (Broadsheet)

> *'Going out in T-shirts and shorts for a quarter of an hour at least three summer days a week is the best way to raise vitamin D levels… exposing the face, arms and legs to the sun for 10 to 15 minutes three times a week is going to do no harm.''*
> (Mid-market newspaper)

Yet, only three articles explicitly went on to offer further 'sun safety' advice:

> *'Seven leading health groups and charities recommend up to 15 minutes of bare skin exposure three times a week in summer. And midday is best… After 15 minutes it is time to go in, cover up or slap on sunscreen.'*
> (Tabloid)

> *'Regularly going outside for a matter of minutes around the middle of the day without sunscreen should be enough. When it comes to sun exposure, little and often is best… Our advice remains to spend some of that time [11-3] in the shade or protected from the sun.'*
> (Mid-market newspaper)

> *'They say 10 minutes' exposure to Britain's strongest rays are enough. Then it is time to go indoors, cover up or slap on the sunscreen.'*
> (Broadsheet)

Just one broadsheet was explicit in its reporting of the dangers of even small amounts of exposure to sunlight:

> *'For some people - those most likely to be at risk of skin cancer - a few minutes in the middle of the day is enough for them to burn and cause serious and lasting skin damage.'*
> (Broadsheet)

The press release was vague in the advice offered, urging people to *'enjoy the sun safely and take care not to burn, helping to ensure the benefits of vitamin D can be enjoyed without the risk of skin cancer being raised unnecessarily'*.

In each article, the source of advice was the consensus statement (or the draft consensus statement in two cases), plus a quote from Cancer Research UK (CRUK) in the press release and four other articles, and a quote from the British Association of Dermatologists in three articles. One mid-market newspaper referenced all three sources. The press release and one broadsheet quoted CRUK in outlining the need for unprotected exposure to sunlight to make enough vitamin D but balancing this against being careful not to increase the risk of skin cancer. The broadsheet published further advice from CRUK stating that 'Messages around safe sun exposure times cannot be generalised to the population'.

None of the articles made reference to specific groups. Only two articles distinguished between UVA and UVB, one of those referred to UVA in relation to sunbeds, and the other specified UVB in relation to the *'sun's UVB rays'*. None of the articles present any confusion (by journalists) over the risks and benefits of exposure to sunlight; however, one mid-market newspaper does present some scepticism as it prints a quote from the Health Research Forum stating *'The public has been seriously misled by advice to avoid the sun'*.

Story Three

This was a systematic review and meta-analysis of the skin cancer risk associated with sunbed use. It was conducted by Boniol, Autier, Boyle and Gandini from the International Prevention Research Institute in France, and the European Institute of Oncology in Italy, and published in the British Medical Journal in 2012(51). In brief, the authors reviewed 27 studies on 'ever use' of sunbeds (n=11,428 cases of melanoma). They determined that the relative risk of skin cancer as a result of sunbed use was 1.20 (1.08-1.34). Further, they found a dose-response of an increase in risk of melanoma for each additional sunbed use session per year of 1.8% (0%-3.8%). A review of 13 'informative studies' led them to conclude that first use of sunbeds before the age of 35 was associated with a relative risk of skin cancer of 1.87 (1.41-2.48). Using 2008 cancer prevalence data from the 15 original EC member states plus three other European countries, the authors determined that 3,438 (5.4% of the total of 63,942) cases of melanoma were attributable to sunbed use. Most of those cases (2,341 cases, 68.1%) were among women, with almost a third (31.9%) among men. Across the 18 countries, melanoma from sunbed use was calculated to have caused 498 deaths/year among women and 296 deaths/year in men, giving a total of 794 sunbed related deaths each year. In the UK, the number of deaths attributable to melanoma from sunbed use was calculated as approximately 99 per year. The authors reported that future studies on sunbed use and skin cancer could show even higher relative risks as the full effects of recent sunbed use are not yet known. Further, they reported that the sunbed industry has not self-regulated effectively and noted that powerful tanning units may be as much as 10-15 times stronger than the midday sunlight on the Mediterranean Sea. In conclusion, the authors argued that sunbed use is associated with a significant increase in the risk of melanoma and they recommended tighter restrictions on use of sunbeds, arguing particularly for the restriction of sunbed use amongst under-18s and a ban on unsupervised indoor tanning facilities. National prohibition was also suggested.

In addition to the Press Release, this research was reported in seven newspaper articles (three of which were different versions of the same newspaper). The seven consisted of three articles in a tabloid, one mid-market tabloid, and three broadsheets.

Completeness

Table 3.5: Completeness of reporting of research Story Three

Article ID	**BMJ(52).**	**Daily Telegraph(53)**	**Mail Online(54)**	**The Sun(55)**	**The Telegraph Online(56)**	**The i(57)**	**Total number. of articles reporting -**
Type of publication*	P.R.	B	M	T	B	B	**6**
At least one of the authors named?	N	N	Y	Y	Y	N	**3**
Research centre named?	Y	Y	Y	Y	Y	Y	**6**
Journal named?	Y	N	Y	N	N	N	**2**
Ref to increase in risk of ever use of sunbeds (20% increase)?	Y	Y	Y	Y	Y	Y	**6**
Ref to increase in risk if first use below age 35 (87% increase)?	Y	N	Y	Y	Y	Y	**5**
Ref to increase in risk per extra session annually (1.8% increase)?	Y	N	N	Y	N	N	**2**
Ref to difference in number of cases and deaths b/w men and women?	Y	N	Y	N	N	N	**2**
Ref to authors' calls for tougher restrictions (esp. u-18s and ban on unsupervised salons)?	Y	Y	Y	N	Y	Y	**5**
Completeness score against published research (out of 8)	**7**	**3**	**7**	**5**	**5**	**4**	**-**
Completeness score against press release (out of 8)	**-**	**4**	**6**	**4**	**4**	**5**	**-**

*__Key__: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid.

Completeness scores as measured against the published research ranged from 3 to 7 (maximum score= 8). The least complete article was published in a broadsheet newspaper, while the most complete reports were found in the press release and a mid-market tabloid. All articles named the research centre, but only half (3) included the name of at least one of the study's authors, and only 2 articles cited the journal. Notably, the press release did not report the names of the study authors; thus the 3 newspaper articles that did report the authors' names must have referred to the original research paper. All articles described the 20% risk of skin cancer from ever having used a sunbed. The majority (5) also reported the 87% increase in risk of skin cancer where age of first sunbed use was below 35 years; but only 2 of the articles reported the dose response of a 1.8% increase in the risk of skin cancer from each extra sunbed session annually. Only 2 articles described the differences in cases and number of deaths between men and women. Most (5) of the articles referred to the authors' calls for tougher restrictions on sunbed use, particularly for under-18s, plus a ban on unsupervised salons. The low scores for individual items are typically low owing to a lack of reporting across the broadsheet newspapers.

It is particularly interesting to compare the completeness scores for newspaper articles when measured against the press release as compared to the published research for story three. The press release itself had scored 7 out of 8 for completeness. The typical pattern is for the completeness scores of the newspaper articles to each increase by one (the difference between the completeness score of the press release and the maximum score possible) when measured against the press release (compared to the published research). This is the case for two of the newspaper articles. However, the middle three newspaper articles each lost one point in their completeness scores when compared to the press release. This is because those three newspaper articles named at least one of the authors of the research and the press release did not. The journalists presumably referred directly to the published research for this information as it was not contained in the press release. However, despite being more comprehensive when compared to the published research, the additional diligence of the journalists meant that their completeness scores fell when measured against the press release because the press release was not wholly comprehensive.

Accuracy

Table 3.6: Accuracy of the reporting of research Story Three

Article ID	**BMJ(52).**	**Daily Telegraph(53)**	**Mail Online(54)**	**The Sun(55)**	**The Telegraph Online(56)**	**The i(57)**	**Total number of articles reporting**
Type of publication*	**P.R.**	**B**	**M**	**T**	**B**	**B**	**6**
Misleading title	N	N	Y	Y	N	N	**2**
Shift in emphasis	N	N	N	Y	N	N	**1**
Treating speculation as fact	N	N	N	N	N	N	**0**
Erroneous information	N	N	N	Y	N	N	**1**
Omitting important results	N	Y	Y	N	Y	Y	**4**
Omitting qualifications	N	N	N	Y	N	N	**1**
Omitting research methods	N	N	N	N	N	N	**0**
Overgeneralisation	N	N	N	Y	N	N	**1**
Inaccuracies from personal communications	N	N	N	Y	N	N	**1**
Accuracy score against published research (out of 9)	**9**	**8**	**7**	**3**	**8**	**8**	**-**
Accuracy score against press release (out of 9)	**-**	**8**	**7**	**3**	**8**	**8**	**-**

***Key**: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid.

The accuracy score ranged from 3 to 9 (out of 9) when newspaper articles were measured against the published research. The most accurate reporting was in the press release (9) and the three broadsheets (8 each). The article in the mid-market tabloid was relatively accurate (7), but the article in the tabloid was largely inaccurate (3).

The inaccuracies were as follows. Two of the articles had misleading headlines. The mid-market tabloid headline, *'Young people who use sunbeds 'are twice as likely to develop deadliest skin cancer"*, was deemed inaccurate as those over the age of 35 (no longer categorized as young people) who used sunbeds before age 35 are also at almost double the risk – not just today's young people. The tabloid headline, *'Cancer risk up 90% on one sunbed'*, was also deemed misleading. It effectively sensationalised the most worrisome statistic without providing any qualification, that is, this figure refers to those whose first sunbed use was under the age of 35. This also served to shift the emphasis of the story.

The tabloid article was also the only one which presented erroneous information. It stated that almost 65,000 cases of melanoma can be directly linked to sunbed use. However, the research report actually states '*of 63,942 new cases of cutaneous melanoma diagnosed each year [in the 18 European countries in the study] … an estimated 3,438 (5.4%) were related to sunbed use'* (p.3). The newspaper article is thus wildly inaccurate and has misrepresented the research findings. In addition, the article states that every sunbed session for those under the age of 35 increases the skin cancer risk by 1.8%, but actually that figure is for every additional sunbed session whatever the age of the sunbed user. Further, the article states that sunbed use for those over age 35 increases the skin cancer risk by 20%; in fact the 20% increase is related to ever use of sunbeds.

Four of the newspaper articles, the three broadsheets and the mid-market tabloid, omitted important results. None reported the increased risk of skin cancer per sunbed session annually; and the broadsheet also failed to report the increased skin cancer risk if the age of first sunbed use was below the age of 35. In addition, the tabloid did not qualify the figure given in the headline in subsequent text.

All the newspaper articles made reference to the research reporting on the results of multiple studies/a systematic review. The tabloid overgeneralised the findings through the inaccuracies and omissions already identified. Finally, the tabloid was the only newspaper to report a quote from the lead author: *"People can get all the Vitamin D they need by occasionally exposing their face and hands to natural sunlight".* This statement must be a personal communication as it is not contained in the research report or the press release. The statement is not qualified (e.g. length of time one should safely spend in the sun, frequency of exposure to natural sunlight, differences depending on skin type, etc.) and it is not wholly accurate as guidance suggests that more of the body must also be exposed in order for the skin to make sufficient levels of vitamin D. The article also quotes the lead author as saying *"Sunbeds cause cancer and pose a greater risk the younger you start using them."* This is a very strong statement that is not presented in the research paper.

For story 3, the press release scored a perfect 9 out of 9 for accuracy when compared to the published research. This meant that comparing the accuracy of newspaper articles against

the press release gave the same results as comparing the newspaper articles to the published research, the accuracy scores did not change when compared to one or the other. Thus, in this case, the accuracy of the articles against the press release was a perfect reflection of the accuracy of the articles against the research findings.

Themes presented in the newspaper reporting of Story Three

All newspaper articles focused on the increased risks of skin cancer, particularly malignant melanoma, resulting from exposure to UV via sunbed use. The discourse was around the increased risk associated with ever use of sunbeds, first use of sunbeds before the age of 35, and increasing risk with each additional sunbed use. This was presented alongside the authors' calls for tougher restrictions on sunbed use. None of the articles referred to the benefits of exposure to UV. Although the severity of the risk is clearly stated in the statistics presented in the report, the newspaper articles had different ways of reporting that severity. This ranged from basic presentation of the report findings, including estimates of the number of new cases of melanoma and number of deaths attributable to sunbed use each year, in the press release and the broadsheets, to more sensationalist or scaremongering reporting in the tabloid and mid-market tabloid:

> '*Young people who use sunbeds almost double their risk of developing the most deadly form of skin cancer… tanning devices could be responsible for triggering malignant melanoma in more than 400 Britons each year - with 100 dying from the disease... the toll from sunbed use is likely to increase as cancer takes several years to develop and young people fail to heed health warnings… Malignant melanoma is the most serious type of skin cancer with almost 13,000 Britons diagnosed in 2010. Tragically, it is also the fasting growing cancer in young people and the most common cancer in women in their 20s. Melanoma, which is linked so sun damage, is treatable if caught early but patients who develop metastatic disease - where the cancer has spread - are rarely cured with chemotherapy. Just five per cent are still alive five years after diagnosis, with around 2000 people dying each year.'*
> (Mid-market tabloid, *emphasis added*)

> *'The study found almost 65,000 cases of the deadliest form of skin cancer - melanoma - can be directly linked to sunbed use and it accounts for almost 900 deaths every year in Europe... Research director Mathieu Boniol said 'Sunbeds cause cancer and pose a greater risk the younger you start using them".*
> (Tabloid, *emphasis added*)

Each of these latter two articles focus on worst case scenarios and the risks of death and dying. The figures presented in the tabloid article are inaccurate. They also suggest the journalist is possibly confused by the data presented in the report, evidenced by misunderstanding or misrepresentation of risk statistics. For example, as noted earlier, the article inaccurately reported that 65,000 cases of melanoma per year across the 18 European countries in the study were directly linked to sunbed use, when the research report clearly stated that of almost 65,000 new cases of melanoma per year, 5.4% (3,438 cases) were attributable to sunbed use.

Each of the articles reported the authors' calls for restrictions on sunbed use for under-18s and for unsupervised tanning salons to be banned. No further 'advice' was presented. Only one article distinguished between UVA and UVB rays and this was only to the extent that human's exposure to UVA (via sunbeds) is a new experience.

Additional sources of information were presented in three of the articles: the mid-market tabloid and two of the broadsheets. One referred to advice from the Health Protection Agency that *'sunbeds should never be used by the under 18s'.* Another presented a quote from an Information Development Nurse at Macmillan Cancer Support: *'Young people who use sunbeds are particularly at risk of developing skin cancers including the most serious type of skin cancer, malignant melanoma. Using a sunbed also ages your skin which will affect your appearance as you get older. New regulations ban the use of sunbeds by people under 18. You should see your GP if you notice any changes to your skin that don't heal or go away on their own'.* The third quoted a representative of the British Association of Dermatologists: *'We need to ensure that legislation regarding sunbeds is fully enforceable. We know that self-regulation of the industry is insufficient'.*

None of the articles appeared sceptical of the risks presented in the research paper; and none made reference to specific groups or populations (other than referring to the differences in risk for those whose first sunbed use was under the age of 35, and calls to restrict access to sunbeds to those under age 18). None reported other means of protection (for example, use of sunscreen, use of concealing clothing, shade, etc.), and none gave advice that could be defined as unhelpful or counter to current recommendations.

Story Four

This story consists of two parts. The first part is an editorial in the Drug and Therapeutic Bulletin from June 2011(58). The editorial reported public health guidance on skin cancer prevention issued by NICE (PH32) which recommends that, used properly, a sunscreen with SPF of 15 is enough to prevent sunburn from all day exposure. It is reported that *'in reality people typically apply much less than the recommended thickness of sunscreen and only get around half of the protection expected'*. The editorial notes the difficulty of applying sunscreen at a thickness of 2mg/cm as it runs off the skin and is not cosmetically pleasing. It is also reported to be costly as whole body coverage at that thickness would, on average, require approximately 35ml of sunscreen per application. If NICE recommendations to reapply every 2-3 hours were also followed then a new 200ml bottle of sunscreen would be needed every 2-3 days. It is noted that it would be difficult to change people's behaviour (to make them apply sunscreen more thickly), thus one suggested option would be for manufacturers of sunscreen to change the standard of testing to better reflect the protection provided at the thickness at which most people typically apply sunscreen. However, the editorial concludes: *'In our view, the NICE advice on sunscreen use is not in the interests of public health. Products labelled with an SPF of 30 (together with a 4- or 5-star rating to indicate broad-spectrum ultraviolet screening effect) will more reliably deliver adequate sun protection to most people who use sunscreens and would be sufficient to prevent sunburn under most circumstances. We believe that this is what NICE should have recommended'.*

The second part is from an evidence review published in Drug and Therapeutic Bulletin (DTB) exploring whether sunscreens have a role in preventing skin cancer(59). The review states that both UVA and UVB can damage skin and cause skin cancer, though 80% of sunburn is due to UVB, and only 20% due to UVA. The review explains how exposure to solar radiation depends upon the local UV climatology (latitude, cloud cover, time of day), immediate environment (reflection or shading from buildings) and behaviour (time spent outdoors, use of hats, clothing and sunscreens). It is noted that exposure to UV stimulates vitamin D synthesis in the skin, that most vitamin D production comes from sunlight, and that vitamin D is important in maintaining bone health. Additionally, it reports that evidence suggesting that vitamin D has some protective role in the prevention of some cancers and autoimmune diseases is weak and equivocal. It also reports that, whilst there is no agreed optimal level of vitamin D, the amount of time needed for the skin to produce vitamin D (from exposure to sunlight) is less than the amount of exposure needed to cause sunburn. The review describes the three types of skin cancer: squamous cell cancer, basal cell cancer, and malignant melanoma. It is stated that no sunscreen can filter out all UV radiation. Sun Protection Factor (SPF) is defined as primarily a measure of UVB protection; an indication of how much longer skin covered with the sunscreen will take to redden in response to UV radiation compared with skin that is unprotected by sunscreen. SPF15 limits exposure to 7% of UVB radiation, while SPF30 limits exposure to 3% of UVB radiation. Since the 1990s, broad-spectrum sunscreens have been introduced which also filter out UVA (the star rating indicates how much UVA protection a particular sunscreen can provide). Research evidence presented in the review suggests that sunscreen use can prevent against squamous cell tumours, but has no effect on basal cell cancer. Further, it states that the evidence suggests that sunscreen use has little or no effect on the incidence of melanoma; however, it is noted that most studies were undertaken when SPFs were typically lower and when sunscreens did not include protection against UVA. It reports that sun protection includes: limiting exposure to direct sunlight between 11am-3pm (UK climate); seeking shade; wearing clothing that absorbs high level of UV; wearing a hat that shades the face and neck; PLUS using sunscreen. The review reports that sunscreen of SPF15 should be applied at a thickness of 2mg/cm; however people typically only apply sunscreen at a thickness of 0.4-1.5mg/cm, and thus are not receiving the amount of protection they expect. Solutions suggested by the reviewers are: to apply the sunscreen more thickly (to the recommended 2mg/cm), applying sunscreen twice (once before going in sun then again shortly after exposure), or using a higher factor sunscreen such as SPF30. In addition, sunscreen should not be rubbed in, but should be reapplied after swimming, towelling, excessive sweating or rubbing. The authors report concerns that chronic sunscreen use might lead to vitamin D deficiency as using SPF15 properly would reduce vitamin D synthesis by more than 99%. They therefore recommend short regular exposure of unprotected skin to sunlight to ensure sufficient vitamin D production. DTB has previously recommended the exposure of hands, arms, face or back for 15 minutes 2-3 times per week in the UK between April and September for those with fair skin, and longer for those with darker skin.

Completeness

Table 3.7: Completeness of the reporting of research Story Four

Article ID	**BMJ(60)**	**Daily Telegraph(61)**	**Daily Mail(62)**	**The Sun(63)**	**Daily Mirror(64)**	**The Sun(65)**	**The Express(66)**	**The Express(67)**	**The i(68)**	**Independent(69)**	**The Times(70)**	**Total number of articles reporting**
Type of publication*	P.R.	B	M	T	T	T	M	M	B	B	B	**11**
Journal named?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**
Explanation of SPF (UVB)?	Y	N	N	N	N	N	N	N	N	N	Y	**2**
Explanation re star-rating (UVA)?	Y	Y	N	N	N	N	N	N	N	N	Y	**3**
Ref to difference of thickness used for testing and thickness typically applied?	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	**10**
Ref to amount of sunscreen used if recommendations followed (200ml bottle every 2-3 days)?	Y	Y	Y	N	N	N	N	N	N	N	Y	**4**
Suggestion that NICE recommendation re SPF15 is not necessarily the best advice?	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**
NICE should change recommendation to a	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	**11**

Article ID	**BMJ(60)**	**Daily Telegraph(61)**	**Daily Mail(62)**	**The Sun(63)**	**Daily Mirror(64)**	**The Sun(65)**	**The Express(66)**	**The Express(67)**	**The i(68)**	**Independent(69)**	**The Times(70)**	**Total number of articles reporting**
higher SPF?												
Manufacturers could change testing to reflect thickness applied by the public?	Y	Y	N	N	N	N	N	N	N	N	N	**2**
Advice re exposure of unprotected skin for 15 minutes 2-3 times per week in UK for vitamin D synthesis?	Y	N	Y	N	N	N	N	N	N	N	Y	**3**
Ref to weak/equivocal evidence that sunscreen protects against BCC and MM	Y	N	N	N	N	N	N	N	N	N	N	**1**
Completeness score against published research (out of 10)	**10**	**7**	**6**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	**8**	**-**
Completeness score against press release (out of 10)	**-**	**7**	**6**	**3**	**4**	**4**	**4**	**4**	**4**	**4**	**8**	**-**

***Key**: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid.

The completeness score ranged from 3 to 10 (out of 10) when measured against the published research. Only the press release was completely comprehensive in its coverage. Completeness amongst broadsheets ranged from 4-8, amongst mid-market tablets 4-6, and amongst tabloids 3-4, thus broadsheets tended to offer the most complete reporting across the newspaper genres, and tabloids the least complete.

All publications made reference to the journal (in this case there were no named authors or research centres as the DTB publishes anonymous independent reviews that are written collaboratively and incorporate the views of a wide range of people and organisations). In addition to the press release, only one other publication gave some explanation of an SPF (for protection against UVB), and only two publications (including the one explaining SPF) gave some explanation of the star-rating related to protection from UVA (both broadsheets). All but one of the articles (excluding a tabloid article) explained the reason why SPF15 sunscreen may not provide adequate coverage (i.e. because people tend to apply it more thinly than is recommended). The press release, two broadsheets and a mid-market newspaper made reference to the quantity of sunscreen that an average person would use if they applied SPF15 in the thickness and frequency recommended by NICE (200ml bottle every 2-3 days). All the newspaper articles reported the researchers' suggestion that NICE's recommendation to use SPF15 was not the best advice and all reported that NICE should change its recommendation to a higher SPF sunscreen, SPF30. Only the press release and one broadsheet picked up the suggestion that manufacturers should amend the way SPF is tested and measured so that it uses the thickness of sunscreen typically applied by the public. Advice for the public to expose unprotected skin to natural sunlight for approximately 15 minutes 2-3 times per week to allow the skin to synthesise vitamin D was only presented in the press release, one tabloid and one mid-market newspaper. Finally, only the press release reported DTB's assertion that evidence that sunscreen protects against BCC and MM is weak/equivocal.

The press release was wholly comprehensive in its coverage of the published research with a score of 10 out of 10. Consequently, the completeness score of each newspaper article remained the same whether it was measured against the published research or against the press release.

Accuracy

Table 3.8: Accuracy of the reporting of research Story Four

Article ID	**BMJ(60)**	**Daily Telegraph(61)**	**Daily Mail(62)**	**The Sun(63)**	**Daily Mirror(64)**	**The Sun(65)**	**The Express(66)**	**The Express(67)**	**The i(68)**	**Independent(69)**	**The Times(70)**	**Total number. of articles reporting**
Type of publication*	P.R.	B	M	T	T	T	M	M	B	B	B	**11**
Misleading title	N	Y	N	N	N	Y	N	N	Y	N	N	**3**
Shift in emphasis	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**8**
Treating speculation as fact	N	N	N	N	N	N	N	N	N	N	N	**0**
Erroneous information	N	N	Y	Y	Y	Y	Y	Y	Y	Y	N	**8**
Omitting important results	N	N	N	Y	Y	Y	Y	Y	N	Y	N	**6**
Omitting qualifications	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	**9**
Omitting research methods	N	N	N	N	N	N	N	N	N	N	N	**0**
Overgeneralisation	N	N	N	Y	Y	Y	Y	Y	Y	Y	N	**7**
Inaccuracies from personal communications	N	N	N	N	N	N	N	N	N	N	N	**0**
Accuracy score against published research (out of 9)	**9**	**7**	**6**	**4**	**4**	**3**	**4**	**4**	**4**	**4**	**9**	**-**
Accuracy score against press release (out of 9)	**-**	**7**	**6**	**4**	**4**	**3**	**4**	**4**	**4**	**4**	**9**	**-**

***Key**: P.R. = Press Release; B = Broadsheet; M = Mid-market tabloid; T = Tabloid.

When measured against the published research, the accuracy score ranged from 3 to 9 (out of 9). The press release and one of the broadsheets scored 9, another broadsheet and a mid-market tabloid scored 7 and a 6 respectively, whilst the remaining newspaper articles (2 tabloids, 2 mid-market tabloids and 2 broadsheets) only scored 4, and one tabloid 3.

Three of the articles (2 broadsheet, 1 tabloid) had slightly misleading headlines. One headline *'Sun cream guidelines 'leave millions at risk''* is categorized as misleading because: (a) it is not acknowledged that people are only at risk if they do not properly apply SPF15; and (b) DTB reported only weak/equivocal evidence that sunscreen protects against basal cell cancer (BCC) and malignant melanoma (MM), thus the extent of the risk (unqualified in the headline) is not clear. The other misleading broadsheet headline, *'Higher sunscreen needed to protect against cancer'* again ignores DTB's finding that evidence linking use of sunscreen to BCC and MM was weak/equivocal. One of the tabloid headlines, *'The Hex Factor'*, is not obviously about sunlight/sunscreen. The term 'Hex' suggests an evil spell which is misleading in relation to this story.

Eight articles effectively shifted the emphasis of the story. Six focused on the public *'being exposed to an unnecessary risk of skin cancer'* or being placed *'at risk of deadly skin cancers'* as the recommended sunscreen with an SPF of 15 provides inadequate protection. These articles all failed to report DTB's view that evidence that sunscreen offers protection against BCC and MM is weak or equivocal. Two other articles made particular reference to the danger of using too low an SPF sunscreen on children. Children were not mentioned in the research paper or in the press release thus this is also a shift of emphasis. One of these articles also failed to mention that SPF15 is only deemed to be inadequate because the population typically does not apply it to an adequate thickness. The same inaccurate or misleading data was also categorized as erroneous. Six articles were deemed to omit important results: five failed to mention the need for sunscreen to also be broad-spectrum to also protect against UVA rays; and one failed to explain that SPF15 would be adequate if properly applied.

Nine of the eleven articles omitted qualifications to what they reported. Eight referred solely to the dangers of unprotected exposure to sunlight and did not refer to the need for people to spend approximately fifteen minutes in the sun two to three times per week with skin unprotected in order to produce sufficient vitamin D. Another included this advice but did not inform the reader why unprotected exposure is necessary (the production of vitamin D). Finally, seven articles overgeneralized findings either through stating that people using SPF15 were being exposed to an unnecessary risk of skin cancer (5 articles) ignoring DTB's view about the evidence base of such a statement, or generalising the study findings to children (2 articles) when children were not mentioned in the research paper or press release.

As with story three, the press release for story four accurately reflected the key messages in the published research with an accuracy score of 9 out of 9. This meant that the accuracy scores for the newspaper articles were the same irrespective of whether they were measured against the press release or the published research.

Themes presented in the newspaper reporting of Story Four

The discourse of the newspaper articles reporting this study was around the risks of using a sunscreen with too low an SPF (not applying sunscreen to an adequate thickness to provide the stated level of protection) and risk of overexposure to UV as a result. Some of the focus was around the risk of sunburn, particularly for children, and an equal amount concerned the perceived increased risks of skin cancer as a result of 'flawed' sunscreen advice. In total, of the 11 publications, eight reported risks of skin cancer, eight reported risks of sunburn, with five reporting risks of both. Although this is primarily a story about risk, the benefits of exposure to sunlight were reported in 3 articles (the press release, a mid-market and a broadsheet). The former and latter explain that some unprotected exposure to UV is necessary for the synthesis of vitamin D, while the mid-market advises some unprotected exposure but does not explain why.

The terminology used to describe the severity of the risk ranged from the matter of fact *'Britons need to use factor 30 sunscreen to prevent burning',* to the more sensationalist *'millions of Britons are putting themselves at risk of sunburn and skin cancer because official guidance on sun cream is inadequate'* and *'People are at risk of deadly skin cancers because advice about sunscreen protection is flawed'.* The more sensationalist wording was only found in the tabloids or mid-market newspapers. Where skin cancer is explicitly mentioned, most refer to malignant melanoma, the most serious form of skin cancer. Most articles refer to current advice about sunscreen (the recommendation to use SPF15) as 'flawed'; some refer to a quote from the editor of the DTB published in the press release that *"NICE's recommendation to use sunscreens with an SPF as low as 15 is a blunder that overlooks the key evidence and is not in the best interests of public health".*

A majority of the articles appeared to overlook current advice: seven of the articles made no reference to other forms of protection from the sun (such as seeking shade, wearing concealing clothing, avoiding the midday sun, etc.) or to the need for some unprotected exposure to sunlight (for the production of vitamin D).

UVA and UVB were distinguished in four of the articles (none of the tabloids) in relation to the protection offered by different types of sunscreen.

There was evidence of a lack of understanding over the risks and benefits of exposure in all but two of the articles (the press release and one broadsheet). Eight articles did not refer to the need for some unprotected exposure to the sun in order to produce vitamin D; two of those articles also did not mention that SPF15 would be sufficient if applied correctly. Two articles stated that inadequate use of SPF15 may leave people at risk of sunburn and some skin cancers, but failed to mention that DTB reported weak/equivocal evidence that sunscreen protects against BCC and MM; one of those articles referred to the need for unprotected exposure but did not explain that this was to produce vitamin D; another reported the need for some unprotected exposure in order to produce vitamin D.

Across all 11 publications, advice was relatively minimal and focused almost exclusively on use of a higher factor sunscreen. Only the press release referred to the use of concealing

clothing in addition to the use of sunscreen; it also noted the need to reapply sunscreen, to use a higher SPF (owing to people not using enough sunscreen per application), and not to forget vulnerable areas (back of neck, ears, etc.). Two articles (a broadsheet and a mid-market) advised use of a higher SPF sunscreen with a 4/5 star rating for broad-spectrum protection and reminded readers of the need to reapply sunscreen; seven articles (3 tabloid, 2 mid-market, 2 broadsheet) advised use of a sunscreen with an SPF higher than 15 (but made no mention of UVA or broad-spectrum sunscreen) and offered no additional advice; and one article (broadsheet) advised using a sunscreen with higher SPF and broad-spectrum protection, and also reminded the reader to apply to vulnerable areas, and to reapply after swimming or sweating. In all cases, the DTB papers were the source of the advice. Only two articles presented other means of protection: the press release referred to the use of concealing clothing, and one of the broadsheets noted that people should not use sunscreen to prolong time spent in the sun and also countered some of the myths around sun exposure (e.g. that fake tan does not protect the skin from sun exposure).

Each article presented some form of additional source of information. Six articles reported a quote from the editor of DTB suggesting that NICE needs to amend its advice; one of those articles (mid-market) also provided a quote from NICE in response to the report: *"We felt it was important, in producing this guidance, to maintain a balance recognising on the one hand the very real dangers of skin cancer, but also remembering on the other hand that we should not extrapolate from research carried out in much hotter, sunnier climates than our own".* Two further articles reported a quote from NICE which noted that factor 15 sunscreen *'is sufficient as long as applied adequately'.* Another two articles presented a different quote from NICE: *"The NICE guidance referred to was not an assessment of which sun protection factor is optimal, but rather was concerned with the most effective ways of reducing skin cancer through information, resources and changes to the environment".* Those articles also referred to the Medical Defence Union citing cases of patients with skin cancer suing their doctors as a result of delayed or failed diagnosis; a further article simply made reference to the Medical Defence Union citation.

None of the articles presented any scepticism of the evidence on the risks and benefits of sunlight exposure. Only one article (mid-market) made reference to a specific group; this was a reference to the number of young people aged 15 to 34 years who are diagnosed with malignant melanoma each day and report that rates of MM have tripled amongst this age range since the late 1970s. Reference to this group accounted for a proportion of 0.12 of the text.

3.2 CROSS-CUTTING ANALYSIS FOR QUESTION ONE

How do the UK media report research findings or nationally agreed guidelines/consensus statements regarding the benefits and risks associated with exposure to sunlight?

The four research stories selected for this review are outlined below to refresh the reader (Table 3.9). There follows an overview of the comprehensiveness and accuracy of the media reporting, a review of references to the role of individual risk factors within the press coverage, and an analysis of the discourse around how the benefits and risks associated with sunlight exposure were presented in the newspaper articles. The focus of the review for Question One is on the completeness and accuracy of the media coverage of published research. Discussion around discourse and the balancing of reporting of risks and benefits of exposure to sunlight are less central to this part of the review as the articles are typically presenting study findings and thus it may not be expected that they also address related risks and benefits of exposure to UV.

Table 3.9: Overview of the four selected research papers reported on by the media

No:	Topic	Risk/Benefit
1	Importance of vitamin D re good bone health (eliminating rickets in children)(30)	Benefit story: Clinical review of evidence around vitamin D - benefits of exposure to sunlight re production of vitamin D, guarding against rickets in children and poor bone health in adults
2	Consensus vitamin D position statement(27)	Risk and benefit story: Joint statement by 7 health organisations/charities. Benefits of vitamin D for good bone health; sources of vitamin D; need to balance exposure to sunlight (for production of vitamin D) with avoidance of the risk of skin cancer
3	Skin cancer risk associated with sunbed use(51)	Risk story: systematic review and meta-analysis of the skin cancer risk associated with sunbed use
4	NICE recommendations on sunscreen and the link between sunscreen and skin cancer prevention(58, 59)	Risk story: The public don't apply sunscreen to the recommended thickness thus NICE advice to use sunscreen with SPF15 is inadequate. Risk of not protecting oneself against UV rays

How accurate and comprehensive is the reporting of research studies or nationally agreed guidelines/consensus statements?

This section reviews the evidence around the comprehensiveness and accuracy of the newspaper reports of the four research papers.

Comprehensiveness of reporting

The comprehensiveness of reporting on research papers was based upon the number of dominant findings or messages described in in the research paper that were also reported in the newspaper articles. This necessarily differed between research papers. A 'completeness score' was ascribed to each newspaper article on the basis of the number of those dominant messages reported, plus the identification of the author (s), research centre (s) and journal of publication.

Table 3.10: Overview of completeness scores

Story	**1**	**2**	**3**	**4**
Maximum completeness score	8	12	8	10
Completeness score range (measured against the published research)	0-6	4-8	3-7	3-10
Most comprehensive genre	Press Release, Mid-market, Broadsheets (score=6)	Press Release (score=8)	Press Release, Mid-market (score=7)	Press Release (score=10)
Least comprehensive genre	Tabloid (score=0)	Broadsheet (score=4)	Broadsheet (score=3)	Tabloid (score=3)
Completeness score range (measured against the press release)	2-7	8-9	4-6	3-8

As indicated in Table 3.10 above, across the four research papers, the maximum completeness score possible to achieve ranged from eight to twelve. Completeness scores across the newspaper articles ranged from zero to ten when measured against the published research. Only one article (out of 37) attained the maximum completeness score and could thus be described as fully comprehensive. This score (10/10) was achieved by a press release. Indeed, the press release was amongst the most comprehensive in reporting the findings for each research story: not surprisingly given this would have been prepared by the research team. The least comprehensive genre of media (based on the completeness scores) were tabloids (worst with a score of zero for one story) and broadsheets. Mid-market tabloids tended to achieve a mid-level of comprehensiveness, sometimes achieving joint status of most comprehensive with press releases and (for one story) broadsheets.

The newspaper articles were also then measured for completeness against the press release as it is understood that most journalists will read and report on a press release rather than a full scientific report. Measuring completeness against the press release generally increased the completeness scores of the newspaper articles. However, a number of articles reporting on stories one and three either reported a lower completeness score or the score remained unchanged when measured against the press release as they reported on key findings or messages (or authors' names) that were not stated in the press release (thus losing them points when measured against the press release). For story four, the completeness scores for the newspaper articles remained completely unchanged when measured against the press release or the published research as the press release had been totally comprehensive in its reporting.

Although each research story had its own often distinct categories for completeness, some themes were common across all the stories: identification of author (s), research centre (s) and journal; recommendation to spend approx. 15-20 minutes in the sun with skin unprotected; and whether the articles focused on risks of exposure to UV, benefits of exposure to UV, or the risks and benefits of exposure to UV.

Identification of research papers

Table 3.11 below illustrates that authors of research papers and their corresponding research centres were identified in the majority of media articles: 10/12 articles identified the authors for story one, all 8/8 articles for story two, and half (3/6) articles for story three; 11/12 articles identified the research centres for story one and 6/6 for story three. Story two, the consensus statement, was not associated with a research centre, and story four did not have identifiable authors or research centres as the DTB publishes anonymous independent reviews. The journal that the research paper was published in was identified in 8/12 articles for story one, 2/6 for story three, and 11/11 for story four. Story two was not published in a journal. Newspaper articles were far more likely to report author names, research centre names and journal names if these were identified in the press release.

Table 3.11: Overview of completeness of identification of research papers

Story	**1 (12 articles)**	**2 (8 articles)**	**3 (6 articles)**	**4 (11 articles)**
Author named?	10	8	3	N/A
Research centre named?	11	N/A	6	N/A
Journal named?	8	N/A	2	11

Overview of reporting or risk, benefits, or risks and benefits of exposure to UV

Of the four stories, two focused on the risks of exposure to UV (Stories Three and Four), one focused on the benefits (Story One), and one discussed both risks and benefits (Story Two). Table 3.12 demonstrates that most articles did not report the alternative evidence in terms of risks or benefits of UV exposure; however, this is perhaps to be expected as the articles were typically simply reporting the piece of published research. Of the 12 articles for story one (rise in rickets), 11 articles focused on the benefits of exposure to increase production of vitamin D, while only one also made reference to the risks of skin cancer from over-exposure to UV. Reporting of story two (the consensus statement) was more balanced, with four articles reporting the benefits of exposure to UV and the other four articles discussing both risks and benefits. This is to be expected given the content of the statement. All six articles for story three (risk of cancer from sunbed use) focused solely on the risks, again as expected as no health benefits to sunbed use were reported in the research paper on which the newspaper articles were based. Reporting of the fourth story (what factor sunscreen is safest to use) was dominated by a focus on risk (8/11 articles) with just over a quarter (3/11) also referring to the benefits of exposure to sunlight.

Table 3.12: Overview of reporting of risks, benefits and risks and benefits of exposure to UV

Story	1	2	3	4	Total number. of articles reporting
Risks of exposure to UV	0	0	6	8	**14**
Benefits of exposure to UV	11	4	0	0	**15**
Reference to both risks and benefits	1	4	0	3	**8**
Total no. of articles	**12**	**8**	**6**	**11**	**37**

Completeness of reporting of advice to spend limited time exposed to UV

As indicated in Table 3.13 below, less than half (14/37) of the articles reported the advice to spend approximately 15 to 20 minutes in the sun with skin unprotected for the purposes of vitamin D production. The newspaper articles tended to take their lead from the associated press release. The press release for story one (reporting on rickets and vitamin D) did not refer to the recommendation to spend time with unprotected skin exposed to UV, thus neither did the majority of newspaper articles. Only a quarter (3/12) of the articles gave the advice. The press release for story two (the consensus statement) gave the advice, and this was then reported in all (8/8) of the newspaper articles. The advice was not relevant to story three (risk of skin cancer from sunbed use) and thus was not referred to by the press release or any of the newspaper articles. The outlier is story 4 (sunscreen factor) where the advice to spend a limited time with unprotected skin exposed to UV was stated in the press release but was only picked up by 3 of the 11 newspaper articles. This may be explained by the fact that the focus of the press release and the newspaper coverage was on the risks of using an inadequate sunscreen.

Table 3.13: Completeness of reporting of advice to spend some time exposed to UV with unprotected skin

Story	1 (12 articles)	2 (8 articles)	3 (6 articles)	4 (11 articles)
Recommendation to spend 15-20 minutes in the sun with skin unprotected?	3	8	Not relevant	3

Accuracy of reporting

The accuracy of newspaper coverage of the four research stories was variable (see Table 3.14 below). Accuracy scores when measured against the published research ranged from two to nine, with a maximum score of 9. The most accurate reports of the research were found in the press release (three stories: two of which had a score of 9), a broadsheet (one

story: also a score of 9), mid-market newspapers (two stories: one score of eight, one of five), and a tabloid (one story: score of 8). The least accurate articles were printed in tabloids (three stories: scores of two and three), mid-markets (two stories: scores of two and five), and broadsheets (two stories: scores of two and five).

Table 3.14: Overview of accuracy scores

Story	**1 (12 articles)**	**2 (8 articles)**	**3 (6 articles)**	**4 (11 articles)**
Accuracy score measured against published research (out of 9)	2-5	5-8	3-9	3-9
Most accurate genre	Mid-market (score=5)	Press release, tabloid, mid-market (score=8)	Press release (score=9)	Press release, broadsheet (score=9)
Least accurate genre	2 tabloids, 1 mid-market, 2 broadsheets (score=2)	2 mid-markets, 1 broadsheet (score=5)	Tabloid (score=3)	Tabloid (score=3)
Accuracy score measured against press release (out of 9)	7-9	6-9	3-8	3-9

When measured against the press release, the accuracy scores for story one increased significantly (from 2-5 to 7-9). This was because the press release itself had a low accuracy score and the newspaper articles had typically reported the inaccuracies from the press release as fact. The accuracy scores each increased by one point for all story two articles (the difference between the accuracy score for the press release and the maximum score possible). For stories three and four the press release had a perfectly accurate score of 9 out of 9 thus the accuracy scores of the newspaper articles were unchanged when compared to the press releases.

Key issues with the accuracy of reporting were found in relation to: the use of quotes from personal communications which did not reflect the content of the research paper (story one); the inclusion of erroneous information (story three); and misrepresentation of the data (stories two and four).

Use of quotes from personal communications:

The press release for the published research in story one included a quote (personal communication) from one of the researchers which did not reflect the findings in the research paper: *"Kids tend to stay indoors more these days and play on their computers instead of enjoying the fresh air. This means their vitamin D levels are worse than in previous years".* This quote was not backed up by any evidence presented in the research paper, but was picked up and quoted in all of the newspaper articles. This resulted in a third (4/12) of the articles running misleading headlines, and a majority (10/12) of the articles shifting the emphasis of the story primarily to focus on children spending too much time indoors playing

computer games. Two articles also focused on other research published by the same author that again was not referred to in the original research paper. A tabloid reporting on a different story (story three: sunbeds and skin cancer) quoted the lead author of that study as saying *"People can get all the Vitamin D they need by occasionally exposing their face and hands to natural sunlight";* however the quote was unqualified (e.g. length of time one should safely spend in the sun) and did not reflect anything that was in the research paper. It was not reported in any other newspaper.

Printing erroneous information:

One tabloid newspaper reporting the research paper about the risk of skin cancer from sunbed use (story three) misrepresented the research findings by publishing erroneous information. The research paper stated that an estimated 5.4 per cent (3,438 cases) of the 63,942 cases of melanoma across Europe were related to sunbed use; however the article stated that almost 65,000 cases of melanoma could be directly linked to sunbed use. This greatly increases the perceived risk associated with sunbed use.

Misrepresentation of the data:

Two of the four research papers included in this review involved the promotion of new or revised advice around sun safety: Story Two - the consensus statement focused on the health benefits of vitamin D and the need for the public to boost their vitamin D levels by exposing unprotected skin to the sun for 10-15 minutes two to three times per week during April to September in the UK; and Story Four - research on which factor sunscreen should be recommended. Both argued that NICE's recommendation for the public to use a sunscreen with SPF15 was too low and should be increased to a sunscreen with SPF30 and sufficient levels of UVA protection. These recommendations were based on reviews of evidence (Story Two) or research findings (Story Four). In each case, other existing guidance on sun safety (using sunscreen after the initial 10-15 minutes of unprotected exposure, frequent reapplication of sunscreen, covering up, staying in the shade, etc.) was not challenged.

Some of the media reporting of both stories was negative and focused largely on previous advice being 'wrong' or 'flawed' ('*tacit admission by Cancer Research UK that it had got it wrong in the past'* - Story Two*; ''Sun cream guidelines 'leave millions at risk''* – Story Four) or risking public health (in terms of the health conditions associated with a lack of vitamin D, or the risks of skin cancer from using too low factor a sunscreen). Some articles even presented erroneous information and made potentially dangerous unsubstantiated and unqualified claims: *'Experts have overturned decades of advice by urging people to go out in the midday sun without sunblock because the dangers of missing out on vitamin D can outweigh the risk of cancer' (*Story Two*).*

Is reference made to the role of individual risk factors?

The authors of the review looking at rickets, bone health and vitamin D production (story one, January 2010) identified the following risk factors for vitamin D deficiency: skin

pigmentation (darker skin), sunscreen/concealing clothing, the elderly, the institutionalised, those with renal/liver disease, and those who use anti-convulsants. Each of the twelve articles reporting this story made specific reference to one or more sub-groups of the population: children (12 articles), adults (7 articles), those living in northern parts of the UK (5 articles), and those with bowel cancer (1 article). However, only four articles referred to people in the high risk groups identified by the authors.

The organisations which published the consensus statement (Story Two, December 2010) defined those at risk of vitamin D deficiency slightly differently: pregnant and breastfeeding women, young children, older people, darker-skinned people, those wearing concealing clothing, people living in institutions, skin cancer patients and those who avoid the sun. However, none of the articles, including the press release, made reference to these high risk groups and consequently none reported the recommendation within the consensus statement that these groups take vitamin D supplements.

The review exploring the risk of skin cancer from sunbed use (story three) did not refer to the groups at high-risk of vitamin D deficiency or those at greatest risk of skin cancer. Rather, the focus was on people who first used sunbeds before the age of 35 (and thus were at greater risk of developing skin cancer from sunbed use), the greater number of cases of and deaths from melanoma attributable to sunbed use among females compared to males, and the authors' calls for the restriction of sunbed use particularly amongst the under-18s. Five of the six articles reported the increased risk of skin cancer when age of first sunbed use was below 35 years, five also reiterated the call for restrictions amongst the under-18s, but only two referred to the differences in cases and deaths between the sexes.

Similarly, the review of sunscreens (story four) did not make reference to those at high risk of vitamin D deficiency or skin cancer. Only one article (mid-market) made reference to a specific group and this was to the number of young people aged 15 to 34 years who were diagnosed with malignant melanoma each day and rates of malignant melanoma amongst this age group since the late 1970s.

How is the research evidence or consensus statement presented and framed in the newspaper coverage?

The dominant themes presented in newspaper reports of the four research stories in terms of the risks and benefits of UV exposure were: the importance and benefits of spending limited periods of time with unprotected skin exposed to natural sunlight (production of vitamin D); the need to balance this benefit against the risk of sunburn, DNA damage and skin cancer associated with exposure to sunlight; recommendations, or support of, revision of guidance around sun safety to attempt to achieve this balance; and the risks of skin cancer associated with exposure to UV via sunbed use.

Most newspaper reports echoed the tone set by the press release. The majority thus were not neutral in tone, but rather were quite critical (of previous guidance, current regulations, parents, etc.) and sought to apportion 'blame'. Reporting of story one (rickets and vitamin D deficiency) saw all 12 articles (including the press release) blaming the indoor lifestyle of

children (watching TV and playing computer games) for the rising incidence of rickets, with three of those articles (not including the press release) also blaming 'over-anxious parents who slap on excessive sunscreen', and a further four articles (including the press release) blaming children's poor diet for vitamin D deficiency. Newspaper reporting of the consensus statement (story two) included three (3/8) articles blaming past advice to stay out of the sun and 'excessive' use of sunscreen for a rise in the incidence of vitamin D deficiency. The press release did not seek to apportion blame. All six newspaper reports (including the press release for story three (risk of skin cancer from sunbed use) referred to the need for tougher restrictions for the sunbed industry (including banning unmanned tanning units and restricting sunbed use for the under-18s), effectively blaming current regulations for being too lax or too dependent upon self-regulation. Finally, all eleven articles, including the press release, reporting on the sunscreen story (story four) 'blamed' previous recommendations around sunscreen protection factors for potentially putting people at risk of sunburn and/or skin cancers.

The importance of spending limited periods of time with unprotected skin exposed to natural sunlight

The authors of three of the four published research stories (stories 1, 2 and 4) included in this review clearly stated the importance of regular limited unprotected exposure to sunlight to stimulate vitamin D synthesis. The advice was to spend approximately 15 to 20 minutes in the midday sun with skin unprotected, two to three times per week in the UK during the months of April to September. After this time it was necessary to follow sun safety advice: use of sunscreen, concealing clothing, seeking shade and so on. The articles reporting on these stories did not systematically repeat this recommendation to their readers, as indicated in Table 3.15 below.

Table 3.15: Overview of extent of recommendations for unprotected exposure to natural sunlight

Story/Recommendations for unprotected exposure to natural sunlight (15-20 minutes, 2-3 times per week)	**Yes**	**No**	**Total number of articles reporting**
1. Rickets, bone health, vitamin D	3	9	12
2. Consensus statement	7	1	8
3. Sunbeds and skin cancer	0	6	6
4. Sunscreen factor	3	8	11
Total articles reporting	**13**	**24**	**37**

The advice was not reported in around two-thirds (24/37) of the articles, including all the articles reporting on sunbed use and the risk of skin cancer (story three). In the 13 articles were the recommendation was discussed, coverage was generally brief: *'most experts agree that a 10 to 15 minute walk in the sun will boost vitamin D levels without causing skin damage' (story one); 'Seven leading health groups and charities recommend up to 15 minutes of bare skin exposure three times a week in summer. And midday is best…' (*story two). Some of the articles reporting on story one also reported more vague advice about the

need for children to spend more time playing outside more (10 articles), for adults to spend more time exposed to sunlight (3 articles), and for children to play outside without sunscreen (1 article).

Sun safety advice

General measures of sun protection set out in previous NICE guidance(7) include: limiting exposure to direct sunlight between 11am-3pm (UK climate); seeking shade; wearing clothing that absorbs high level of UV; wearing a hat that shades the face and neck; plus using sunscreen (which should not be rubbed in, but should be reapplied after swimming, towelling, excessive sweating or rubbing). Such sun safety advice was not presented in three of the four research papers or associated press releases and was only partially documented in the fourth research paper and press release. Consequently the vast majority of newspaper articles (28/37) also did not report sun safety advice. Whilst it would not be expected for a research paper, associated press release or newspaper article reporting on the research to include general advice about sun safety, the newspaper articles nonetheless may be expected to present a more balanced picture, highlighting the advice that should be followed once, for example, the 15 minutes of unprotected exposure to sunlight has elapsed. This was largely not the case. None of the newspaper articles gave complete sun safety advice, and only 9 gave some sun safety advice. This raises the question of whether it is the role of a newspaper to simply report the story (in this case research findings) or to interpret those findings and share associated advice and guidance with the reader. This is explored further in the Discussion.

Table 3.16: Overview of extent to which sun safety advice was reported in the newspaper coverage

Story/Sun safety advice reported?	**In research paper**	**In press release**	**In newspaper articles**			**Total number. of articles reporting**
			Yes	**Some**	**No**	
1. Rickets, bone health, vitamin D	N	N	0	2	10	12
2. Consensus statement	N	N	0	3	5	8
3. Sunbeds and skin cancer	N	N	0	0	6	6
4. Sunscreen factor	Y	Some	0	4	7	11
Total articles reporting			**0**	**9**	**28**	**37**

The two stories which focused on the benefits of exposure to UV for the production of vitamin D (story one – rickets, bone health and vitamin D; and story two – the consensus statement) advocated unprotected exposure to sunlight for short periods two to three times per week. This is where one would expect balanced reporting of the need for exposure along with the need to follow sun safety advice. However, the vast majority (10/12) of the articles (including the press release) reporting on story one did not make any reference to sun safety. Two further articles (same broadsheet) simply quoted one of the report's authors

saying *'it's good to have 20 to 30 minutes of exposure to the sun two to three times a week, after which you can put on a hat or sunscreen'*. Clearly, this was not comprehensive sun safety advice. Reporting of story two offered similarly weak sun safety advice. The press release simply encouraged people to *'enjoy the sun safely and take care not to burn, helping to ensure the benefits of vitamin D can be enjoyed without the risk of skin cancer being raised unnecessarily'*. Of the remaining seven articles, four did not provide explicit sun safety advice. Three offered limited advice, typically along the lines of *'After 15 minutes it is time to go in, cover up or slap on sunscreen'*.

None of the articles covering the story about sunbeds and the risk of skin cancer (story three) made any reference to sun safety. This is perhaps unsurprising as the focus of the reporting was exclusively on sunbed use.

Reporting of the sunscreen story (story four) again would have been expected to offer sun safety advice as part of the focus around using a higher factor, and broad-spectrum, sunscreen. However, two thirds of articles (7/11) simply advised use of a sunscreen with an SPF higher than 15 and made no reference to using a broad-spectrum sunscreen and no reference to other forms of protection from the sun. Only the press release referred to the use of concealing clothing in addition to the use of sunscreen; it also noted the need to reapply sunscreen, to use a higher SPF, and not to forget vulnerable areas. Two other articles advised use of a higher SPF sunscreen with a 4/5 star rating for broad-spectrum protection and reminded readers of the need to reapply sunscreen. The remaining article noted that people should not use sunscreen to prolong time spent in the sun and also countered some of the myths around sun exposure (e.g. that fake tan does not protect the skin from sun exposure).

Sunbed use

Sunbed use was only discussed in articles reporting stories two and three. In both cases all newspaper reporting was negative and emphasised the risks of skin damage and cancer from using sunbeds. The consensus statement (story two) noted that sunbeds are linked to high frequency of sunburn and risk of melanoma; that UVB exposure via sunbeds can increase vitamin D production but that this was outweighed by the risks of developing skin cancer; and sunbeds also emit high levels of UVA which the consensus statement reported can cause melanoma and do not contribute to vitamin D production. The negative framing of sunbed use in the consensus statement and associated press release was echoed in the newspaper reporting of the story. Press coverage of story three also followed the findings of the research and the information contained in the press release and reported the relative risks of skin cancer as a result of sunbed use at any age, the higher risk for those who began using a sunbed below the age of 35, and the additional risk posed by each additional sunbed use. A number of newspaper articles also reiterated the researchers' warning that powerful tanning units may be as much as 10-15 times stronger than the midday sunlight on the Mediterranean Sea, and that future studies on sunbed use and skin cancer could show even higher relative risks as the full effects of recent sunbed use are not yet known.

Distinctions between UVA and UVB

Very few references were made specifically to UVA, UVB or the differences between the two. Amongst the 37 articles analysed (from across all four stories), only seven made any specific reference. Two articles referred to UVA in relation to sunbeds, one noting that human exposure to UVA was a relatively new experience with the advent of sunbeds (stories two and three); one noted the UVB rays from the sun (story two); and four articles distinguished between UVA and UVB in discussion of the differences between different types of sunscreen (story four).

3.3 QUESTION TWO

Review Question 2: How are the health benefits and risks of UV exposure conveyed by UK national newspapers and magazines?

The more specific research questions were:

- How are the health benefits and risks of UV exposure represented in the UK media?
- What risks and benefits of UV exposure are presented in UK media?
- How do the media frame, or what are the discourses used with respect to, the benefits and risks of UV exposure?
- What types of evidence sources are used?
- Do individual articles cover both the benefits and risks associated with exposure to UV? How are these risks and benefits presented?

These questions were addressed through an analysis of:

Extent of reporting

National newspapers varied considerably in terms of the number of items published during the course of a calendar year which included some sort of reference to the risks and/or benefits of UV exposure, see Table 3.17. The *Daily Mail* (a mid-market tabloid) published nearly twice as many items as *The Sun* ('red-top' tabloid) and almost three times as many items as the *Daily Telegraph* (broadsheet).

Table 3.17: Number of articles published during 2013 which include reference to the risks and/or benefits of UV exposure

	Number of items published which include reference to the risks and/or benefits of UV exposure
Newspaper	
Daily Mail	53
Daily Telegraph	19
The Sun	31
Magazines	
Cosmopolitan	2
Country Living	1
Good Housekeeping	3
Prima	2
Runners' World	1
Other magazines indexed by Nexis UK *(Zest; Company; New Scientist ; Harper's Bazaar; Prima Baby; Esquire; Men's Health; Coast)* Asda's and Tesco's monthly magazine	All '0'

Coverage in monthly magazines was low. Most of the magazines listed in Nexis UK did not carry any relevant items during 2013. Four women's magazines published a total of eight items and a specialist magazine (*Runner's World*) had a single item which included reference to the risks and/or benefits of UV exposure. In total, therefore, the remainder of this analysis is concerned with 112 published by three national newspapers and five UK monthly magazines.

The nature of the articles

Articles were categorised according to their predominant content (determined by the content allocated the greatest volume of words), see Table 3.18:

Table 3.18: Predominant content of articles in each publication

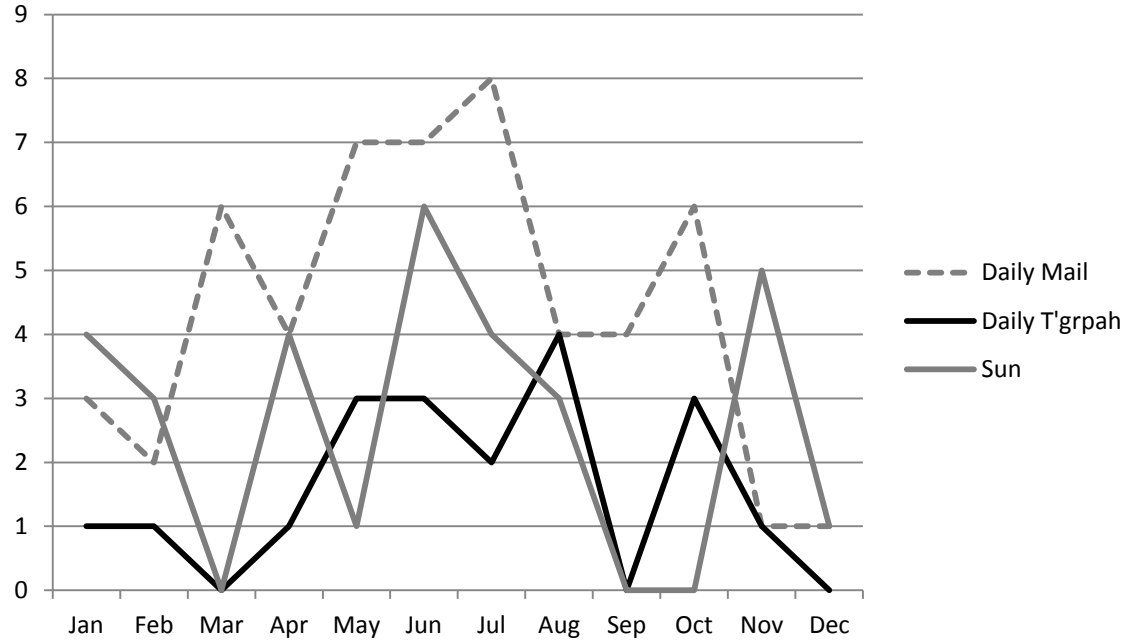
	Daily Mail	Daily T'graph	The Sun	Cosmo-politan	Country Living	Good House-keeping	Prima	Runner's World
Research	**27**	**6**	**5**					**1**
Product reviews	1	0	7	1	1	1		
Celebrity story	4	1	4	1				
Personal story	9	1	**8**				1	
News	5	3	5					
Health	6	0	0			2		
Travel	0	1	0					
Fashion & beauty	0	4	1				1	
Opinion	1	3	1					
TOTAL ARTICLES	**53**	**19**	**31**	**2**	**1**	**3**	**2**	**1**

Newspaper publications varied in terms of the type of 'story' around which an article was constructed. The most common focus, or starting point, for articles published by the *Daily Mail* and *Daily Telegraph* was recently published research, including annual national cancer statistics. In contrast, articles in *The Sun* relating to the risks and/or benefits of UV exposure were either centred around personal stories or reviews of 'sun protection' products such as sunscreens and sunglasses. The *Daily Mail* and *Daily Telegraph* also published product reviews. However, these were typically excluded from this review because the 'pre-amble' to the actual product descriptions was usually minimal. As would be expected, personal and celebrity stories related to UV exposure were much more common in the tabloids compared to the broadsheet. Articles reviewing sun protection products were the most common format through which material on the risks and benefits of UV exposure were presented in monthly magazines.

Seasonality

Across the three newspapers, it was a summer months (June, July, August) which had the greatest number of relevant articles, see Figure 3.1.

Figure 3.1: Seasonality of relevant articles



Summer was also the season when most articles were published in each of the newspapers, though this seasonal pattern was more pronounced in *The Sun* compared to the *Daily Mail* and *Daily Telegraph*, see Table 3.19. This can be ascribed to the greater volume of product reviews published by *The Sun* which were retained for this analysis compared to the *Daily Mail* and *Daily Telegraph*.

Table 3.19: Publication of articles by season

	Daily Mail	**Daily Telegraph**	**The Sun**
Winter (Dec-Feb)	6	2	8
Spring (Mar-May)	17	4	5
Summer (Jun – Aug)	**19**	**9**	**13**
Autumn (Sep – Nov)	11	4	5

Volume of risk and benefit articles

Articles were categorised in terms of whether the predominant message related to UV exposure was one of risks or benefit, or both. Risk was the predominant message for the majority of articles (83/112), with 26 articles focussing on the benefits of UV exposure. Four articles explicitly set out to discuss both the risk and benefits of UV exposure ('risk & benefit articles'). In addition, 6/26 'benefit articles' also made clear reference to the risks of UV exposure, and 5/81 'risk articles' also noted one or more health benefits of UV exposure.

Table 3.20 provides an overview of the risks and benefits of UV exposure *as presented in the articles*. At this stage in the analysis we adopted an inclusive view of risks and benefits, including risks not directly related to 'health' (skin ageing) and softer indicators of emotional health (sense of well-being, body confidence). We also took an inclusive view in terms of the way risk or benefits were presented. Thus the review included articles which were

explicitly about the risks or benefits of sun exposure (for example, a report on research findings; a health and beauty column on staying safe in the sun) as well as articles where the main topic or focus was not on describing or explaining risks or benefits *per se* but carried some sort of reference, implicit or explicit, that UV exposure is associated with risks or benefits (for example, 'sun protection' product reviews; story about a sunburnt celebrity).

Table 3.20: Risks and benefits of UV exposure as presented in the articles

UV exposure risks presented in articles	**Number of articles reporting**
Skin cancer	64
Sunburn (including sunbed burn)	20
Skin ageing	22
Skin damage (non-specific)	9
Other melanoma (including ocular n=2))	4
Eye damage (non-specific)	3
UV exposure benefits presented in articles	
Source of vitamin D	28
'Well-being'	3
Foetal sight development	1

Skin cancer or, sometimes more specifically, malignant melanoma was the most frequently reported risk with 64 of the 81 articles analysed making some reference to this health risk. Sunburn (including burns from sunbed use) was presented as a risk by a quarter of the articles (20/81). An equal number reported skin ageing as a risk associated with UV exposure. One in ten articles used the term 'skin damage' to describe a risk of UV exposure. Five articles reported risks to eye health: ocular melanoma (n=2) or non-specific 'eye damage' (n=3).

Among the 21 articles which presented sunburn as a risk of UV exposure, just over half (n=12) did not refer to the association between sunburn and skin cancer. Where skin ageing was reported as a risk of UV exposure (n=20), skin cancer was also identified as a risk in eleven of these articles.

The health benefits of Vitamin D reported in articles were predominately related to prevention of rickets and/or bone development or bone health. In addition, there were articles which reported Vitamin D increased general energy levels, ensured efficient cell metabolism and (potentially) lowered the risk for a range of conditions including: multiple sclerosis, bowel and breast cancers, heart disease, diabetes, high blood pressure, asthma, autism, migraine and snoring. In terms of the role of Vitamin D in lowering the risk of these various health conditions, the articles were typically reporting the start of, or findings from, a piece of research.

The balance of risk and benefit reporting across genres

The Sun's reports of the risks and benefits of UV exposure was almost exclusively about risk (N=30/32 articles), see Table 3.21. None of the articles were categorised as 'risk & benefit' articles. A similar pattern was found for *Daily Mail* articles, with 38/53 categorised as 'risk articles', followed by 14 benefit articles and 1 article categorised as a 'risk & benefit' article. The newspaper with the greatest balance in terms of risk and benefit reporting was the *Daily Telegraph* (n=19 articles) though the majority were still categorised 'risk articles' (n=11/19) as opposed to 'benefit articles' (n=7/19) or 'risk & benefit' articles (n=1/19). Among the magazines (n=8 articles), the majority were categorised as 'risk articles' (n=6).

Table 3.21: Reporting of the risk and benefits of UV exposure by different print media

	Category of article			
	Total no. articles analysed	**Risk**	**Benefit**	**Risk & Benefit**
Newspaper				
Daily Mail	53	38	14	1
Daily Telegraph	19	11	7	2
The Sun	32	30	2	0
Magazine				
Cosmopolitan	2	2		
Country Living	1	1		
Good Housekeeping	3	2		1
Prima	1	1		
Runners' World	1		1	

Neither of the 'benefit articles' published by *The Sun* included any reference to the risks of UV exposure. Among the *Daily Telegraph*'s 'benefit articles' (n=7), only two made reference to skin cancer (malignant or non-malignant). Finally, just three of the Daily Mail's 14 benefit articles also reported the risks of skin cancer associated with UV exposure.

Terms used to describe UV exposure

Almost two thirds of articles (73/112) did not specify UV exposure beyond general phrases such as: sunlight, sun's rays, sunshine or sunbeds. Indeed, one or more of these terms were present in all the articles. One in five articles (22/112) also used the phrase '*UV*', '*UV light*', '*UV rays*' or '*UV radiation*' but offered no further specification. Eleven articles (<10%) referred to UVA and UVB. Five of these articles did not offer any explanation of the difference between UVA and UVB in terms of their impact on the skin. Here references to UVA and UVB were in the context of reviews or recommendations of sun protection products [*If you want to minimise ageing wearing a shield to protect against UVA and UVB is the biggest investment you can make(71)*]. On occasion this information was incorrect [*The SPF is a measure used to explain how much protection a cream gives against harmful ultraviolet rays (UVA and UVB)(72)*]. The remainder offered some explanation of the difference in terms of the impact on the skin (ageing, skin cancer risk),eye (damage, cancer) and/or the

role of UVB in vitamin D production [*Ultraviolet radiation has two forms: UVA and UVB. The latter is the main culprit for sunburn and skin cancers. But UVA can also increase the risk of cancer and cause premature skin ageing(73)*].

Finally, a further 4/112 articles (covering a range of topics: Vitamin D, eye protection, sunburn) only specified UVB, and 2 only specified UVA (sun protection products).

The discourse on sunbeds and sunbed use

Sunbeds and/or sunbed use featured in a quarter of the risk articles (22/81). For the majority of these articles, sunbeds/use was the primary focus of the article. Overall, the messages presented in these articles were uncompromisingly negative about using sunbeds and the risks to health, and life, were made explicit. As reported later, this contrasts with the discourse around sunbathing.

Nine articles comprised one or more personal stories of incidents of significant burning or death attributed to sunbed use. All these stories were presented as traumatic [*'It feels like my face is falling off and I can't describe the pain.'(74)*] and/or tragic events [*'Sunbed use has robbed us of our only daughter'(75)*; *Mum who paid the tragic price(76)*]. There was no discourse within the reporting around self-responsibility on the part of the individuals concerned. Rather the blame was located in a lack of information, or public understanding, on the risks associated with using sunbeds at the time the individuals were using sunbeds [*I wish I'd been told more about the risks(77)*], or on unscrupulous practices by tanning salons (increasing UV levels above the 'legal limit', allowing children to use sunbeds).

Two articles were personal stories of 'addiction' to achieving a suntan through the use of sunbeds. Neither story 'glamorised' the individuals involved and carried strong messages regarding the risks associated with sunbed use [*So addicted to sunbeds they would rather die than be pale(78)*; *Anyone indulging in this behaviour makes themselves a sitting duck for something to go wrong(79)*].

Some articles (n=3) referred to sunbed use within the broader context of reporting data on the (changing) incidence of skin cancers. Typically a clear connection was made between sunbed use and increased risk of skin cancers [*one of the most dangerous cancer-causing habits, as lethal as cigarettes(80)*] and two articles explained the difference in UV rays in natural sunlight and sunbeds. Natural sunlight was presented as 'safer' than sunbeds [*Twice as likely to cause skin cancer as a holiday in the sun(81)*]. It is important to note, however, that a further four articles on skin cancer incidence, whilst noting the risks associated with sunbathing/exposure to sunlight did not report sunbed use as a source of UV and/or a health-risk behaviour.

Just one article presented using sunbeds more neutrally. This was a piece penned by a celebrity whose identity is partly centred on her skin colour [*It's no secret I'm a fan of being orange(82)*].

The discourse on sunlight exposure

Discourses on sun exposure varied according to the nature of the article.

Product reviews

Articles which were reviewing or recommending products (sunscreens, sunglasses) and which had some sort of opening commentary on sun exposure were included in the review and the content of these commentaries analysed. There was an implicit assumption in these articles that readers wanted to sunbathe and achieve a suntan *[….most of us still want a tan, or at least some sun-kissed colour(83); how to play it safe in the sun(84)*], but there were risks associated with this [*Sun damage is the classic enjoy-now-pay-later trap….that's why so many of us find our skin falls off a cliff in our late 30's: it's all those carefree days in the sun finally catching up with us(85)*].

The dominant discourse was of 'protection' from the sun which was presented as a source of harm, a cause of skin damage and/or posing a risk to the skin [*harmful sun rays(86)*; *harmful UV rays pose a risk to your skin(87)*]. Skin ageing was consistently identified as the main risk from which the skin needed protection. Articles often also referred to other risks, but these were often presented in a very ambiguous way (*…while UVA penetrates more deeply, causing premature ageing and longer-term deeper damage(88)*]. Around half of the product review articles (6/12) named skin cancer as a risk of unprotected sun exposure.

Personal and celebrity stories attributing cancer to sunlight exposure
There were fewer articles relating personal experiences of skin cancer believed to be caused by sunlight exposure (n=5) compared to personal story articles on cancer caused by sunbed exposure (n=7). In these articles, sunlight exposure was typically described as excessive and/or prolonged [*…years of sun abuse(89)*; *Tanning yourself like I used to is a death sentence(90)*]. The majority of stories referred to being exposed to the sun in hotter countries with the implication that sunlight in these places carries a greater risk [*I've been told it was caused by intense sunlight(91)*; *I have fair skin and spent time abroad(92)*].

The representation of sunlight exposure in 'risk articles'

The great majority of text related to UV exposure in the sunlight 'risk articles' was related to writing about sunbathing, suntans and sunburn. References to 'everyday' UV exposure or prolonged exposure for reasons other than tanning (for example, sport, outdoor hobbies) were uncommon. The risks of everyday UV exposure were exclusively presented in terms of skin-ageing and restricted to product review or fashion/beauty articles [*Even a short walk without UV protection will show its effects on your skin later(71); Not using sunscreen every day is madness(82)*]. These articles often also stressed the need for all-year UV protection [*I recommend (name of product) every day, come rain or shine(93); Harmful UV rays still pose a risk to your skin despite the leaden January skies(87)*].

Sunburn was consistently portrayed as undesirable and harmful. Shots of sunburnt celebrities provoked critical or mocking comments from journalists (*….by exposing herself to*

the sun's rays Miss XXX is placing herself at risk of skin cancer(94); it appears that staying out of the sun does not feature in XXX's anti-ageing regime(95)]. News stories carrying photographs of sunburnt bodies were accompanied by strong negative, verging on tragic, language [*….gruesomely burnt; a beauty lobster-red all over apart from a thong line* (96)]. There was also a discourse around self-responsibility to prevent burning [*These dopes show what happen when you skimp on the sun lotion(96)*], and for parents, the extension of that responsibility to their children. For example, news articles about sunburnt children both carried a consistent message condemning the parents who had allowed it to happen (*Children who get badly sunburnt should be referred to social services, say campaigners(97)*].

However, the link between sunburn and skin cancer was not consistently portrayed. Some articles highlighted the short-term effects such as an unfortunate appearance [*a beauty lobster-red all over apart from a thong line(96)*] and pain and discomfort [*Spending just a couple of minutes applying sunscreen to a child before they go out is the difference between a summer of fun and a summer spoilt by sunburn(98)*]. Others only identified skin-ageing as a commonly identified longer-term outcome of sunburn (*…an old age of leathery, wrinkly skin(73)*]. However, a small number of articles provided some explanation as to why sunburn increases the risk of skin cancer [*It's painful but the worst thing about sunburn is that dermatologists increasingly think ….disrupts the cells enough….to the development of skin cancer(99)*].

Where episodes of sunburn were linked to skin cancer, the discourse of some research articles and personal stories presented it as a consequence of getting sunburnt as a child or young person (*A few bouts of sunburn in childhood can trigger cellular changes that lead to skin cancer in later life(100); It's hard to compute that such idyllic days could one day be blamed for causing a serious risk to my health(101)*]. However, articles reporting the increasing incidence of skin cancer typically took a different perspective, reporting the increase in overseas holidays, the popularity of sunbathing and the shift to skimpier clothing. Some, but not all, also noted that sunburn at any age increases the risk of skin cancer [*A painful sunburn once every two years triples the risk of skin cancer(73)*].

The discourses around sunbathing in the articles analysed were complex and, to some extent, contradictory. A common discourse was 'safe sunbathing', with sun protection products (as opposed to sun avoidance) presented as the means by which this could be achieved (*How to sun bathe safely(102)*; *Enjoy the sunshine with none of the ageing or skin-damaging side effects(88)*] . The discourse here was not to question the practice of sunbathing or to condemn suntans, but rather the importance of achieving a suntan in a safe way. Indeed, some product reviews included text on *taking care of your tan(84)*, implying a suntan is something of worth. Reference to the fact that damage to skin DNA is not limited to episodes of burning was not typically presented in this context.

Another, and perhaps related, discourse was to acknowledge that some individuals believe that suntans improve appearance. These beliefs were not questioned in the articles rather, as above, the issue is safely achieving something which has value and importance to some individuals, despite growing evidence of the risks associated with sunlight (over)-exposure

[*The official word is while it may look good, the only safe way to get a tan is with a bit of slap (103); Most of us still want a tan(83)*].

A critical discourse of what was perceived as 'over-protection' was found in two celebrity stories, both concerning female celebrities who had chosen to cover-up whilst on the beach (*While I applaud such concern over sun damage to the skin, have these people never heard of Factor 50? Or if you're that obsessed, just stay inside for goodness sake(104)*; *…she resembled a hippo when she wore a burkini on Bondi Beach….. said she wore it to protect her from sunburn(105)*].

Unlike the negative discourses about suntans achieved through the use of sunbeds, this was not found in the articles relating to suntans and/or sunbathing in natural sunlight. That said, sunburn was consistently portrayed as a harmful or damaging occurrence (see above). Any negative discourses around suntans were typically in relation to skin ageing [*Not only does she look like she's fallen face first into a (clay) tennis court, her skin has the smoothness of a walnut(85)*]. Only a couple of articles were explicit in stating that suntans are indicators of skin damage [*A tan is not a sign of a healthy body, but an indication skin has been damaged by cancer-causing ultraviolet, UV, rays(73)*]. Where sunbathing was directly linked to skin cancer within an article, it was usually couched in terms of 'intense sunbathing' (106, 107) or sunbathing without 'protection'.

The representation of sun exposure in benefit articles

Twenty-four articles included in this review were categorised as 'benefit articles'. Common themes in the benefit articles were the risks associated with the lack of UV or sunlight exposure and/or the (potential) health benefits of UV exposure in terms of its associations with vitamin D production [*..not just an excuse to eat ice-cream in the park: sunshine is also how the average person gets up to 90% of their vitamin D(108); Want to cut your blood pressure? Sit in the sun(109)*]. Indeed some articles refer to vitamin D as 'the sunshine vitamin' [*Sunshine vitamin knocks migraines on the head(110)*; *Sunshine vitamin may help irritable bowels(111)*]. Sunlight as a 'natural source'(112) of vitamin D was a theme in some articles, with the contrast being made with vitamin supplements.

A primary discourse on sun exposure in the benefit articles centred on the reasons for the lack of UV, or sunlight, exposure. Here, geographical location or gloomy climate were identified as increasing the risk of vitamin D deficiency and associated health problems [*Our grey summer weather really may leave you under the weather(113)*]. Over-use of sun protection in response to concerns about skin cancer was also implicated, particularly in terms of the increasing incidence of rickets in children. Emotive language was sometimes used to present the risks of sunlight avoidance [*Staying out the sun could be almost as damaging as ultraviolet radiation(114)*] and 'over protection' [*Parents have become so worried about skin cancer that they smother their children in too much sunscreen inadvertently increasing their risk of rickets(115); Naively, we believed that a deep tan made us look thinner, richer and healthier. Any maybe that was correct, in that although some got melanomas in later life, none of us got rickets(116)*].

The great majority of the 'benefit articles' did not signal any potential health risks associated with sunlight exposure. Advice on safe, or appropriate, levels of exposure was very unusual (*A healthy diet and ten to 15 minutes of sunshine on the hands and face several times a week in spring and summer can prevent rickets(117)*]. A recommendation or advice to consider taking Vitamin D supplements was more common.

Articles which sought to present the risks and benefits of sun exposure

Four articles were categorised as 'risk & benefit articles'. Articles in this category carried text on the risk and benefits of sunlight exposure and there was clear reference to the competing arguments around the risks and benefits of sun exposure. Two newspaper articles were was based around research findings on the health benefits of sunlight exposure in terms of vitamin D production including its role in preventing rickets (118, 119). A third article reported research pointing to the potential role of vitamin D in reducing the risk of heart attacks, 'early death' and bone health (120). Finally, a monthly magazine(102) carried an article which sought to 'present the facts' on the risks and benefits of sun exposure [*Sun or shade: get the facts before you head out into the sun*].

Three articles made explicit reference to the competing messages from government, research and professional bodies regarding sunlight. Reference was made to apparently conflicting messages from government or 'expert groups' [*Just when we accepted that the safest thing was to stay out of the sun, the tide has turned and we're being told that sunshine is absolutely vital for good health(102)*; *After the concerted campaign in recent years warning to protect ourselves from the sun, questions are being raised about the advisability of the great cover-up(119)*] and questioned whether advice, or the expert position, may need to change in the future. The fourth article(118) reported a campaign for social services to be involved when badly sunburnt children are admitted to hospital. However, it also presented the views of parents' groups who reported the need for awareness of the risks and benefits of sun exposure. Two opposing positions were also presented by a campaign group (*Malignant melanoma is the most common cancer in young adults in the UK and happens from getting sunburnt*) and a consultant paediatrician (*Sunshine is practically their (children's) only source of vitamin D*].

Risks to specific populations

References to populations at increased risk from UV exposure was not common (n=17/83 articles). Characteristics of individuals at increased risk were those with: *red hair* (n=1); fair skin (sometimes specified as this, sometimes '*blue/green/pale eye colour'*, or '*lots of freckles'*) (n=8); and/or '*a lot of moles'*/'*Atypical Mole Syndrome'* (n=3). Finally, one article used the phrase *'skin that is sensitive to the sun'(121)*. The only article which presented this risk in relative terms was the one reporting research on increased risk for people with red hair [*100 times more at risk of the worst forms of skin cancer(122)*].

The most dominant discourse around risk was, however, that children and young people were at increased risk of damage due to UV exposure (n=9/17 articles). This was typically

presented in terms of an increased risk of sunburn. In addition, one article reported that pregnant women were at increased risk and another cited '*older people*' as an at risk group.

There were slightly more articles which included at least some reference to individuals at risks of insufficient exposure (n=13) and this was always contained in articles reporting the health benefits of Vitamin D and/or the increased incidence of rickets. Here individuals identified as being at risk included those living in parts of the UK with duller weather (n=1) or at a national population level following a period of poor weather (n=2). Five articles identified children/young people as being at risk of insufficient exposure to UV rays with this being ascribed to parents being *overly protective(116)* in their use of sunscreen and/or the fact that children spend more time indoors than in the past due to parental concerns over their safety or sedentary leisure interests or pursuits,. Finally, four articles reported that individuals with '*dark skins' (123)* or minority groups were at increased risk of vitamin D deficiency and related this to under-exposure to sunlight. Skin colour and cultural practices around clothing (particularly women) were two explanations offered for this increased risk.

Advice provided on sun exposure

Excluding the 19 articles which were concerned with sunbed use, the nature and depth of advice provided to the reader regarding sun exposure was investigated.

The majority of 'benefit articles' (17/26) did not contain any advice on sun exposure. The advice contained in the remaining articles was at a general level. One article referred to guidance published by the '*Department of Health and charities'(114)*, stating that the emphasis now is on: '*avoiding sunburn and very strong sun rather than staying out of the sun altogether'*. Another stated: '*Doctors have previously recommended at least 20 minutes exposure to sunlight each day'(124)*. Advice contained in other articles was even more non-specific [*the key is to enjoy the sun safely and avoid sunburn(120)*; *just rolling up your sleeves during your summer lunch break should be enough(125)*].

Likewise, the majority of risk articles provided no or very superficial advice on sun exposure. Typically this was from an individual or celebrity with an experience of skin cancer [*Use sunscreen!(126); If I've learnt anything from this experience it is this: skip the sunbed, wear sun-screen at all times, wear a hat, and cover your shoulders in the sun(92)*], or within the context of some of the articles which reviewed sun protection products [*It's never too late to protect your skin. Use a daily sunscreen in your moisturiser(105)*; *It's essential to take care not to burn, particularly given the sunny weather we've been having this summer(79)*].

Twenty articles containing some level of detail on sun protection were then 'scored' using a checklist of sun protection advice derived from NICE guidance PH32 (skin cancer). Eleven different pieces of information were extracted from this guidance, yielding a maximum 'score' of eleven.

- Avoid getting sunburnt.
- Avoid excess or prolonged sun exposure1.

[1] This was accepted if it was simply a theme throughout an article.

- Spend time in the shade between 11am and 3pm2.
- Wear clothing that protects areas which may be vulnerable to burning. This includes a broad-brimmed hat that shades the face, neck and ears, a long-sleeved top and trousers. Where possible, choose close-weave fabrics that don't allow the sun through.
- Sunscreens should not be used as an alternative to clothing and shade, rather they should offer additional protection.
- Choose a 'broad spectrum' sunscreen which offers both UVA and UVB protection.
- Sunscreen should be at least SPF 15 to protect against UVB.
- Sunscreen should also offer a high UVA protection (in the UK, this is indicated by at least four stars and the circular UVA logo).
- Use water resistant products if sweating or contact with water is likely.
- Sunscreen application - Apply liberally half an hour before and after going out in the sun.
- Re-apply at least every 2 hours and immediately after being in water, even if the sunscreen is 'water resistant'. Also re-apply after towel drying.

None of the articles directly attributed the advice provided to these guidelines, neither was NICE cited as a source.

Overall, the notion that sunscreens should not be used as an alternative to clothing and shade was rarely expressed explicitly. This is not surprising given the earlier findings regarding a dominant discourse of 'safe sunbathing' in many articles and the fact that some articles were sun cream product reviews.

Two thirds of the articles (13/20) provided 4 or fewer points of advice, the remaining third of articles (7/20) provided between 6 and 8 points of advice. Most frequently appearing items were avoid sunburn and excessive exposure and use sunscreen with SPF equal or >15. Practices around re-application, applying sunscreen 30 minutes before exposure and UVA protection, being in the shade between 11am and 30m were more likely to be omitted.

> *And to stay safe in the sun, doctors recommend protecting your skin with clothing and a hat, wearing sunscreen of SPF30 or higher, and reapplying every two hours(127)*

> *Follows textbook advice about covering up and staying in the shade between 11 and 3pm and uses Factor 30 sunblock (128)*

In addition, whilst individual sun protection practices may have been correct, they were sometimes falsely represented as alternatives.

> *If you really can't afford endless bottles of suncream, try a T shirt and light trousers on your kids, **or** keep them in the shade between 11 and 4pm(101).*

[2] Also scored 'hottest part of the day'.

In the following example, a seemingly thorough presentation on how to choose the correct sunscreen, attributed to a consultant dermatologist, is significantly compromised in two ways. First, it lacks any of reference to reapplication (indeed, it advises sunscreen should be '*long-lasting*') and, second, appears to suggest that personal choice is the deciding factor:

> '*Your sunscreen should be broad spectrum (UVA and UVB), offer high protection, and be long-lasting. All in all, the best sunscreen for you comes down to personal choice matched with your outdoor activity(121)'.*

There were also examples of quite specific advice being placed adjacent to vague advice which was open to misinterpretation. In the following extract, specific advice about applying sunscreen before and soon after exposure (note it should, however, be 20-30, as opposed to 15-30 before exposure) is followed by much more vague advice in terms of the frequency of reapplication. It is also worth noting the contradictory message implicit in this advice: it is safe to be in the sun all day despite the fact that sunscreens do not provide complete protection:

> *'You must apply it 15-30 minutes before you go out and a second coat 20-30 minutes after you've been in the sun. If you are out all day you will need two or three smotherings. …Remember, all creams will still let some burning rays through'(73)*

Even those articles which contained a more complete set of advice none fully complied with the NICE guidance, not least because they all carry a clear discourse of how to sunbathe 'safely' [*Sun-day Girl: before you soak up those rays, read our ultimate SPF guide!(84); Beat the Burn!(129)*].

Provision of sources of additional advice and information

All the articles were inspected to see if they contained reference to a source of further advice and/or information. Just six articles (~5%) provided the reader with such a resource. These included three articles from *The Sun*, two from the *Daily Mail* and one woman's monthly magazine. None of the *Daily Telegraph* articles offered this information. Two articles provided the Macmillan Cancer Care web address and helpline number. The remainder referred readers to different websites from the following list: Cancer Research UK, British Association of Dermatology (sun awareness pages); Skcin (skin cancer charity); health pages on magazine's website (allaboutyou.com/health) and CRUK's 'Sunsmart' website.

Section 4: Discussion and conclusions

4.1 Research Question 1

The analysis presented for Review Question One reveals that published research findings and public health messages are not being presented to the public in a balanced, accurate and comprehensive way in some newspaper articles. This issue is not confined to certain sections of the print media; rather it is, to varying degrees, evident across all genres of newspaper.

The analysis highlights the critical role played by the press release in communicating information to journalists which in turn is reported to the general public. Our analysis found that the accuracy and comprehensive of the newspaper articles more closely reflected the information contained in the press release than the original research paper/report, thus any inaccuracies and omissions in the press release are reproduced in news media reports. Thus there is, to a greater or lesser degree, omission or misrepresentation of research findings to the general public. This is significant in that newspapers play an important role in shaping the public's perception and understanding of public health issues (10-15, 19). Our analysis also found that where the press release contains verbatim quotes from researchers which are not confined to the findings contained in the research paper, this shift of emphasis is again often replicated in the newspaper coverage which, again, carries the risk of misleading the public. A clear example of this was found in our analysis of story one. Here newspapers accurately reported the content of the press release. However, it contained a speculative verbatim comment by one of the study authors which was not based on the findings of the study.

Evidence Statement 1: Press releases – key findings

Journalists reporting on pieces of published research tend to only report from the press release associated with that published research. There is very little evidence of consulting the primary source. Analyses of the comprehensiveness and accuracy of newspaper reports vis-à-vis the published research presented some relatively mid to low scores. However, when the comparison was instead made between the press release and the newspaper articles, the comprehensiveness and accuracy of newspaper reporting was much higher. Thus, where a press release clearly, fully and accurately states the key messages emanating from published research, the ensuing newspaper coverage will be more faithful to the study findings than if the press release omitted key messages or contained erroneous information. Further, where a press release introduces new information that is not contained or reflected in the published research, this new information may be reported in newspapers as if it were part of the study's findings.

Evidence Statement 2: Press release content and advice to spend limited time exposed to UV contained in news reports.

Newspaper reporting of advice to spend approximately 15 to 20 minutes in the sun with skin unprotected for the purposes of vitamin D production was again largely determined by the inclusion or exclusion of this advice in the press release. In most cases, if the press release referred to this advice, the newspaper articles tended to refer to it too; if the press release did not mention the advice then most, if not all, newspaper articles similarly did not refer to it.

In addition, our analysis revealed that journalists do not consistently report key risk data, even when such data was clearly presented in the press release. This was notable in four of the newspaper articles reporting on story three (the sunbed story).

To varying degrees, each genre of newspaper (broadsheet, mid-market, and tabloid) printed articles containing some omissions, inaccuracies or shifts of emphasis. Across the reporting of the four stories analysed for Question One, the press release typically, and not unexpectedly, offered the most comprehensive and most accurate presentation of the published research, followed by mid-market then broadsheet newspapers. The least comprehensive and least accurate articles were typically (though certainly not always) printed by the tabloids, followed by the broadsheets. This ranking of accuracy and comprehensiveness by genre did not change when the newspaper articles were instead assessed against the press releases.

Evidence Statement 3: Accuracy and comprehensiveness of newspaper reports of research genre

Whether measured against the published research or the press release, the comprehensiveness and accuracy of newspaper articles reporting on UV exposure research was generally greatest among the mid-market tabloids and weakest among the tabloids. Broadsheets lay somewhere in between

Particularly noteworthy, given the context of the subject of the articles, was the limited reference to current advice around sun safety contained within the newspaper articles. Over two-thirds (28/37) of the articles analysed did not include sun safety advice. Articles reporting on the risks and benefits of exposure to UV would suggest themselves as a 'natural' place to include sun safety advice as well as alerting readers to the risks of insufficient exposure. However, it must be remembered that the purpose of these particular newspaper articles was to report the research; In addition, sun safety advice was not presented in the press releases for three of the four research stories we analysed, and was only partially documented in the press release for the fourth story.

Evidence Statement 4: Newspaper reporting on sun safety advice in articles reporting research findings.

The majority of newspaper articles (28/37) analysed for Review Question One did not contain any sun safety advice, despite reporting research on the risks and/or benefits of UV exposure. One explanation for this is that the associated press release did not typically offer sun safety advice.

In addition, the analysis revealed that the majority of newspaper articles (33/37) made no explicit reference to risk factors or sub-populations at greatest risk of insufficient sunlight exposure. Again, this reflects an absence of such information in press releases. . For example, this was an important aspect of the consensus statement on vitamin D (Story 2) yet did not feature in newspaper coverage. Similarly, the majority of newspaper articles (excluding those reporting on story three) did not report on individual risk factors or sub-populations at greatest risk of developing skin cancer as a result of UV exposure.

Evidence Statement 5: Reference to individual risk factors or sub-populations at greatest risk in newspaper reports of research.

Newspaper articles typically did not make reference to risk factors or sub-populations at greatest risk of either developing skin cancer through exposure to UV or of developing a vitamin D deficiency through under-exposure to UV. Again, this reflects the absence of such reporting or inferences in the published research and press releases.

Only a minority of articles included some presentation of the alternative risk/benefit issue (i.e. the risks and benefits associated with over-exposure or insufficient UV exposure), thus offering a more balanced picture of the risks and benefits. This relative lack of balance is again potentially problematic as it fails to present the full picture and give full information to the general public, which in turn may indirectly encourage risk-taking or overly risk-adverse behaviours. However, in the absence of guidance or recommendations to the contrary, the purpose of the newspaper article is to accurately and comprehensively report new research findings which themselves tend to focus on the risks or benefits proven in the study. A more balanced 'bigger picture' approach in press releases would filter through and result in more balanced reporting in newspapers.

Evidence Statement 6: The reporting of risks and benefits of UV exposure within the context of presenting research findings.

The vast majority of newspaper articles did not report on both the risks and benefits of UV exposure. Instead they reported the information stated in the press release (and occasionally other information contained in the published research paper) which focused on the particular risks or benefits identified in the research findings. Thus, newspaper reports based on press releases indicating only risks of UV exposure themselves only reported risks; press releases reporting the benefits of UV exposure led to the vast majority of newspaper articles stating only the benefits; and those press releases reporting on research findings which highlighted some risks and benefits of UV exposure (but with a focus on the benefits) were followed by a roughly equal number of newspaper articles reporting both risks and benefits, and those focusing solely on benefits. Across the four stories, the vast majority of newspaper articles reported only the risks, benefits or risks and benefits outlined by the press release.

A discussion or factual reporting about the absolute and relative risks of an outcome occurring or not occurring was typically missing from the press release (sometimes from the published research itself) and thus also from the newspaper coverage of the study findings. This could result in the general public being confused or somewhat misled by the figures being reported.

4.2 Research Question 2

There have been surprisingly few analyses of news media coverage of the risks associated with UV exposure and skin cancer prevention(130). Two studies are relatively dated, analysing coverage by the New York Times from 1890 to 2004 (131) and articles released by the Associated Press between 1979 and 2003(132). More recently there have been content analyses of US and Australian print media(130, 133). We have not, however, identified any studies which have analysed UK news media. The analysis presented in this report is therefore a useful contribution; not only because it provides an analysis of UK media but also because previous studies have primarily adopted content analysis approaches where as we have also endeavoured to identify and describe underlying discourses in greater depth.

The findings from the analyses of a calendar year of articles published by a tabloid, mid-market tabloid and broadsheet revealed different levels of reporting, with a mid-market tabloid publishing at least twice as much material as the other newspapers. Covering in monthly women's and specialist interest magazines was relatively low with many not covering this issue during a twelve month period. As has been found in other studies, the volume of articles 'peaked' in the summer and then spring months (130).

Evidence statement 2.1: Differences in coverage by newspapers and magazines

National newspapers vary considerably in terms of the number of items published during the course of a calendar year which include some sort of reference to the risks and/or benefits of UV exposure. Coverage in monthly women's magazines and specialist interest monthly magazines appears low with many publications carrying no content on this topic during a calendar year. Summer appears to be the main season in which this topic is likely to receive most attention in news media.

The publication of research findings was a common stimulus for the publication of a newspaper article and for the mid-market and broadsheet this was the most common type of article. Personal stories featured heavily in the tabloids. Product reviews were another source of writing about the risks and benefits of UV exposure. Certainly product reviews may not be something which the presentation of other health risk/benefit issues will be found. However, they, and health & beauty columns, are often written in an 'instructional' tone and are therefore, potentially, an important source of health behaviour information for some individuals. The weather is always news in the UK and so it was, perhaps, unsurprising, that some of the news and feature articles were prompted by the current weather (e.g. a heat wave, a prolonged spell of gloomy weather). Thus overall, there are a number of different reasons, or catalysts, to the UK news media printing an article which is about, or contains material about, the risk or benefits of UV exposure.

Evidence statement 2.2: Location of material on risks and benefits within newspapers

Articles containing some sort of reference to the risks and/or benefits of UV exposure were found in a wide range of sections making up a daily or Sunday newspaper including: news reports, celebrity stories, features stories, opinion pieces, health and beauty columns and product reviews.

The seasonal differences in the publication of UV exposure stories – peaking in the summer – means that papers are publishing articles at a time when readers' may perceive themselves as having an information need with respect to sun protection. The importance of that information and advice being appropriate and correct is clearly very important.

The primary focus of the great majority of articles was on the risks associated with UV exposure. However, not all made explicit reference to skin cancer even in articles about sunburn. Skin ageing was presented as a risk associated with sun exposure in a quarter of 'risk articles', with half of these articles not referring to any other risk. Overall, within the sample of newspapers analysed, it appears there is a degree of mis-representation of risk or, in some cases, a reluctance to refer directly to skin cancer, using terms such as 'sun damage' or merely pointing to the risks of sunburn, rather than its consequences.

Evidence statement 2.3: Volume of reporting on risks and benefits

A greater volume of articles containing material on the risks of UV exposure were identified compared to those presenting the benefits. A very small proportion of articles set out to present and consider the risks and benefits of sunlight exposure. There were differences between newspapers in terms of the proportions of risk and benefit material.

Evidence statement 2.4: Types of risk associated with UV exposure presented

Skin cancer was the most frequently reported risk, presented in around three quarters of 'risk articles' analysed. A quarter of articles identified sunburn as a risk and a similar proportion reported skin ageing as a risk. A small proportion concerned risks to eye health. Around a half of articles which identified sunburn or skin ageing as a risk associated with UV exposure did also not refer to the risk of skin cancer.

A quarter of the articles analysed were primarily about the benefits of sunlight exposure in terms of vitamin D production. The majority of these articles were concerned with bone health and development and/or the rising incidence of rickets. Vitamin D deficiency was a topical issue in 2013, caused in part by the publication of further research reporting increased incidence of rickets along with other research pointing to other, wide-ranging, potential health benefits. It is important to note that the majority of benefit articles did not refer to the risks associated with sunlight exposure.

Evidence statement 2.5: Benefits of UV exposure

The pre-dominant benefits of UV exposure presented in the material analysed related to Vitamin D production or levels. Articles reporting on the benefits of UV exposure did not typically refer to the risks.

It was perhaps surprising, therefore, to find that very few articles (4/112) set out to examine and weigh up the risks and benefits of UV exposure. Here reference was made to 'conflicting' messages from government and 'health experts', and on occasion opposing positions were presented in articles by campaign groups or senior health professionals We would note that there may well have been a higher volume of reporting in 2010 when the consensus statement on UV exposure and vitamin D was published. Indeed we would refer the reader to the findings from our analyses for Question 1 analysis which included the publication of this statement as one of the stories it analysed (Story 2).

Evidence statement 2.6: Presentation of UV, and distinction between UVA and UVB

Two-thirds of the articles analysed did not specify UV exposure beyond general phrases such as sunlight, sun's rays, sunshine or sunbeds. Less than one in ten referred to both UVA and UVB, with around half of these offering an explanation as to their different impact on the skin.

The topic where there was consistent discourse was the negative presentation of sunbed use. Personal stories and research findings were used to present clear messages about the risks associated with using sunbeds. This current negative framing may represent a change in the way UK newspaper and magazine media are presenting sunbeds and sunbed use. An analysis of sun protection coverage in the Australian news media over a 12 year period (134) revealed a significant shift in coverage to almost exclusive presentation of risk. A longitudinal analysis of UK media would be required to test whether something similar has happened in the UK.

Evidence statement 2.7: Framing and presentation of sunbeds and sunbed use

A quarter of articles containing material on the risks of UV exposure were on the topic of sunbeds and/or sunbed use. Overall, the messages presented in these articles were uncompromisingly negative and explicit connections were made between sunbed use and risks to health and, possibly, life. This contrasts greatly with the discourse around sunbathing found in the articles analysed.

Sunbathing and suntans, in contrast, emerged as acceptable or, even, something of value. This is not unexpected as it reflects current social attitudes to tanned skin(135) and its perceived association with well-being, healthy lifestyle and physical beauty. This appeared to drive the way that sun protection advice was presented - protection in order to tan safely or preventing sunburn whilst achieving a tan – rather than minimising skin cancer risk. This message aligns the public's perception, and use of, sunscreen as a 'tanning aid' to avoid

sunburn and its perceived association with intentional sun exposure(136). It also replicates findings from analyses of other print media.(137) As a result, advice centred very much on the use of sunscreen products. It was very rare that they were identified as offering 'additional' protection as opposed to an alternative to staying in the shade or covering up with clothing. There is some similarity with findings from a previous study of US news media in terms of presentation of sunscreen as a 'standalone' approach and omission of advice about staying in the shade(130). However, whilst the US study reported less than 2% of articles advised readers 'not to burn', burn prevention was a much more common theme in the sample of UK articles. This may be due to an increased understanding of the way episodes of sunburn increase the risk of skin cancer, and/or cultural differences. We would note that the discourse around sunburn was consistently negative and one of self-responsibility, or for children, the blame lay with irresponsible parents. It suggests that individuals can prevent themselves from burning: the snag is that sunscreens are typically presented as *the* sole means to achieving this. In addition, there is very little presentation of risks of UV exposure aside from sunbathing, for example through spending prolonged periods outside due to leisure activities or work.

Evidence statement 2.8: Presentation of activities which increase risks of over-exposure to UV

The risks associated with sunlight exposure were almost exclusively presented in terms of sunbathing as opposed to exposure to sunlight in the course of work or outdoor leisure pursuits

Evidence statement 2.9: Framing and presentation of sunburn

Sunburn was consistently portrayed as undesirable and harmful, and there was a discourse around self-responsibility which, for parents, included their children. However, as noted in Evidence Statement 2.4, the link between sunburn and the increased risk of skin cancer was not consistently portrayed.

Evidence statement 2.10: Framing and presentation of sunbathing

Discourses around sunbathing were complex and, to some extent, contradictory. A common discourse was 'safe sunbathing', with sunscreen presented as the means by which this could be achieved. Another common discourse was around the benefits of, and value placed on, a suntan (achieved through sunbathing) in terms of improved physical appearance and/or sense of well-being. Articles containing material about 'safe sunbathing' rarely referred to the risks of sun exposure. Negative discourses were unusual and suggested abnormal behaviour (for example, intense sunbathing) or sunbathing behaviour) or lack of personal responsibility by sunbathing 'without protection'.

The identification of particular populations at additional risk of harm, or at risk of insufficient exposure, was uncommon. It was children and young people who were most likely to be

presented at risk of both over- and under-exposure to the sun. Just four articles noted the risk of insufficient exposure to people with darker skins.

Evidence statement 2.11: Reference to specific populations

Children, followed by individuals with red hair or fair skin, emerged as the sub-populations most frequently identified as being at increased risk by exposing their skin to UV. In terms of references to individuals at risk of under-exposure, this was most commonly found with reference to whole populations, due to gloomy weather, and children. Here, the risk was presented as being caused by over-protective parents and/or indoor leisure pursuits. A handful of articles referred to the increased risk of under-exposure for some minority groups.

Advice on sun exposure included in the articles was typically absent, incomplete and, at times, inaccurate or just simply too vague - a finding similar to that of earlier studies. As noted above, the underlying premise was safe sunbathing as opposed to avoiding over-exposure. The absence of advice in some articles is, arguably, understandable. A brief news story of less than 200 words cannot accommodate sun safety advice. However, it would appear that even over the period of a year, print space for comprehensive dissemination of sun safety advice is very limited in the UK. Just seven articles, across three daily newspapers and fifteen monthly magazines, were identified as providing relatively comprehensive guidance on sun protection. Crucially, even when given fuller treatment, the underlying discourse was typically 'safe sunbathing' as opposed to minimising the risk of skin cancer. Finally, it is important to draw attention to the fact that only a minority of articles provided the reader with information about how to access further information. Whilst word limits might be a barrier to providing UV safety information in the article itself, a web address would seem a feasible option. Indeed, with on-line/downloadable versions of news media onto tablets and mobile devices, accessing these additional sources of advice and information becomes very easy for the reader.

Evidence statement 2.12: Presentation of sun safety advice

The majority of articles which included material on the risks associated with UV exposure provided no, or highly vague, advice on sun protection. Less than one in twenty articles directed the reader to further sources of information. The notion that sunscreens should not be treated as an alternative to clothing and shade was rarely expressed. No article provided presented complete and accurate guidance on sun safety as set out by NICE guidance.

4.3 Implications of findings

A clear message from the findings of our analysis for Question 1 concerns the importance of accurate, comprehensive and comprehensible presentation of research findings in press releases. As well as the constraints of time and journal access which journalists face, they are also unlikely to have the knowledge or expertise to understand scientific writing. They are therefore dependent on the comprehensiveness and accuracy of a press release.

Researchers writing, or simply authorising, press releases need to ensure that the content accurately presents all the main research findings, and does not contain additional information or personal communications from the authors that in any way do not reflect the content of the published research. That said, as with any news story, journalists reporting on published research equally have a responsibility to ensure and convey the research findings in a clear, comprehensive, accurate and balanced manner(138).

There was surprising little material identified and included in our Question 2 analyses which explicitly sought to present and weigh up the risks and benefits of UV exposure: just four articles were identified which fulfilled these criteria. It is important to note that these articles typically presented conflict or confusion among 'the 'experts' (variously, government, scientists, doctors) in terms of the risks and benefits of sun exposure. The experiences in other areas of public health is that controversy or conflicting messages can lead to cynicism about the robustness and validity of scientific evidence, and also result in individuals drawing on other sources of (non-scientific) evidence to inform decision-making around health behaviours(139). It is also worth noting findings from an Australian study(140) of news coverage on skin cancer prevention between 1993 and 2006, (skin cancer prevention campaigns in Australia have been very successful). Here researchers observed a decrease in the proportion of stories positive for sun protection and a rise in stories reporting the risks of under-exposure to sunlight in terms of Vitamin D deficiency and/or controversies around sun protection/sun exposure during that period. The researchers note the potentially negative impact this may be having on maintaining public perceptions and understanding of sun protection issues.

Another implication of the findings arising from our analysis for Question 2 was the diversity in the type of articles which may convey information or messages about the risks and benefits of UV exposure. These included: celebrity and personal stories, news pieces, research reports, health and beauty columns, and 'sun protection' product reviews. This is perhaps different to other health risks where reporting may be more confined. This certainly has implications in terms of ensuring information about public health guidance is conveyed to a wide range of journalists. It also increases the challenge of ensuring readers are more consistently provided with or directed to sun safety guidance.

A significant issue would appear to be societal views of sunbathing as an acceptable behaviour, and a suntan as something to aspire to. These views were portrayed and promoted (if only implicitly) by much of the media we analysed. This has been the conclusion of similar studies conducted in other countries (133). The (somewhat limited) body of research consistently suggests an association between media presentations of tanned skin and women's attitudes towards, and intentions to, tan (133). Younger women, appear to be particularly influenced by media portrayal of tanning in terms of tanning beliefs and behaviours. An emerging model, drawing on theories of body image, on 'appearance motives' to tan (or not to tan) offers an explanation for the role of the media on women's attitudes and behaviours (141, 142). Researchers argue that 'appearance motives' are informed, or driven by, sociocultural influences (media, friends, family), appearance reasons to tan (e.g. change skin colour, body shape, reducing acne) and appearance reasons not to tan (e.g. skin ageing). The currently positive value given to tanned skin within a lot of print

media is therefore seen as an important area for intervention if skin cancer campaigns are to be successful. It would be useful to identify whether there is any evidence that the presentation of skin ageing as a consequence of smoking as part of recent anti-smoking campaigns, particularly those aimed at younger people, has been effective. This may help inform whether or not to actively use fears around skin ageing to promote sun safe behaviours. It would also be interesting to learn how the Australian government and associated bodies engaged and worked with the print and news media in its skin cancer campaigns.

It is important to draw attention to the fact that much of theory and research discussed above concerns women. Indeed, evidence suggests that there are gender differences in sun exposure motivations and behaviours, though we would note the lack of very recent evidence. Overall, studies have shown that appearance is a stronger motivation to tan for women than men and that women more are more likely to deliberately seek to tan but (in order to safely tan) also more likely to use sunscreen. Men's sun exposure is more likely to a consequence of outdoor activities, and thus incidental (143). These findings around gender difference are interesting and clearly have implications. We would note, however, the lack of update evidence and, therefore, the need for further research.

Our analysis also found that the media presented sunscreen as the primary way to protect the skin from UV exposure and this aligns with public understanding of sunscreen (144). This highlights the importance of the role of the media as a source of health information as well as something which forms and reinforces societal attitudes. Positively engaging print and news media in this process of changing attitudes and improving understanding of sun protection practices would be necessary (145)

Over and above these specific issues, it is essential to draw attention to what is understood as to why the approach taken in Australia to address this issue was so successful. Here the incidence of skin cancer has been reversed following a multi-level and multi-modal intervention which addressed individual and societal responsibilities for minimising the risks associated with UV exposure. It is this holistic, on-going 'ecological' approach to the issue which has been implicated as the reason for the success of this public health intervention (144), and for the lack of success of initiatives in America which have focussed solely on personal responsibility (146).

4.4 Limitations of the review

The constraints of time and budget have inevitably placed some limitations on what it has been possible to achieve in this piece of work. First, analysis for question one was focused on only four research stories, reported in 37 newspaper articles. None of those stories had been reported in magazine articles. Whilst analysis of a greater number of stories could have enhanced understanding of media representation, the four stories were carefully selected to present a range of topics and a balance of 'risk', 'benefit' and 'neutral' stories. Second, analysis for question two was limited to media portrayal of the risks and benefits of UV exposure during a single calendar year (2013): the latest year for which full data was available as opposed to since 2010, as originally planned...Whilst this means we could not

look at any trends or developments over time, it was felt more important to conduct a detailed analysis of current discourses and representations in UK newspapers and magazines rather than the more broadbrush approach which would be have been required with the much higher volume of articles generated from searches covering a 4 year period.. Third, searches were limited to print media, and on-line editions, indexed by UK Nexis. This meant that publications which specifically target certain sections of the population (for example, weekly magazines, those produced by and for minority groups, including those in languages other than English) have not been included in this analysis. Nevertheless, the inclusion of all genres of newspaper and 15 most popular magazines hopefully includes a significant readership from across the demographics. Finally, it is important to note that whilst there is clear evidence that print media plays a key role in informing people's preventive health behaviours (144), it is just one way by which the public are accessing public health information. Web-based information and social networks (peers, family) are other important sources (147, 148).

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APPENDIX A

Search Histories

Question 1

Database name	Nexis UK
Database host	LexisNexis
Database coverage dates	1979 to current
Searcher	HW
Search date	18/03/14-19/03/14
Search strategy checked by	Mick Arber (information specialist YHEC), Paul Levay (information specialist NICE)
Number of records retrieved and downloaded	41 records identified by magazine searches, 41 downloaded in a Word document and 41 passed to reviewers (no first pass undertaken as result numbers so small). 798 records identified by newspaper searches, 798 downloaded in a Word document. 541 remain after first pass (removal of obviously irrelevant records and duplicates) and passed to reviewers.
Name of RefMan library	N/A records saved in Word document, as per protocol
Number of records loaded into RefMan	N/A records saved in Word document, as per protocol
Reference numbers of records in RefMan library	N/A records saved in Word document, as per protocol
Number of records after de-duplication in RefMan library	N/A records saved in Word document, as per protocol.

The following UK National Newspapers were searched:

1. Daily Mail and Mail on Sunday
2. Daily Star
3. Daily Star Online
4. Daily Star Sunday
5. The Daily Telegraph (London)
6. The Express
7. Express Online
8. The Guardian (London)
9. guardian.co.uk
10. i - Independent Print Ltd
11. The Independent (London)
12. Independent on Sunday
13. Independent.co.uk
14. MailOnline
15. The Mirror and The Sunday Mirror
16. The News of the World*
17. The Observer
18. The Sun
19. The Sunday Express
20. Sunday Sun (UK)
21. The Sunday Telegraph (London)

22. The Sunday Times (London)
23. telegraph.co.uk
24. The Times (London)

Power search option used. Duplicate detection option turned off. All results downloaded in full text as a Word document.

1. Liu 2014

You searched for: (((sun OR suns OR sunning OR sunshine OR sunlight* OR uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR sunscreen! OR sunblock! OR spf OR sunburn! OR sunbath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sunlamp* OR solarium! OR solaria!) W/10 ("blood pressure" OR "heart attack*" OR “myocardial infarction” OR “cardiac event*” OR stroke* OR cardiovascular OR cardio-vascular OR hypertens!)) AND (liu OR fernandez OR hamilton OR feelisch OR lang OR gallagher OR newby OR weller OR "Journal of Investigative Dermatology" OR southampton OR edinburgh OR "Foundation for Skin Research" OR "Stroke Scotland" OR "Claire Wand Fund")) and DATE (>=2013-01-01 and <=2014-03-18) 69 results. 51 remain after first pass and were passed to reviewers.

2. 2010 consensus statement

You searched for: ((“vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin” OR rickets OR osteomalacia) AND (“British Association of Dermatologists” OR “Cancer Research UK” OR “Diabetes UK” OR “Multiple Sclerosis Society” OR “National Heart Forum” OR “National Osteoporosis Society” OR “Primary Care Dermatology Society” OR “consensus statement” OR “position statement” OR "definitive statement" OR "joint guidance" OR "joint advice" OR “Rona Mackie” OR “Professor Mackie” OR ((seven OR 7) W/3 (charities OR “health groups” OR “organisations” OR expert*)))) and DATE (>=2009-12-17 and <=2014-03-18) 219 results. 176 remain after first pass and were passed to reviewers.

3. Tierney 2013

You searched for: (((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!”) W/15 (danger! OR risk! OR safety OR exposure OR expose! OR “skin cancer*” OR melanoma! OR radiation)) AND (dundee OR “cancer research uk” OR “british journal of dermatology” OR tierney OR ferguson OR ibbotson OR dawe OR eadie OR moseley)) and DATE (>=2012-01-01 and <=2014-03-18) 127 results, all 127 passed to reviewers.

4. Drugs and Therapeutics Bulletin review 2011

You searched for: ((suncream! OR "sun cream!" OR sunscreen! OR "sun screen!" OR sunlotion! OR "sun lotion!" OR spf OR "sun protection factor!" OR spf OR spf30 OR spf15 OR "factor 30" OR "factor 15") AND ("Drugs and Therapeutics Bulletin" OR DTB OR Iheanacho)) and DATE (>=2010-06-01 and <=2014-03-18) 15 results, all 15 passed to reviewers.

5. Boniol 2012

You searched for: (((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!”) W/15 (danger! OR risk! OR safety OR exposure OR expose! OR “skin cancer*” OR melanoma! OR radiation)) AND (“International Prevention Research Institute” OR “European Institute of Oncology” OR “British Medical Journal” OR bmj OR boniol OR autier OR gandini)) and DATE (>=2011-07-24 and <=2014-03-18) 28 results, all 28 passed to reviewers.

6. Pearce 2010

You searched for: ((“vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin” OR rickets OR osteomalacia) AND (pearce OR cheetham OR newcastle OR "royal victoria" OR bmj OR "british medical journal")) and DATE (>=2009-01-01 and <=2014-03-18) 226 results, 77 remain after first pass and were passed to reviewers.

7. Tewari 2011

You searched for: ((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!” OR suntan! OR “sun-tan!” OR tan OR tanning) AND (“Journal of Investigative Dermatology” OR “King! College” OR Tewari OR Sarkany OR “National Institute for Health Research,” OR “Medical Research Council” OR “British Skin Foundation” OR “British Association for Dermatology”)) and DATE (>=2010-10-01 and <=2014-03-18) 96 results, 50 remain after first pass and were passed to reviewers.

8. Anderson 2011

You searched for: ("breast cancer!" W/10 (sun OR suns OR sunning OR sunshine OR sunlight* OR uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR sunscreen! OR sunblock! OR spf OR sunburn! OR sunbath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sunlamp* OR solarium! OR solaria! OR “vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin”) AND (Ontario OR Toronto OR Canada! OR Canadian! OR “Journal of American Epidemiology” OR "Journal of Epidemiology" OR Anderson OR Cotterchio OR Kirsh OR Knight)) and DATE (>=2010-06-01 and <=2014-03-19) 18 results, 17 remain after first pass and were passed to reviewers.

The following UK monthly magazine titles were searched:

Power search option used. Duplicate detection option turned off. All results downloaded in full text as a Word document.

1. Coast (UK)*
2. Company (UK)
3. Cosmopolitan (UK)
4. Country Living (UK)
5. Esquire (UK)
6. Good Housekeeping (UK)
7. Harper's Bazaar (UK)
8. Men's Health (UK)
9. New Scientist
10. Prima (UK)

11. Prima Baby (UK)*
12. Runner's World (UK)
13. Zest (UK)*

1. Liu 2014

You searched for: (((sun OR suns OR sunning OR sunshine OR sunlight* OR uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR sunscreen! OR sunblock! OR spf OR sunburn! OR sunbath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sunlamp* OR solarium! OR solaria!) W/10 ("blood pressure" OR "heart attack*" OR “myocardial infarction” OR “cardiac event*” OR stroke* OR cardiovascular OR cardio-vascular OR hypertens!)) AND (liu OR fernandez OR hamilton OR feelisch OR lang OR gallagher OR newby OR weller OR "Journal of Investigative Dermatology" OR southampton OR edinburgh OR "Foundation for Skin Research" OR "Stroke Scotland" OR "Claire Wand Fund")) and DATE (>=2013-01-01 and <=2014-03-18) 3 results, all records passed to reviewers.

2. 2010 consensus statement

You searched for: ((“vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin” OR rickets OR osteomalacia) AND (“British Association of Dermatologists” OR “Cancer Research UK” OR “Diabetes UK” OR “Multiple Sclerosis Society” OR “National Heart Forum” OR “National Osteoporosis Society” OR “Primary Care Dermatology Society” OR “consensus statement” OR “position statement” OR "definitive statement" OR "joint guidance" OR "joint advice" OR “Rona Mackie” OR “Professor Mackie” OR ((seven OR 7) W/3 (charities OR “health groups” OR “organisations” OR expert*)))) and DATE (>=2009-12-17 and <=2014-03-18) 13 results, all records passed to reviewers.

3. Tierney 2013

You searched for: (((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!”) W/15 (danger! OR risk! OR safety OR exposure OR expose! OR “skin cancer*” OR melanoma! OR radiation)) AND (dundee OR “cancer research uk” OR “british journal of dermatology” OR tierney OR ferguson OR ibbotson OR dawe OR eadie OR moseley)) and DATE (>=2012-01-01 and <=2014-03-18) 0 results

4. Drugs and Therapeutics Bulletin review 2011

You searched for: ((suncream! OR "sun cream!" OR sunscreen! OR "sun screen!" OR sunlotion! OR "sun lotion!" OR spf OR "sun protection factor!" OR spf OR spf30 OR spf15 OR "factor 30" OR "factor 15") AND ("Drugs and Therapeutics Bulletin" OR DTB OR Iheanacho)) and DATE (>=2010-06-01 and <=2014-03-18) 0 results

5. Boniol 2012

You searched for: (((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!”) W/15 (danger! OR risk! OR safety OR exposure OR expose! OR “skin cancer*” OR melanoma! OR radiation)) AND (“International Prevention Research Institute” OR “European Institute of Oncology” OR “British Medical

Journal” OR bmj OR boniol OR autier OR gandini)) and DATE (>=2011-07-24 and <=2014-03-18) 0 results

6. Pearce 2010

You searched for: ((“vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin” OR rickets OR osteomalacia) AND (pearce OR cheetham OR newcastle OR "royal victoria" OR bmj OR "british medical journal")) and DATE (>=2009-01-01 and <=2014-03-18) 14 results, all records passed to reviewers.

7. Tewari 2011

You searched for: ((sunbed* OR “sun bed*” OR sunlamp* OR “sun lamp*” OR solarium! OR solaria! OR “artificial tan!” OR “indoor tan!” OR suntan! OR “sun-tan!” OR tan OR tanning) AND (“Journal of Investigative Dermatology” OR “King! College” OR Tewari OR Sarkany OR “National Institute for Health Research,” OR “Medical Research Council” OR “British Skin Foundation” OR “British Association for Dermatology”)) and DATE (>=2010-10-01 and <=2014-03-18) 1 result, all records passed to reviewers.

8. Anderson 2011

You searched for: ("breast cancer!" W/10 (sun OR suns OR sunning OR sunshine OR sunlight* OR uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR sunscreen! OR sunblock! OR spf OR sunburn! OR sunbath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sunlamp* OR solarium! OR solaria! OR “vitamin d” OR “vit d” OR vitamind OR “sunshine vitamin” OR “sun shine vitamin”) AND (Ontario OR Toronto OR Canada! OR Canadian! OR “Journal of American Epidemiology” OR "Journal of Epidemiology" OR Anderson OR Cotterchio OR Kirsh OR Knight)) and DATE (>=2010-06-01 and <=2014-03-19) 10 results, all records passed to reviewers.

Hand searches of Tesco and Asda Magazines, carried out 19 March 2014.

Full text of Asda Magazine editions available from March 2014 to October 2012 http://issuu.com/asdamagazine. Each issue scanned by an experienced information specialist to identify any coverage of sunlight, UV, skin cancer or vitamin D deficiency. No relevant records identified.

Full text of Tesco Magazine available from March 2014 to Oct/Nov 2012 http://realfood.tesco.com/magazine-archive.html. Each issue scanned by an experienced information specialist to identify any coverage of sunlight, UV, skin cancer or vitamin D deficiency. No relevant records identified.

Question 2

Database name	Nexis UK
Database host	LexisNexis
Database coverage dates	1979 to current
Searcher	HW
Search date	25/02/14 (Sun, Mail) 18/03/14 (Telegraph and magazine titles)
Search strategy checked by	Mick Arber (information specialist YHEC), Paul Levay (information specialist NICE)
Number of records retrieved and downloaded	3722 records identified post automatic duplicate removal by Nexis. 3722 records downloaded to a Word Document. 740 records remained after first pass and were passed to reviewers for assessment.
Name of RefMan library	N/A records saved in Word document, as per protocol
Number of records loaded into RefMan	N/A records saved in Word document, as per protocol
Reference numbers of records in RefMan library	N/A records saved in Word document, as per protocol
Number of records after de-duplication in RefMan library	N/A records saved in Word document, as per protocol.

Due to the restrictions in the number of records that can be displayed and downloaded at one time, the searches of the newspaper titles (Daily Mail and the Mail on Sunday, The Sun) were searched by year.

Although the Mail on Sunday was not included in the protocol as an eligible resource for Q2 – Nexis UK does not allow this title to be searched separately from the Daily Mail.

Power Search. Source Description: Daily Mail and Mail on Sunday; The Sun. Duplicate Options: On- High Similarity (identifies documents that are nearly identical e.g. same story in different editions of the same newspaper)

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets)) and DATE (>=2010-01-01 and <=2010-12-31) **786 records**, 117 records identified by duplicates by Nexis, **669 records downloaded.** (477 The Sun, 192 Daily Mail & Mail on Sunday)

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure*

OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets)) and DATE (>=2011-01-01 and <=2011-12-31) **821 records**, 96 records identified by duplicates by Nexis, **725 records downloaded.** (530 The Sun, 195 Daily Mail & Mail on Sunday)

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets)) and DATE (>=2012-01-01 and <=2012-12-31) **1205 records**, 351 records identified by duplicates by Nexis, **866 records downloaded.** (705 The Sun, 161 Daily Mail & Mail on Sunday)

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets)) and DATE (>=2013-01-01 and <=2013-12-31) **1244 records**, 319 records identified by duplicates by Nexis, **925 records downloaded.** (677 The Sun, 248 Daily Mail & Mail on Sunday)

HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath!

OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets)) and DATE (>=2014-01-01 and <=2014-12-31) 186 records, 47 records identified by duplicates by Nexis, **139 records downloaded. (**108 The Sun, 31 Daily Mail & Mail on Sunday)

The Telegraph and the magazine titles (13 relevant monthly magazines searched for Q1) were added to potential searches after the initial searches had been run. At this point it was also decided to search for stories published in 2013 only:

You searched for: (HLEAD (((sun OR suns OR sunning OR sunshine OR sunlight*) W/3 (damag! OR protect! OR safe OR safety OR risK! OR benefit* OR beneficial OR index OR indexes OR exposure* OR overexposure* OR overexpose* OR underexposure* OR underexpose*)) OR ((uv OR uva OR uv-a OR uvb OR uv-b OR uvc OR uv-c OR ultra-violet OR ultraviolet OR solar) W/3 (ray* OR radiation OR irradiat! OR protect! OR index OR indexes OR exposure! OR overexposure! OR expose! OR underexpose! OR underexposure!)) OR (sunscreen! OR sun-screen! OR sunblock! OR sun-block! OR spf OR sunburn! OR sun-burn! OR photo-damag! OR photodamag! OR photoag! OR photo-expos! OR photoexpos! OR sunbath! OR sun-bath! OR suntan! OR tan OR tans OR tanning OR tanned OR sunbed* OR sun-bed* OR sunlamp* OR solarium! OR solaria! OR “skin cancer” OR “melanoma” OR “vitamin D” OR rickets))) and DATE (>=2013-01-01 and <=2013-12-31) **397 records identified** and downloaded, duplicate options turned off.

Full text of Asda Magazine editions available from March 2014 to October 2012 http://issuu.com/asdamagazine. Each issue scanned by an experienced information specialist to identify any coverage of sunlight, UV, skin cancer or vitamin D deficiency. 1 potentially relevant record identified.

Full text of Tesco Magazine available from March 2014 to Oct/Nov 2012 http://realfood.tesco.com/magazine-archive.html. Each issue scanned by an experienced information specialist to identify any coverage of sunlight, UV, skin cancer or vitamin D deficiency. No relevant records identified.

Records remaining after first pass and passed to reviewers for assessment:

230 – Mail
319 – Sun
190 – Telegraph and 13 magazines in Nexis
1 – Asda magazine hand-searches.

Total – 740

APPENDIX B

Bibliographic details of all newspaper articles analysed for Question One

1. Guardian Weekly: Weekly review: Science: Rickets recurrence. The Guardian (London, Final Edition). 2010: 5 February; p.31. Nexis UK Database, Accessed 18 March 2014.
2. Rickets hits indoor kids; computers. Daily Mirror (3 Star Edition). 2010: 22 January; p.35. Nexis UK Database, Accessed 18 March 2014.
3. Kids alert on rickets. The Sun (Edition 1, Scotland). 2010: 22 January; p.40. Nexis UK Database, Accessed 18 March 2014.
4. Factor 30 for Brits. The Sun (Edition 1, Scotland 1). 2011: 1 June; p.31. Nexis UK Database, Accessed 18 March 2014.
5. Sun cream risk. Daily Mirror (3 Star Edition). 2011: 31 May; p.9. Nexis UK Database, Accessed 18 March 2014.
6. The hex factor. The Sun (Edition 2, National Edition). 2011: 1 June; p.11. Nexis UK Database, Accessed 18 March 2014.
7. Alleyne R. Sunbathe for 10 minutes, then apply the cream, say experts. The Daily Telegraph (Edition 2, National Edition). 2010: 17 December; p.6. Nexis UK Database, Accessed 18 March 2014.
8. Beckford M. Sun cream guidelines 'leave millions at risk'. The Daily Telegraph (Edition 2, National Edition). 2011: 1 June; p.10. Nexis UK Database, Accessed 18 March 2014.
9. Bowcott O. Rickets warning from doctors as vitamin D deficiency widens. Guardian Unlimited (http://www.theguardian.com/). 2010: 22 January; Nexis UK Database, Accessed 18 March 2014.
10. Bowcott O. Doctors warn of increase in rickets cases. Guardian Unlimited (http://www.theguardian.com/). 2010: 21 January; Nexis UK Database, Accessed 18 March 2014.
11. British Medical Journal. Experts say use of sunbeds leads to more than 3000 cases of melanoma and nearly 800 deaths a year in Europe and say that “tougher actions” are needed [Online press release]. 23 July 2012. Accessed 18 March 2014 http://www.bmj.com/press-releases/2012/07/24/experts-say-use-sunbeds-leads-more-3000-cases-melanoma-and-nearly-800-deat
12. British Medical Journal. UK advice on sun creams “not in the interests of public health,” warns DTB. [Online press release]. 1 July 2012. Accessed 18 March 2014 http://www.sciencenewsline.com/articles/2011060109050049.html
13. Cancer Research UK. Joint position statement issued to provide vitamin D clarity [Online press release]. 16 December 2010. Accessed 18 March 2014 http://www.cancerresearchuk.org/about-us/cancer-news/news-report/joint-position-statement-issued-to-provide-vitamin-d-clarity
14. Connor S. Public advice on suntanning may mean vitamin deficiency risk; Health bodies to acknowledge need to tan during peak hours - despite cancer risks. The Independent (First Edition). 2010: 5 July; p.4. Nexis UK Database, Accessed 18 March 2014.
15. Fletcher V. Sunshine vitamins cut risk of cancer. The Express (UK 1st Edition). 2010: 22 January; p.1. Nexis UK Database, Accessed 18 March 2014.
16. Fletcher V. Now the advice is you should go out in the midday sun. The Express (UK 1st Edition). 2010: 17 December; p.17. Nexis UK Database, Accessed 18 March 2014.
17. Hope J. Rickets returns. Daily Mail 2010: 22 January; Nexis UK Database, Accessed 18 March 2014.

18. Hope J. Why we should all spend 15 minutes in the midday sun. Daily Mail 2010: 17 December; Nexis UK Database, Accessed 18 March 2014.
19. Hope J. Why factor 15 sunscreen is not enough. Daily Mail 2011: 1 June; Nexis UK Database, Accessed 18 March 2014.
20. Hope J. Young people who use sunbeds 'are twice as likely to develop deadliest skin cancer'. Mail Online (http://www.dailymail.co.uk/). 2012: 24 July; Nexis UK Database, Accessed 18 March 2014.
21. Laurance J. Higher sunscreen needed to protect against cancer. The i (First Edition). 2011: 1 June; p.7. Nexis UK Database, Accessed 18 March 2014.
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APPENDIX C

Assessing comprehensiveness of reporting for Q1

Column headings used to determine the 'completeness score' for each of the four stories analysed:

Story 1
ID no.
Author (s) named?
Research centre (s) named?
Journal named?
Reference to other diseases that may be associated with vitamin D deficiency – as mentioned in the research paper (diabetes, cardiovascular disease, cancers, autoimmune conditions, etc.)?
Reference to those with rickets being only a very small proportion of those with a vitamin D deficiency?
Reference to authors' recommendation for people to exposure unprotected skin to sunlight for approx. 20-30 minutes, 3 times per week?
Reference to authors' calls for milk and some foods to be supplemented with vitamin D?
Reference to other risk factors/high risk groups identified by the authors (e.g. those with more skin pigmentation, those who use more sunscreen/concealing clothing, those who spend more time inside such as the elderly or institutionalised, etc.)?
Completeness score (out of 8)

Story 2
ID no.
At least one of the 7 charities/groups named?
All of the 7 charities/groups named?
Note that sunlight is the most important source of vitamin D production?
Identifying the high risk groups at risk of vitamin D deficiency?
Recommendations for vitamin D supplements for high risk groups stated?
References to the benefits of sunlight exposure for vitamin D production?
References to the risks of overexposure to sunlight re the risk of skin cancer?
Recommendation to regularly expose unprotected skin to midday sun for a few minutes noted?
Fortification/supplementation milk and food products not recommended as not sure about the effects of high vitamin D levels in blood (toxicity risk)?
Note that exposure to UVB produces vitamin D but soon plateaus - additional exposure does not lead to more vitamin D production, just DNA damage and risk of skin cancer?
Sunbeds: note that production of vitamin D plateaus rapidly, risk of DNA damage and skin cancer outweigh the benefits?
Inconclusive re whether vitamin D has a role in preventing/reducing the risk of other disease (cancers, MS, diabetes, etc)?
Completeness score (out of 12)

Story 3
ID no.
At least one of the authors named?
Research centre (s) named?
Journal named?
Refers to increase in risk with 'ever use' of sunbeds (20% increase)?

Refers to increase in risk if first sunbed use below age 35 (87% increase)?
Refers to increase in risk per sunbed session (1.8% increase)?
Refers to differences in number of cases and number of deaths between men and women?
Refers to authors' calls for tougher restrictions, especially restrictions on under-18s using sunbeds and ban on unsupervised tanning salons?
Completeness score (out of 8)

Story 4
ID no.
Journal named?
Explanation of what an SPF is (UVB)?
Explanation re star-rating for UVA?
Refers to thickness testing of SPFs and how this often differs in practice rendering sunscreen less effective than assumed?
Refers to costs/quantity associated with 2mg/cm thickness applied every 2 hours (as recommended by NICE) (need new 200ml bottle every 2-3 days)?
Suggestion that NICE recommendation re SPF15 is not necessarily the best advice?
Statement that NICE should change recommendation to a higher SPF?
Statement that sunscreen manufacturers could change their testing to reflect thickness applied by the public?
Advice re exposure of unprotected skin for 15 minutes 2-3 times per week in the UK from April to Sept for vitamin D synthesis (from evidence review, not the editorial)?
Refers to weak/equivocal evidence that sunscreen protects against basal cell cancer (BCC) and malignant melanoma (MM)?
Completeness score (out of 10)

APPENDIX D

Assessing accuracy of reporting for Q1

In developing the thematic framework for the documentary analysis, two members of the research team (NM and BB) read a number of papers reporting research and evaluation studies of the content of media stories and the accuracy of their reporting of science papers.

Paper:	**Approach:**	**Useful to analysing data for Q1**
LaFountain, C. (2004) "Health Risk Reporting", *Social Science and Public Policy*, Nov/Dec 2004: 49-56.	The paper is about what readers should ask when reading/evaluating a story about a new risk. It discusses/critiques press coverage of 3 stories but only refers to what the articles are missing (e.g. upper and lower bounds of the risk of X not reported), and whether external sources other than the report's authors were consulted about the results.	No. No methods, no coding frame or categorisation, not a scientific evaluation.
Stryker, J.E., Solky, B.A. and Emmons, K.M. (2005) "A content analysis of news coverage of skin cancer prevention and detection, 1979 to 2003", *Arch Dermatol.* 2005; 141: 491-496.	Newspaper articles were coded in terms of type of skin cancer discussed, presentation of risk information, and presentation of information related to skin cancer prevention, detection, diagnosis or treatment. Reports on the number of times prevention (e.g. sun avoidance) or detection or risk of skin cancer were mentioned in press reports.	No. The accuracy of media reports was not the focus of this study.
Mayer, B. (2012) "'Relax and take a deep breath': Print media coverage of asthma and air pollution in the United States", *Social Science and Medicine* 75 (2012) 892-900.	Coding frame developed from a review of medical and public health literature on environmental links to asthma. Ten codes, including relationship (e.g. causal), pollution source (e.g. indoor/outdoor), and certainty (e.g. validity). Identification of latent themes.	No. This paper is not about the accuracy of media reporting. Rather, it is focused on the media's reporting of the relationships between environment and health (air pollution and asthma) and the percentage of newspaper reports over time that discuss or infer that relationship.
Brechman, J., Lee, C. and Cappella, J.N. (2009) "Lost in translation? A comparison of cancer-genetics reporting in the press release and its subsequent coverage in the press", *Science Communication* Vol. 30, No.4, June 2009, 453-474.	Looking at whether inconsistencies in the reporting of scientific reports occur in the press release or subsequent news coverage. Does not look at the whole article, rather picks out central arguments/findings in the press report and news coverage and tries to match them to the press release, news coverage or original research report. Focuses on the role of the press release in the information transfer process. Coded by: presence or absence of qualifying information, over-interpretation of partial or preliminary findings, overgeneralisation or simplification, and contradiction. Found that	Possibly, as this paper is focused on the accuracy of reporting. For the Sunlight study we have the original research report, press release and subsequent newspaper articles. In consultation with NICE we decided to also analyse the accuracy and completeness of the reporting in the press release in addition to the news coverage to identify

Paper:	Approach:	Useful to analysing data for Q1
	information was altered or additional information contained in press release or in press coverage in 40% of cases. Concluded that some distortion in media coverage of science reporting is attributable to the press release.	the source of any inaccuracies.
Carsten, L.D. and Illman, D.L. (2002) "Perceptions of accuracy in science writing", *IEEE Transactions on Professional Communication*, vol. 45, no. 3, Sept 2002, 153-156.	Suggests a five category scheme for coding errors/ inaccuracies in representation of science/ technology in popular writing: (i) minor corrections (typos); (ii)objective technical errors (factual errors); (iii) subjective errors (changes in language and meaning); (iv) lack of completeness; and (v) style and usage.	Possibly, but Moyer et al (see below) more useful as has more (and more refined) categories which will allow for more detailed analysis.
Moyer, A., Greener, S., Beauvais, J. and Salovey, P. (1995) "Accuracy of health research reported in the popular press: Breast cancer and mammography", *Health Communication* 7 (2): 147-161.	Analysis of newspaper and magazine coverage of reports on breast cancer and mammography over a 2 year period. Evaluated (a) the adequacy of the information provided for locating the cited piece of research, and (b) the accuracy of the information conveyed about the research. Strict comparisons of research publications against the associated media coverage. Articles were selected if they pertained to (a) risk factors, or (b) prevention/early detection. Developed a coding frame containing ten types of coded error, plus noted 'blatant errors of fact'. May be multiple errors per article. Found more accurate reporting in newspapers compared to magazines. The study only included those articles where citations to particular studies were given and were accurate (53% of all articles). Articles where studies could not be identified may contain even more errors. The ten categories are: 1) Misleading title; 2) Shift in emphasis; 3) Treating speculation as fact; 4) Erroneous information; 5) Omitting other important results; 6) Omitting qualifications to findings; 7) Omitting important aspects of the research methods; 8) Over-generalising findings; 9) Inaccuracies due to obtaining information from personal communications; 10) Other miscellaneous inaccuracies.	Yes, highly relevant. Presents a relatively detailed coding frame/set of categories through which to record the different types of inaccuracies in media reports. This could be applied to press releases as well as to full newspaper articles. Category 9 is especially interesting as for one of the Q1 stories journalists picked up on a quote from the author (not from the study report) which was unqualified and potentially problematic.

As a result of this investigation, and with approval from NICE, the team adopted the strategy developed by Moyer et al (1995). The approach was successfully piloted for one of the Sunlight stories from Q1 prior to adoption.

The decision was taken to adapt Moyer's categorisation of 10 coding errors/inaccuracies to remove the tenth category. The tenth category, 'other miscellaneous inaccuracies', was defined by Moyer et al as general factual errors not related to the study. The review team unfortunately did not have the capacity to check the accuracy of anything other than the information given in the research paper. It was beyond the scope of the study to comment on the accuracy of additional information. Thus, the research team adopted categories one to nine from Moyer's list.

Accuracy assessment (Moyer et al. 1995)	
1. Misleading title (distorts/exaggerates meaning of the study)	
2. Shift in emphasis (more dramatic/optimistic, or risk is exaggerated)	
3. Treating speculation as fact	
4. Erroneous information (factual errors that distort the meaning)	
5. Omitting other important results (e.g. talks about the health benefits but not the risks)	
6. Omitting qualifications to findings (e.g. limited generalizability)	
7. Omitting important aspects of the research methods (integral to the study's meaning)	
8. Overgeneralising findings (generalising to a larger population than is reasonable)	
9. Inaccuracies due to obtaining information from personal communications	
Accuracy score (out of 9):	

Two columns per category were set up in Excel: one to record a 'yes' or 'no' answer, and one to allow the insertion of explanatory information if the response was 'yes'. The accuracy score was arrived at by counting up the number of 'no' responses as a 'no' response indicated that the information for a category was accurate.

APPENDIX E

Qualitative framework for analysing articles for Q1

Risk or benefit categorization	
Representation/discourse of risk or benefit	*Insert segments of text*
The opposite (ie risk or benefit) also presented?	*Y/N*
If yes, record what is presented	*Summarise relevant content*
Presentation of risk / benefit	
Types of risks / benefits presented	*Risk categories (can be extended)* *: sunburn* *: 'skin damage'* *: skin cancer* *: other melanomas* *: other skin conditions (specify)* *: age-related macular degeneration* *: other eye conditions (specify)* *Benefits (can be extended)* *: vitamin D* *: 'well-being'*
How is UV identified/referred to:	*Categories (can be added to)* *: sunlight* *:sunshine* *:UV* *:UVA* *:UVB* *:UVA and UVB* *:sunbed*
UVA/UVB distinguished?	*Y/N*
Words used to describe skin's exposure to sunlight / UV	*Insert segments of text*
Words used to indicate severity of risk	*Insert segments of text*
Any presentation of confusion re risks/benefits	*Y/N*
If yes, record reason for confusion	*Summarise, using segments to illustrate*
Any presentation of scepticism re risks/benefits	*Y/N*
If yes, record reason for scepticism	*Summarise, using segments to illustrate*
Specific groups/populations at particular risk	
Any reference to specific groups/populations	*Y/N*
If yes, how are groups/populations identified?	*Categories (can be extended)* *: men* *: redheads* *: fair skin* *: minority ethnic* *: family history of skin cancer*
Proportion of item devoted to specific group (s)	
Topic of text	*Category* *: description of risk /benefit* *: advice re UV protection*
Presentation of extent of additional risk	*Insert segments of text*
Advice re UV protection (note: this analysis will not examine the accuracy of advice)	
Nature of 'positive' advice	*Categories (can be extended)* *: sun protection (sunscreen)* *: sun protection (clothing)* *: sun protection (sunglasses)* *: sun avoidance* *: contact with GP*
Any text on limitations of protection?	*Y/N*
If yes, describe	*Summarise limitations (e.g. duration of effectiveness of sunscreen)*
Any text indicating other means of protection exist?	*Y/N*
Source of advice	Categories (can be extended) : *unspecified/journalist* : *researcher (study specified)* *: researcher (study unspecified)* *: individual clinician* *: individual other health professional*

	: representatives of 'campaign' organisation *: representative of professional organization* *: product manufacturer*
Any 'unhelpful' (i.e. counter to current evidence) advice	*Y/N*
If yes, record what is presented	*Insert segments of text*
Any presentation of journalist's intention to ignore current evidence / consensus statements	*Y/N*
If yes, record what is presented	*Insert segments of text*
Additional sources of information	
Does the item provide readers with sources of additional information?	Y/N
Nature of additional information source	*Categories (can be extended):* *: web address* *: helpline*
Type of information sources	*Categories (can be extended):* *: CRUK* *: NICE* *: campaign organization* *: product manufacturer* *: other*

APPENDIX F

The proportion of text relating to specific groups for Story 1

ID/Group	P.R.	298	299	302	303	304	305	306	307	194	198	201
Children	0.44	1.0	1.0	0.57	0.36	0.13	0.52	0.55	0.18	0.34	0.78	0.27
Adults	0.14	-	-	0.06	0.04	0.15	-	-	0.15	0.03	-	0.04
People in northern parts of UK	0	-	-	-	0.05	0.02	-	-	0.02	0.02	-	0.02
People in high risk groups	0.08	-	-	-	-	0.22	-	-	0.21	-	-	0.11
Those with bowel cancer	0	-	-	0.06	-	-	-	-	-	-	-	-

APPENDIX G

Qualitative framework for analysing articles for Q2

Ref No:	
Publication:	
Date:	
Edition:	
Word length:	
Section:	
Headline:	*Enter entire text*
Nature of article	*Categories (can be extended)* *: reporting research* *: product reviews* *: news story: celebrity* *:news story: public* *: opinion piece* *: other ….*
Risk or benefit categorisation	
Word count of text on risk or benefit	*Enter 'n' words*
Representation/discourse of risk or benefit	*Insert segments of text*
Risk or benefit main focus?	*Y/N*
If no, main topic	*Enter keywords*
The opposite (i.e. risk or benefit) also presented?	*Y/N*
If yes, record what is presented	*Summarise relevant content*
Source material	
Source material	*Categories (can be extended)* *: research studies (specified)* *: research studies (unspecified)* *: individual researchers* *: individual clinicians* *: representatives of 'campaign' organisation* *: representative of professional organization*
Primary source (based on word count)	
First source occurring	
Presentation of risk / benefit	
Types of risks / benefits presented	*Risk categories (can be extended)* *: sunburn* *: 'skin damage'* *: skin cancer* *: other melanomas* *: other skin conditions (specify)* *: age-related macular degeneration* *: other eye conditions (specify)* *Benefits (can be extended)* *: vitamin D* *: 'positive mood'*
How is UV identified/referred to:	*Categories (can be added to)* *: sunlight* *:sunshine* *:UV* *:UVA* *:UVB* *:UVA and UVB* *:sunbed*
UVA/UVB distinguished?	*Y/N*
Words used to describe skin's exposure to sunlight / UV	*Insert segments of text*
Words used to indicate severity of risk	*Insert segments of text*
Any presentation of confusion re risks/benefits	*Y/N*
If yes, record reason for confusion	*Summarise, using segments to illustrate*
Any presentation of scepticism re risks/benefits	*Y/N*
If yes, record reason for scepticism	*Summarise, using segments to illustrate*
Treatment of sunbathing/suntans	
Discourse/presentation of sunbathing	*Insert segments of text*

Discourse/presentation of suntan	*Insert segments of text*
Treatment of sunbeds/tanning salons	
Discourse/presentation of sunbeds	*Insert segments of text*
Discourse/presentation of tanning salons	*Insert segments of text*
Specific groups/populations at particular risk	
Any reference to specific groups/populations	*Y/N*
If yes, how are groups/populations identified?	*Categories (can be extended)* *: men* *: redheads* *: fair skin* *: minority ethnic* *: family history of skin cancer*
Proportion of item devoted to specific group (s)	
Topic of text	*Category* *: description of risk /benefit* *: advice re UV protection*
Presentation of extent of additional risk	*Insert segments of text*
Advice re UV protection	
NICE recommendation elements: coded as: 'in line with recommendations'; counter to NICE recommendations; not mentioned)	
Avoid getting sunburnt	
Avoid excess or prolonged sun exposure	
Shade between 11 and 3pm (regardless of location)	
Cover skin with clothing	
Sunscreens not an alternative to shade and clothing	
Need for UVA and UVB sunscreen identified	
UVB protection: SPF15	
UVA protection: 4 stars OR circle UVA logo	
Water resistant needed : sweating/water	
Application: 30 mins before	
Application: liberal	
Reapplication: at least every 2 hours	
Reapplication: after in water and/or towel drying	
Any text re other means of protection?	*Y/N*
If yes, describe	
Any text re feasibility of NICE recommendations?	Y/N
If yes, describe	Insert segments of text
Source of advice	Categories (can be extended) : *unspecified/journalist* : *researcher (study specified)* *: researcher (study unspecified)* *: individual clinician* *: individual other health professional* *: NICE recommendations* *: representatives of 'campaign' organisation* *: representative of professional organization* *: product manufacturer*
Additional sources of information	
Does the item provide readers with sources of additional information?	Y/N
Nature of additional information source	*Categories (can be extended):* *: web address* *: helpline*
Type of information sources	*Categories (can be extended):* *: CRUK* *: NICE recommendations* *: campaign organization* *: product manufacturer* *: other*

APPENDIX H

Bibliographic details of all newspaper articles analysed for Question Two

1. Sunshine vitamin knocks migraines on the head. Daily Mail 2013: 16 April; Nexis UK Database, Accessed 18 March 2014.
2. Sunshine vitamin may help irritable bowels. Daily Mail 2013: 30 April; Nexis UK Database, Accessed 18 March 2014.
3. Menace returns. Daily Mail 2013: 13 May; Nexis UK Database, Accessed 18 March 2014.
4. Children of six want a sun tan. Daily Mail 2013: 29 May; Nexis UK Database, Accessed 18 March 2014.
5. Factor 30 - even in the rain! How doctors protect their own families. Daily Mail 2013: 11 June; Nexis UK Database, Accessed 18 March 2014.
6. Our grey summer really may leave you under the weather. Daily Mail 2013: 22 June; Nexis UK Database, Accessed 18 March 2014.
7. Could this be the answer to sunburn? Daily Mail 2013: 7 August; Nexis UK Database, Accessed 18 March 2014.
8. 70% of sunbeds fail safety tests. Daily Mail 2013: 9 September; Nexis UK Database, Accessed 18 March 2014.
9. Catwalk ban on sunbed models. Daily Mail 2013: 10 October; Nexis UK Database, Accessed 18 March 2014.
10. Give snoring the boot with a stroll in the sun. Daily Mail 2013: 14 October; Nexis UK Database, Accessed 18 March 2014.
11. Ask Sarah. Daily Mail 2013: 14 December; Nexis UK Database, Accessed 18 March 2014.
12. Insider secrets. Good Housekeeping (UK) 2013: October; p.129-130. Nexis UK Database, Accessed 18 March 2014.
13. Sunbed warning after woman dies; In brief. The Daily Telegraph (Edition 2, National Edition). 2013: 7 November; p.19. Nexis UK Database, Accessed 18 March 2014.
14. Lack of sunshine is gloomy news for energy levels. The Daily Telegraph (National Edition). 2013: 22 June; p.13. Nexis UK Database, Accessed 18 March 2014.
15. How bad lifestyle can put 10 years on women's skin. The Daily Telegraph (Edition 1, National Edition). 2013: 5 June; p.3. Nexis UK Database, Accessed 18 March 2014.
16. Avoiding the sun could increase arthritis risk; In Brief. The Daily Telegraph (Edition 1, National Edition). 2013: 5 February; p.6. Nexis UK Database, Accessed 18 March 2014.
17. Insider beauty. The Sun (Edition 1, Northern Ireland). 2013: 29 December; p.37. Nexis UK Database, Accessed 18 March 2014.
18. Hugh Skin Cancer. The Sun (Edition 2. National Edition). 2013: 22 November; p.3. Nexis UK Database, Accessed 18 March 2014.
19. 'Sun risk' case lost. The Sun (Edition 1, National Edition). 2013: 4 November; p.11. Nexis UK Database, Accessed 18 March 2014.
20. Cancer Red Alert. The Sun (Edition 1, National Edition). 2013: 23 August; p.9. Nexis UK Database, Accessed 18 March 2014.
21. ….But don't forget the lotioln. The Sun (Edition 1, National Edition). 2013: 7 July; p.23. Nexis UK Database, Accessed 18 March 2014.
22. Don't forget the cream. The Sun (Edition 1, National Edition). 2013: 29 June; p.2. Nexis UK Database, Accessed 18 March 2014.
23. We put sun lotions to the SPF test. The Sun (Edition 1, National Edition). 2013: 27 June; p.4. Nexis UK Database, Accessed 18 March 2014.
24. Kids of 6 want tans. The Sun (Edition 1, National Edition). 2013: 29 May; p.23. Nexis UK Database, Accessed 18 March 2014.

25. D-light at free pills. The Sun (Edition 1, Scotland). 2013: 20 April; p.27. Nexis UK Database, Accessed 18 March 2014.
26. Celebrity health check. The Sun (Edition 1, National Edition). 2013: 28 February; p.6. Nexis UK Database, Accessed 18 March 2014.
27. Nigella's so hip. The Sun (Edition 1, National Edition). 2013: 25 February; p.4. Nexis UK Database, Accessed 18 March 2014.
28. Winter sun's a threat to skin. The Sun (Edition 1, National Edition). 2013: 30 January; p.33. Edition 1, National Edition.
29. Tan girl's burn hell. The Sun (Edition 1, National Edition). 2013: 30 January; p.9. Nexis UK Database, Accessed 18 March 2014.
30. Light there be sight. The Sun (Edition 1, National Edition). 2013: 17 January; p.11. Nexis UK Database, Accessed 18 March 2014.
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35. Bischoff V. How her skin cancer 'precaution' gave Jackie the disease. Daily Mail 2013: 21 May; Nexis UK Database, Accessed 18 March 2014.
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38. Bradshaw C. The paper and pencil cure for skin cancer. Daily Mail 2013: 8 September; Nexis UK Database, Accessed 18 March 2014.
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41. Cowen-Rivers S. Drivers warned to put on sun cream in car to cut risk of skin cancer. Daily Mail 2013: 31 July; Nexis UK Database, Accessed 18 March 2014.
42. Cox K. Experts see red as Kate promotes a healthy tan. Daily Mail 2013: 9 May; Nexis UK Database, Accessed 18 March 2014.
43. Craig A. It'll take more than vitamins to stop children getting rickets. The Daily Telegraph (Edition 1, National Edition). 2013: 25 October; p.28. The Daily Telegraph.
44. Daily Mail Reporter. Obesity and deadliest form of skin cancer have genetic link. Daily Mail 2013: 4 March; Nexis UK Database, Accessed 18 March 2014.
45. Daily Mail Reporter. Mum who paid fatal price. Daily Mail 2013: 30 March; Nexis UK Database, Accessed 18 March 2014.
46. Daily Mail Reporter. Call for social services to be alerted over sunburn. Daily Mail 2013: 22 July; Nexis UK Database, Accessed 18 March 2014.
47. Daily Mail Reporter. Skin cancer is 70% more deadly for men. Daily Mail 2013: 21 August; Nexis UK Database, Accessed 18 March 2014.

48. Daily Mail Reporter. Struck down. Daily Mail 2013: 13 May; Nexis UK Database, Accessed 18 March 2014.
49. Derbyshire D. Is there any point in buying factor 50? Daily Mail 2013: 18 July; Nexis UK Database, Accessed 18 March 2014.
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51. Donnelly C. How too much sun can give you skin cancer on your eyeball. Daily Mail 2013: 16 July; Nexis UK Database, Accessed 18 March 2014.
52. Donnelly L. Free vitamins 'will halt rickets return'. The Daily Telegraph (Edition 1, Scotland). 2013: 24 October; p.7. Nexis UK Database, Accessed 18 March 2014.
53. Dowden A. How to beat the vitamin d slump. Daily Mail 2013: 12 February; Nexis UK Database, Accessed 18 March 2014.
54. Earle C. How sun can give you eye cancer: as UK's summer soars towards 35 degrees we meet 3 women with sobering warning. The Sun (Edition 1, National Edition). 2013: 23 July; p.6. Nexis UK Database, Accessed 18 March 2014.
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