Sun safety in construction

Evaluation of a sun safety intervention for the UK construction sector

Report submitted to the IOSH Research Committee

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Abstract

Background and aims: The high incidence of skin cancer among construction workers in the UK and the preventability of the disease highlight a need for interventions to improve sun safety in the sector. This project had five aims. First, to review scientific knowledge and the legal position on sun safety in UK construction. The second and third aims concerned the development of a national profile of sun safety knowledge, attitudes and behaviours in UK construction and administration of a sector-specific sun safety intervention to a large sample of workers. The fourth aim was to evaluate the intervention in terms of its influence on sun safety knowledge, attitudes and behaviours. The final aim was to examine the views of construction workers and employers on barriers and facilitators to sun safety.
Method: A questionnaire that assessed sun safety risk, knowledge, attitudes, and occupational behaviours was administered to a large sample of construction workers from across the UK, range of trades, and company type and size in the summer of 2012. Workers were next administered an educational intervention - *Sun Safety in Construction* - a 12-minute DVD designed to increase sun safety knowledge, attitudes, and positive behaviours that was developed for the current project. To evaluate the efficacy of the intervention, at 12-month follow-up a questionnaire was sent to respondents that had provided a contact address on the baseline questionnaire. To address the fifth of the study aims a series of eight focus groups involving managers and workers (N = ~6 per group) was conducted in March 2013.
Results: 1,279 construction workers completed the baseline questionnaire. Respondents worked outside for an average of 6.7 hours per day, the majority had a high-risk skin type, and two-thirds indicated that they thought they were not at risk for skin cancer or did not know if they were at risk. Almost three quarters reported that they had never received occupational sun safety training. Use of sun safety measures was generally low. Eighteen per cent of participants returned a completed post-intervention questionnaire. The intervention group demonstrated positive change across a set of knowledge, attitude, and behaviour dimensions. On five (out of 10) behaviours the proportion of participants who typically used the measure when working outdoors in the summer increased by more than 20 percentage points. The control group generally showed little or no improvement. The focus groups showed that workers and managers did not consider sun safety an important issue, primarily owing to a perception that the UK climate generates little risk for skin cancer. The development of a sun safety culture was considered to be contingent upon the provision of appropriate measures (e.g., clothing and sunscreen) by the employer and enforcement of sun safety behaviours by employers and government.
Conclusions : Sun safety is generally poor across the UK construction sector. The *Sun Safety In Construction* intervention is effective in producing significant positive change in sun safety knowledge, attitudes and behaviours. Initiatives that combine employee-focused educational interventions in the context of an employer-led drive on the issue are likely to represent the most effective approach to the

development of a sun safety culture, particularly when underpinned by enforcement.

Executive Summary

Project Overview and Aims

The high incidence of skin cancer among construction workers in the UK and the potential preventability of the disease presents an imperative for the development and evaluation of interventions focused on improving sun safety in the sector. The research project described in this report represents a response to that imperative. With funding from the IOSH Research Fund the project set out to address five specific aims, each of which was addressed in a discrete project phase:

Project Phase 1: The first aim was to review scientific knowledge on the epidemiology of skin cancer; sun safety knowledge, attitudes, and behaviours; and sun safety interventions in the UK construction sector. In addition the review sought to establish the legal and policy imperatives for action on sun safety in construction.

Project Phase 2: The second aim was to profile sun safety knowledge, attitudes and behaviours among a large-scale representative sample of workers from the UK construction sector. This took place in the summer of 2012. This study had two key purposes. First, by profiling UK construction workers' sun safety knowledge, attitudes and behaviours we aimed to gather data that might inform the focus of future sector-specific interventions and the occupational health policy agenda. Second, the study provided a baseline (pre-intervention) sun safety profile against which to compare post-intervention knowledge, attitudes and behaviours, thereby permitting conclusions to be drawn on the extent to which exposure to an intervention might enhance sun safety.

Project Phase 3: The third aim was to administer a sector-specific sun safety intervention to a large-scale representative sample of workers from the UK construction sector. The intervention was developed specifically for this project and funded by a grant from the IOSH Development Fund that was awarded in March 2011. Administration of the intervention followed Project Phase 2 in the summer of 2012.

Project Phase 4: The fourth aim was to evaluate the intervention in terms of its influence on sun safety knowledge, attitudes and behaviours. This took place in the summer of 2013.

Project Phase 5: The final aim of the project was to examine the views of workers and employers on sun safety barriers and facilitators in the UK construction sector. This took place in the spring of 2013.

Review of knowledge on skin cancer and sun safety in UK construction (Project Phase 1)

- Construction workers in the UK are at increased risk for the development of skin cancer. Estimates based on 2005 cancer mortality data and 2004 cancer incidence data (GB only) indicate that 58% of occupational cancer deaths and 55% of occupational cancer registrations attributed to sun exposure involved construction workers. Reports submitted to the Occupational Disease Intelligence Network (ODIN) between 1996 and 2000 show that skin cancer accounted for 7% of diagnosed work-related disease among construction workers. Data contributed by clinical specialists, occupational physicians, and general practitioners to the Health and Occupation Reporting (THOR) network over the period 2002-2008 indicate that among skilled tradesmen exposure to solar UVR was the suspected cause in all but a single reported case of skin cancer.
- Knowledge on the use of sun safety measures in the UK construction sector is limited. One study from 2011 found a positive association between receipt of sun safety training and use of sun safety measures, suggesting that construction-specific sun safety training interventions hold the potential to lead to behavioural improvements. The study also found that the statistical majority of respondents typically used three specific sun safety measures when working outdoors in the summer: plentiful water intake, sunscreen, wearing of loose fitting long sleeved tops and trousers. Low-cost interventions such as safety helmet attachments that offer neck protection were rarely used.
- No research has examined the efficacy of sun safety interventions in UK construction.
- Legislation requires employers to assess and take reasonable steps to minimise risks to the health of employees arising out of their work. The relevant legislative instruments (Health and Safety at Work Act 1974, Management of Health and Safety at Work Regulations 1999, Construction [Design and Management] Regulations 2007) can be interpreted as having application to sun safety. The legislative framework is consistent with public health policy set out in the National Institute for Health and Care Excellence (2011) Public Health Guidance *Skin Cancer: Prevention, Using Public Information, Sun Protection Resources and Changes to the Environment*.

Profile of Sun Safety in UK Construction (Project Phase 2)

- 1,279 construction workers drawn from across the UK, a range of trades, and 22 companies completed a questionnaire in the summer of 2012. Following deletion of cases for which no information was given on hours spent working outdoors and those that indicated zero outdoor work analyses were conducted on a sample of 1,154 responses.
- Respondents worked outdoors for an average (mean) 6.7 hours on a typical working day.
- More than half of respondents (55%) were either ‘very pale’ or ‘fair/pale’, indicating that the majority was at high risk for development of skin cancer.
- The majority of respondents (59%) had experienced a sunburn within the last 12 months that remained red for a day or more.

- The majority of respondents (82%) had never had their skin checked by a health professional for signs of skin cancer. More than half (61%) indicated that within the last 12 months they had not checked areas of their body regularly exposed to the sun for moles or skin damage.
- 70% had never had training on the risks of working in the sun.
- Relatively few respondents - 34% - thought they were at risk of skin cancer and a similar proportion (39%) indicated that they did not know if they were at risk. Almost three quarters (70%) indicated that they like to have a tan.
- The majority of respondents failed to regularly use seven (from a list of 10) sun safety measures. The minority regularly used measures concerned with minimising direct exposure to UV rays through modifications to work organisation. For example, 21% regularly avoided or minimised their exposure to direct sunlight in the middle of the day; 13% regularly swapped jobs to reduce exposure to direct sunlight; and 24% regularly used a shade or cover when working outdoors in the sun. For clothing, 42% reported that they wore long-sleeved loose-fitting tops and trousers when working outdoors in the summer while 23% wore a safety helmet with neck protection. 88% did not regularly check the UV index forecast and 59% did not regularly check their skin for moles or unusual changes. The majority of respondents regularly used three measures: sunglasses (55%), sunscreen (57%), and plentiful water intake (86%).
- These findings point to an imperative for sun safety training that helps construction workers to understand the risk of skin cancer associated with outdoor work and empowers them to adopt risk-reduction measures.

Administration of a Sector-Specific Sun Safety Intervention (Project Phase 3)

- *Sun Safety in Construction: A Workplace Health Guidance Film* is a low-cost educational intervention based on a 12-minute DVD that addresses (i) the risk of skin cancer in the UK construction sector, (ii) sun safety behaviours that might be adopted on construction sites, and (iii) self-checking of skin for signs of skin cancer. The intervention was developed specifically for this project and funded by a grant from the IOSH Development Fund that was awarded in March 2011.
- Following administration of the baseline questionnaire (Project Phase 2) the DVD was shown to workers in 31 construction companies across the UK in the summer of 2012.

Evaluation of the Sun Safety in Construction Intervention (Project Phase 4)

- To evaluate the efficacy of the Sun Safety in Construction DVD in terms of its influence on sun safety knowledge, attitudes and behaviour a repeat administration of the questionnaire took place in the summer of 2013.
- One hundred and sixty construction workers completed the follow-up questionnaire (18% of those who had provided contact details on the baseline questionnaire). After deletion of non-valid cases analyses were conducted on an intervention group comprised of 70 workers and a control group of 50.

- The intervention group demonstrated positive change across a set of knowledge and attitude dimensions. The strongest positive change concerned knowledge of the need to wear sunscreen on a cloudy day (34 percentage point increase in correct knowledge). The second strongest positive change concerned the post-intervention fall in the proportion of respondents who indicated a desire a suntan (17 percentage point decrease in unhealthy attitude). The third strongest positive change concerned knowledge on the need to wear sunglasses to protect the eyes from the sun (13 percentage point increase in correct knowledge).
- Among intervention group participants positive changes were found across a set of 10 sun safety behaviours: On five of the 10 behaviours the proportion of participants who typically used the measure when working outdoors in the summer increased by more than 20 percentage points. Particularly strong results emerged in relation to:
    - Use of a shade/cover when working in the sun. At baseline one quarter (26%) of intervention group participants typically used the measure when working outdoors in the summer; post-intervention more than half of the group (59%) did so. In contrast, the control group showed no change between baseline and follow-up.
    - Use of a safety helmet with neck protection. At baseline one fifth (21%) of intervention group participants typically used the measure when working outdoors in the summer; post-intervention almost one-third (30%) of the group did so. The control group showed no change.
    - Wearing of sunglasses. At baseline half (50%) of intervention group participants typically used the measure when working outdoors in the summer; post-intervention almost three quarters (72%) of the group did so. The control group showed no change.
- More than nine out of 10 participants across the groups indicated that they would adhere to a site rule, if introduced, requiring use of sun safety measures, suggesting that enforcement of sun safety in the sector could prove effective.

Barriers and Facilitators of Sun Safety in UK Construction (Project Phase 5)

- Four focus groups involving managers and four involving workers (*N* = ~6 per group) were conducted in March 2013. The Theory of Planned Behavior was used as a guiding framework to understand barriers and facilitators of sun safety behaviour. This theory suggests that intention to perform a behaviour is informed by behavioural beliefs (i.e., appraisal of the behaviour as un/favourable), normative beliefs (i.e., perceived social pressure to perform the behaviour), and control beliefs (i.e., perceived ease of performing the behaviour).
- A range of attitudes and beliefs were identified as facilitators and barriers to sun safety in the sector. For attitudes, ambiguity over whether responsibility lies with the employer or employee, financial cost, and the perceived non-relevance of sun safety given the UK climate were viewed as potential barriers to the development of a sun safety culture. Social influences on sun safety included pressure from colleagues and the fashion for a tan. Legislation,

education of the workforce, and the widespread availability of sun safe clothing were viewed as key factors that might influence the development of a sun safety culture in UK construction.

Conclusions and Recommendations

- Despite the comparatively high incidence of skin cancer among construction workers in the UK and the potential preventability of the disease, sun safety knowledge, attitudes and behaviours are generally poor across the sector.
- The *Sun Safety In Construction* DVD-based intervention is effective in producing significant positive change in construction workers' sun safety knowledge, attitudes and behaviours.
- Interventions designed to stimulate positive change in sun safety in construction are likely to be effective but not wholly sufficient when applied in isolation. Initiatives that combine employee-focused educational interventions in the context of an employer-led drive on the issue are likely to represent the most effective approach, particularly where underpinned by enforcement.
- It is recommended that the *Sun Safety in Construction* film is made freely available online and that construction sector employers are encouraged to integrate the intervention into health and safety briefings. Sun safety interventions can take as much as two decades to produce a decline in skin cancer rates (Staples et al., 1998; 2006). Alongside the nationwide rollout and promotion of this intervention, and the prioritisation of sun safety within the UK occupational health research agenda, a concerted focus is required on research to address the development of efficacious interventions for other outdoor worker groups.

Chapter 1: Introduction

Project Overview and Aims

The high incidence of skin cancer among construction workers in the UK and the potential preventability of the disease presents an imperative for the development and evaluation of interventions focused on improving sun safety in the sector. In response, the research project described in this report was conducted over a two-year period between January 2012 and December 2013. Funding was received from the IOSH Research Fund. The project had five specific aims, each of which was addressed in a discrete project phase:

Project Phase 1: The first aim was to review scientific knowledge on the epidemiology of skin cancer; sun safety knowledge, attitudes, and behaviours; and sun safety interventions in the UK construction sector. In addition the review sought to establish the legal and policy imperatives for action on sun safety in the sector.

Project Phase 2: The second aim was to profile sun safety knowledge, attitudes and behaviours among a large-scale representative sample of workers from the UK construction sector. This took place in the summer of 2012. This study had two key purposes. First, by profiling UK construction workers' sun safety knowledge, attitudes and behaviours we aimed to produce important information that may inform the focus of future sector-specific interventions and the occupational health policy agenda. Second, the study provided a baseline (pre-intervention) sun safety profile against which to compare post-intervention knowledge, attitudes and behaviours, thereby permitting conclusions to be drawn on the extent to which exposure to a intervention may enhance sun safety.

Project Phase 3: The third aim was to administer a sector-specific sun safety intervention to a large-scale representative sample of workers from the UK construction sector. This followed Project Phase 2 in the summer of 2012. The intervention was developed by the current authors and funded by a grant from the IOSH Development Fund.

Project Phase 4: The fourth aim was to evaluate the intervention in terms of its influence on sun safety knowledge, attitudes and behaviours. This took place in the summer of 2013.

Project Phase 5: The final aim of the project was to examine the views of workers and employers on barriers and facilitators to sun safety in the UK construction sector. This took place in the spring of 2013.

Project Governance

A steering group comprised of academics with research interests in occupational health interventions and construction sector experts was appointed at the outset of the project to monitor and advise on progress. The group comprised:

- John Lacey – Past President, IOSH; Managing Director, LincSafe
- Mary Ogungbeje – Research and Development Advisor, Institution of Occupational Safety and Health
- Dr Raymond Randall – Senior Lecturer in Organisational Behaviour and Human Resource Management, Loughborough University
- Dr Ian Strudley – Head of Health Risk Management Unit, Construction Division, Health and Safety Executive
- Alex Wilson – Occupational Hygienist, Tata Group; Council Member, British Occupational Hygiene Society.

Technical guidance was provided by Professor David Gawkrodger, Consultant Dermatologist at the Royal Hallamshire Hospital Sheffield and Past President of the British Dermatological Association.

Chapter 2: Project Phase 1 – Literature Review

Phase 1 Overview

This chapter addresses the first aim of the project: to review scientific knowledge on UK construction sector skin cancer epidemiology; sun safety knowledge, attitudes, and behaviours; and sun safety interventions. In addition the review considers legal and policy imperatives for action on sun safety in the sector.

The review of the peer-reviewed scientific literature is presented in a narrative structure. Documents were identified through (a) the authors' and project steering group members' knowledge of the research area, (b) keyword and author searches in Google Scholar, (c) reference lists in identified articles, and (d) international skin cancer conference books of proceedings. The review is orientated towards the UK literature because the sun safety intervention at the centre of this research project was designed specifically for use in the UK construction context. Non-UK occupational sun safety literature has limited relevance to the current study owing to it being largely conducted (a) in countries (such as Australia and the USA) that experience climactic conditions dissimilar to those in the UK, (b) among occupational groups (such as lifeguards and ski instructors) that are likely to share limited socio-demographic characteristics with UK construction workers, and (c) in countries with an established sun safety culture.

Skin Cancer Epidemiology in the UK

Exposure to solar ultraviolet radiation (UVR) is the leading cause of skin cancer. It is estimated that worldwide UVR causes up to 65% of melanoma skin cancer (MSC) and 99% of non-melanoma skin cancers (NMSC), mostly basal cell cancer (BCC) and squamous cell cancer (SCC) (Armstrong, 2004). Studies have consistently found links between sun exposure, MSC, and NMSC (Berwick et al., 2009; Madan et al., 2010); whereas MSC and BCC tend to be associated with intermittent sun exposure, SCC is most strongly related to chronic exposure.

In the UK skin cancer is the most common type of cancer: almost 100,000 cases of NMSC and 12,818 cases of MSC were diagnosed in 2010 (Cancer Research UK, 2012). In the same year 2,749 people in the UK died from skin cancer, 80% of these from MSC (ibid). Cancer registration data for England indicate that in 2011 there were 5,440 melanoma skin cancer registrations among men and 5,681 among women (Office for National Statistics, 2013). These figures represent a rise in incidence of 56% for men and 38% for women since 2002 – changes that have been attributed to sun safety behaviours (Parkin, Mesher, & Sasieni, 2011). Non-melanoma skin cancers are excluded from ONS reports due to problems with under-registration owing to difficulties in accessing outpatient and general practitioner records. A systematic review of 75 studies conducted over a 50-year period across the globe indicated that the average incidence rate in England is 76 per 100,000 person-years

for BCC and 23 per 100,000 person-years for SCC. The review concluded that the UK incidence rate appears to be increasing at a faster rate than in the rest of Europe, possibly owing to increased sun seeking behaviour and improved surveillance (Lomas et al., (2012). Indeed, although skin cancer rates are around one-quarter of those in Australia, more Britons die of melanoma each year than in Australia (Cancer Research UK, 2009). This difference is possibly due to early detection and high awareness of sun protection strategies in Australia (Kemp, Eagle, & Verne, 2011).

Skin Cancer Epidemiology in the UK Construction Sector

Outdoor workers are at increased risk of skin cancer attributable to solar UVR compared with the rest of the working population, having an especially elevated risk of SCC owing to this type of cancer being most strongly related to chronic sun exposure (Lucas et al., 2006; Schmitt et al., 2011). Outdoor workers are also at increased risk of developing BCC (Bauer et al., 2011) and MSC (Beral et al., 1981; Vagero et al., 1986).

In the UK, reports submitted to the Occupational Disease Intelligence Network (ODIN) between 1996 and 2000 showed that skin cancer accounted for 7% of diagnosed work-related disease among construction workers (Chen et al., 2003). More recently, Rushton et al. (2010) estimated on the basis of 2005 cancer mortality data and 2004 cancer incidence data (GB only) that 58% of occupational cancer deaths and 55% of occupational cancer registrations attributed to sun exposure involved construction workers. Consistent with this, data contributed by clinical specialists, occupational physicians, and general practitioners to the Health and Occupation Reporting (THOR) network over the period 2002-2008 indicated that among skilled tradesmen exposure to solar UVR was the suspected causal exposure in all but a single reported case of skin cancer (Stocks et al., 2010). Further, the risk of skin cancer was found to be particularly high for roofers, painters and decorators, and labourers in the building and woodwork trades (Stocks et al., 2011).

Outdoor Workers' Sun Safety Behaviour

Throughout this report the terms 'sun safety measures' and 'sun safety behaviours' are used interchangeably to refer to actions that address (i) the protection of skin against sun exposure, (ii) the limitation of direct exposure to sunlight, (iii) detection activities (i.e., checking skin for unusual changes), and (iv) heat stress prevention strategies (i.e., plentiful water intake). Sun safety behaviour and its determinants have often been studied in the context of leisure-time pursuits. Hamilton et al. (2012), for example, surveyed 816 Australian adults and found that sun safety behaviours were determined by beliefs about ability to tan, friends' views, forgetfulness and inconvenience in regard to sun protection. Other studies have examined sun protective behaviours and their determinants among undergraduate students and a community sample in Australia (Borschmann, Lines, & Cottrell, 2012) and beach-goers in Sweden (Kristjansson et al., 2001). Fewer studies have examined outdoor workers' use of sun safety measures. Such studies have shown that, in general, manual outdoor workers tend to be poor at using sun safety measures. For example, a study of almost 2,000 Californian farmers found that only 6% of those surveyed used both sunscreen and a long-sleeved

top at least half of the time when working outdoors, and 69% reported that they never or rarely used sunscreen (Schenker et al., 2002). Similarly, Nahar and colleagues (2013) surveyed 109 landscapers in Mississippi and found that 51% never or rarely used sunscreen, 61% never or rarely wore a long-sleeved shirt, and 52% never or rarely wore a wide-brimmed hat. Reinau and colleagues' (2013) review of the literature published up to 2012 concluded that "reported sun-protective behaviours were largely inadequate, with many workers stating that they never or only rarely wore a long-sleeved shirt (50-80%), sun protective headgear (30-80%) and sunscreen (30-100%) while working in the sun" (p. 928).

Outdoor workers have also been found to be largely ignorant of the association between sun exposure and skin cancer and unreceptive to direction on behaviour modification. A qualitative study of farm workers in North Carolina found that while the majority of participants mentioned the immediate impact of sun exposure on the skin, only three interviewees mentioned the possibility of skin cancer as a long-term outcome (Acrury et al., 2006). Three quarters of respondents in a study of 495 US operating engineers indicated that they were not interested in receiving sun safety guidance (Duffy et al., 2012).

Construction Workers' Sun Safety Behaviour

Although a literature exists on the use of sun-protection behaviours among outdoor workers, particularly within the outdoor recreation industries in the USA and Australia, the possibility that sun protection attitudes may be occupation and location-specific renders it difficult to generalise the findings of such studies to the UK construction sector.

Studies beyond the UK have provided some insight into the extent to which construction workers typically use sun safety measures. However, these studies have taken place in Southern California, USA (Stepanski et al., 1998) and New Zealand (McCool et al., 2009; Reeder et al., 2013), locations that typically experience more intense and prolonged periods of sunshine than is the case in the UK and where, in consequence, attitudes towards sun protection might differ from those held in the UK. In addition, although New Zealand has a largely temperate climate, summer UVR exposure can be as much as 40% higher than that experienced at similar Northern Hemisphere latitudes such as Germany (Seckmeyer et al., 1992). Moreover, with one exception these studies involved samples of fewer than 100 participants, further limiting their generalizability. Two further studies can be identified that involved the collection of data through observation rather than self-report. These involved construction workers in Australia (Gies & Wright, 2003) and Georgia, USA (Parrott et al., 1996). Both attract the aforementioned limitation on generalisability to the UK construction context.

Only one study has examined the use of sun safety measures in the UK construction sector. Madgwick, Houdmont, and Randall (2011) found a positive association between receipt of sun safety training and use of sun safety measures in a sample of 360 workers, suggesting that construction-specific sun safety training interventions might hold the potential to lead to behavioural improvements.

The study also found that the statistical majority of respondents typically used three specific sun safety measures when working outdoors in the summer: plentiful water intake, sunscreen, wearing of loose fitting long sleeved tops and trousers. Importantly, a number of low-cost interventions, such as safety helmet attachments that offer neck protection, were rarely used. In this respect the findings were consistent with those of studies concerning other types of outdoor worker that have shown this broadly defined group to be particularly poor at using sun safety measures.

Sun Safety Interventions for Outdoor Workers

Numerous studies have reported on sun safety intervention evaluations targeted at groups such as school children (Gilaberte et al., 2008; Reeder, Jopson, & Gray, 2012), the general public (Craciun et al., 2012), beach users (Weinstock et al., 2002), public pool users as well as those in the outdoor recreation industries such as lifeguards and ski instructors (for a review see Glanz, Buller, & Saraiya, 2007). Fewer have examined the efficacy of sun safety interventions targeted at manual outdoor workers. This is perhaps surprising given that the findings of intervention studies suggest that four out of five skin cancers could be prevented by minimising exposure to UVR and sunburn (Baum & Cohen, 1998; Lens & Dawes, 2004; Myers & Horswill, 2006). To the best of our knowledge only one study has evaluated the efficacy of a sun safety intervention in a group of outdoor workers that in terms of demographic characteristics might share key features with construction workers. Girgis and colleagues (Girgis et al., 1994) administered a sun safety intervention to 65 outdoor workers employed by an electrical supply company in Australia. The work of these employees involved digging trenches; lopping trees; erecting, treating and maintaining electricity poles; and reading meters door to door. The intervention consisted of (a) a skin check by a dermatologist and (b) a 30-minute lecture on skin cancer risk and sun safety measures that might be reasonably applied when working outdoors. Results showed that the number of workers who reported using a high level of sun protection post-intervention was 16% higher than pre-intervention, whereas no difference was found for control group participants (n = 77). Both groups showed improvements in sun safety knowledge, though the improvement was greatest in the intervention group; neither group showed any improvement in sun safety attitudes.

Sun Safety Interventions for the UK Construction Sector

The evidence to show that construction workers in the UK are at elevated risk of skin cancer, allied with evidence to support the efficacy of sun safety interventions for outdoor workers, might reasonably be expected to have stimulated the development of sector-specific interventions to promote workers' use of sun safety measures. It is surprising therefore that no studies have reported on the development or evaluation of UK construction-specific sun-safety interventions.

Financial, Policy, and Legal Drivers of Sun Safety in UK Construction

Financial Imperatives

Skin cancer presents a substantial financial burden to the taxpayer. Estimates for England for 2008 place the cost to the NHS at £106-£112 million. The cost per case of malignant melanoma is

estimated to be £2,560-£2,607, while the cost per case of non-melanoma skin cancer is £889-£1,226 (Vallejo-Torres et al., 2013). On the basis of the current incidence trajectory it is estimated that by 2020 the cost to the NHS will exceed £180 million (ibid).

Policy Imperatives

In the UK there is a strong policy imperative for sun safety promotion activities. In January 2011 the National Institute for Health and Care Excellence (NICE) published Public Health Guidance PH32 '*Skin Cancer: Prevention, Using Public Information, Sun Protection Resources and Changes to the Environment'* for the attention of all parties with a role in preventing skin cancer. This guidance document made six broad recommendations, all of which are addressed in the current project:

> "The six recommendations aim to raise and maintain awareness – and increase knowledge – of the risks of exposure to natural and artificial ultraviolet (UV). They also aim to influence attitudes and prompt people to change their behaviour to protect themselves against skin cancer. They focus on:

1. National mass-media campaigns and the provision of local information (including verbal advice and printed and visual material).
2. Developing and evaluating information campaigns and interventions.
3. The factual content of information
4. The tone of messages and how to tailor them for specific audiences.
5. The workplace – to help protect children, young people and outdoor workers.
6. The provision of shade as part of the design of new buildings."

Legal Imperatives

Three legislative instruments can be interpreted as having application to sun safety in UK construction. Under the Health and Safety at Work Act 1974, UK employers are required to assess health and safety risks within their workplaces and ameliorate these risk factors. This piece of primary legislation effectively requires employers "to do whatever is necessary subject to the qualification of 'reasonably practicable' - to make sure that the employee suffers no detriment to their health, safety or welfare by the mere fact that they have been employed by the particular employer" (Humphreys, 2007).

The Management of Health and Safety at Work Regulations 1999 represent secondary legislation relating to occupational safety and health. This statutory instrument originally came into force in 1993 as the principal method of implementing the European Framework Directive (89/391/EEC). The regulations are notable for their emphasis on risk assessment and, by extension, the prevention of illness and injury. Indeed, the Regulations are unambiguous in regard to an employer's duty to assess "the risks to the health and safety of his employees to which they are exposed whilst they are at work" (Section 3). The Health and Safety Executive's Approved Code of Practice and Guidance (HSE, 2000) that accompanies the Regulations makes clear that risk assessments should encompass a wide range of hazards: "a hazard is something with the potential to cause harm (this can include

articles, substances, plant or machines, methods of work, the working environment and other aspects of work organisation)" (p. 12). The Approved Code of Practice and Guidance that accompanies each Regulation is an important piece of quasi-legislation in its own right. "Failure to comply with the provisions of an ACOP may be taken by a court in criminal proceedings as evidence of a failure to comply with the requirements of the Act or of regulations to which the ACOP relates, unless it can be shown that those requirements were complied with in some other equally effective way. ACOPs (which can be updated more easily) provide flexibility to cope with innovation and technological change without a lowering of standards (p. 14)" (HSE, 2009). On this basis it is technically possible for an employer to be prosecuted for failing to adequately risk assess for sun exposure.

Further legal imperative for the promotion of sun safety can be found in construction-specific legislation. The Construction (Design and Management) Regulations 2007 state that:

- Every place of work shall, so far as is reasonably practicable, be made and kept safe for, and without risks to health to, any person at work there. (Regulation 26, 2)
- Every place of work outdoors shall, where necessary to ensure the health and safety of persons at work there, be so arranged that, so far as is reasonably practicable and having regard to the purpose for which that place is used and any protective clothing or work equipment provided for the use of any person at work there, it provides protection from adverse weather. (Regulation 43, 2).

Chapter 3: Project Phase 2 - Research Methodology

Phase 2 Overview

Phase 2 addressed the second aim of the project: to generate a profile of sun safety knowledge, attitudes and behaviours based on a large-scale representative sample of workers drawn from the UK construction sector. This project phase had two key purposes. First, by profiling UK construction workers' sun safety knowledge, attitudes and behaviours the study sought to produce data that might inform the focus of future sector-specific interventions and the occupational health policy agenda. Second, the study provided a baseline (pre-intervention) sun safety profile against which to compare post-intervention knowledge, attitudes and behaviours, thereby permitting conclusions to be drawn on the extent to which exposure to the intervention might enhance sun safety.

Sampling

Participants were sampled from across the UK construction sector. A geographically diverse sample was sought due to differences in typical sunlight hours across the UK. Furthermore, in view of empirically demonstrated differences in sunburn reporting procedures and policies by size of construction company (Pritchard & Dixon, 2008) efforts were made to sample by size of organisation. Between January and March 2012 the research team invited 107 companies to participate in the study. The majority of these companies were identified through the personal contacts of the research team and the project steering group. A member of the research team made initial contact with each company via telephone or email. Advertisements were also placed in Safety and Health Practitioner magazine and a series of presentations was used to generate interest. Six key presentations were given:

- CONIAC (Construction Industry Advisory Committee Health Risks Working Group)
- Crossrail project health and safety managers and contractors
- Health and Safety Group of the House Builders Federation
- 'Preventing Occupational Disease in Construction' training course for Health and Safety Executive construction inspectors (x2)
- British Occupational Hygiene Society 2012 Annual Conference

Organisations that expressed an interest in participation were asked to complete an 'intention to participate' form that detailed the approximate number and type of workers to which they would be able to administer the questionnaire within the survey administration window (May – August 2012). The form enabled organisations to indicate their preferred method of questionnaire administration (online / hard copy; supplied by the researchers / printed by the organisation). Close contact was maintained with each of the 38 organisations that returned a completed intention to participate form in order to maximise the likelihood of delivery on the agreement. These companies employed between

10 and 66,000 direct employees (mean = 4,729). Most operated nationwide with the minority of organisations operating on a regional basis.

Procedure

Questionnaires were administered in each participating organisation within a four-month administration window of May to August 2012. A project champion in each organisation distributed questionnaires to workers. Questionnaires were distributed in each organisation on a single day to all workers that the project champion was able to access on that day. Questionnaire completion and return was incentivised by a prize draw to win a sports car driving day. It was anticipated that this particular prize would appeal to construction workers given that monetary incentives have been shown to more than double response rates (Edwards et al., 2002). A stamped addressed envelope was provided with each questionnaire for participants to return completed questionnaires directly to the research team. The questionnaire also contained a hyperlink to an electronic version of the survey that participants were invited to use as an alternative to the paper-based form should they prefer. Only four online questionnaires were completed, representing just 0.3% of total responses.

Ethics

Ethical approval was granted by the Research Ethics Committee of the Institute of Work, Health and Organisations at the University of Nottingham and the research followed the British Psychological Society's (2009) code of ethics and conduct.

Approach to Measurement

Data collection was by self-report questionnaire. This method has been used in most sun safety behaviour studies (Glanz & Mayer, 2005) and can be justified on the basis that studies that have applied both observation and self-report methods to the assessment of sun safety behaviours have typically found a high degree of concordance between the two (Glanz et al., 2010; Oh et al., 2004).

Questionnaire Development

Care was taken to ensure that where applicable questionnaire items were consistent with those used in a pilot study (Madgwick, Houdmont, & Randall, 2011) so as to facilitate cross-study comparisons. In addition, several questionnaire items were informed by the outcomes of a large-scale collaborative project that sought to develop a standardised set of core questions on sun exposure and sun protection habits, the use of which in future studies could usefully facilitate cross-study comparisons (Glanz et al. (2008). Since publication in 2008 this set of core questions has been used in several sun safety studies (e.g., Williams, Jones, Caputi, & Iverson, 2012). On the basis of Glanz and colleagues' assertion that "a central concern in monitoring progress and summarizing the evidence for effective prevention strategies with broad applicability is the comparability of assessments across population-based surveys and outcome measures used in intervention research" (p. 218), it was deemed

appropriate to adopt their core set of questions where appropriate, and in doing so to contribute to the creation of a methodologically-consistent knowledge base.

The questionnaire was designed to explore respondents' sun safety knowledge, attitudes and worksite behaviours. Given that questionnaire length is inversely associated with response rate in occupational health studies (Edwards et al., 2002; 2004), the questionnaire was limited to two sides of A4. The questionnaire was piloted with 10 construction workers to check for clarity of meaning and to establish the time required for completion.

Socio-demographic Characteristics

Socio-demographic characteristics included age, gender, and geographical location within the UK.

Skin Type

Skin type was assessed because it is associated with skin cancer risk (Dubin, Pasternack, & Moseson, 1990) and may be associated with sunburn experiences as well as the use of sun safety measures (Duffy et al., 2012). The 'Skindex' categorical system developed by the British Association of Dermatologists (2013) was used. Respondents indicated which of six skin types most closely represented their skin: very pale, fair/pale, fair/beige, olive/light brown, dark brown, or black.

Occupational factors

In order to establish the amount of time spent working outdoors an adapted version of the single item developed by Glanz et al. (2008) for use in skin cancer research was applied: '*In the summer, on average, how many hours per day do you work outdoors?*' In response to findings from the pilot study (Madgwick et al., 2011) which showed that receipt of sun safety training was associated with use of sun safety measures, an item (with additional follow-up item) was included to examine whether employer-provided sun safety training had been received:

(i) Has your employer ever provided you with sun safety training?
   a. If yes, was this within the last 12 months?

Sunburn experience

Sunburn experience was examined because a history of severe sunburn is associated with increased risk of skin cancer (Dubin, Pasternack, & Moseson, 1990). Sunburn was measured using a single item: *"In the last 12 months how many times have you had a red sunburn that lasted a day or more?"*

Skin cancer experience

Personal experience of skin cancer and experience of a close relative or friend having skin cancer was measured using two items:

- Have you ever had skin cancer?
- Has a close friend or family member had skin cancer?

Previous studies have sought to introduce a degree of consistency in responses regarding the meaning of 'close relative' through reference to, for example, 'first degree relative' (see, for example, Patel et al. 2010). The research team felt, however, it was possible that a substantial number of respondents in the current study might not understand what is meant by this term. Furthermore, the biological proximity of two related individuals does not necessarily correspond with feelings of 'closeness' and it can be hypothesised that emotional rather than biological closeness to a relative who has experienced skin cancer is likely to be a stronger influence on the respondent's sun safety behaviours; thus, the term 'family member' was used.

Sun safety knowledge and attitudes

These were measured using a set of seven statements adapted from Patel et al.'s (2010) study of sun safety knowledge and attitudes among students. Respondents indicated whether or not they agreed with each statement on a 3-point scale of agree, disagree, don't know. The seven items were:

- I don't need to wear sunscreen on a cloudy/overcast day
- It is important to wear sunglasses to protect the eyes from the sun
- Sun exposure is the most important risk factor for skin cancer
- If I apply factor 30 sun screen I need only apply it once per day
- I like to have a suntan
- I think I am at risk of skin cancer
- Sun protection is important when working outside for less than one hour

Skin checking

Despite the high incidence of skin cancer, survival rates for men of working age are high. UK data for the period 2005-2009 indicate a malignant melanoma five-year survival rate of 89.8% (for those aged15-39 years), dropping to 85.8% for men aged 50-59 (Cancer Research UK, 2012). That survival is in part dependent on early diagnosis highlights the importance of self-checking for signs of skin cancer. Skin checking was measured using adapted versions of the core items developed by Glanz et al. (2008) for use in skin cancer research. Two primary questions and one follow-on question were applied:

(i) Have you ever had your skin checked for skin cancer by a health professional?

(ii) In the last 12 months have you examined your entire body for skin cancer?

   a. If yes, how many times?

Sun Safety Behaviours

Workers' use of a set of 10 sun protection and exposure-reduction measures was assessed. These measures were identified in a literature review on the primary sun safety measures typically available to outdoor workers (Young, 2009) and adapted for use in the pilot study (Madgwick, Houdmont, & Randall, 2011). The ten measures were (i) drink plenty of water, (ii), wear sunscreen, (iii) wear long sleeved loose fitting tops, (iv) wear sunglasses, (v) avoid direct sunlight during the middle of the day, (vi) wear a wide brimmed hat with neck protection, (vii) rotate jobs to minimise sunlight, (viii) erect a

cover to shade the work area, (ix) check the UV index for the day, and (x) regularly check skin for moles or unusual changes.

Use of these measures was assessed in accordance with the Transtheoretical Model (TTM) of behaviour change (Prochaska & DiClemente, 1984). Since its inception this model has guided a considerable amount of research that has examined workers' behavioural changes and in recent times it has informed the design and evaluation of several sun safety interventions (e.g., Craciun, Schüz, Lippke, & Schwarzer, 2012; Pagoto, McChargue, & Fuchua, 2003; Weinstick et al., 2002) and studies that have profiled sun safety (Borschmann, Lines, & Cottrell, 2012; Kristjansson, et al., 2001). The core of the TTM is notion that individuals pass through stages of change in respect to a particular behaviour:

1. Pre-contemplation - *people who are not thinking about performing the health behaviour in question and who may not be sufficiently aware that their current behaviour is risky.*
2. Contemplation - *people who have begun to think seriously about their behaviour, but have yet to act.*
3. Preparation - *people who are preparing themselves for health behaviour change in the near future (i.e., within the next month).*
4. Action - *people who have successfully and consistently performed the health behaviour in question.*
5. Maintenance – *people who have remained in the action stage for an extended period.*

The item response format was informed by Arden and Armitage's (2010) study of adolescents' condom carrying behaviour. Respondents were asked to indicate which of five statements best described their usual behaviour in relation to each sun safety behaviour. The five response options were (i) I do not do this and I am not thinking about starting, (ii) I do not do this but I am thinking about starting, (iii) I do not do this but am planning to start in the next month, (iv) I do this but have only begun to do so this year, and (iv) I do this and have done so for more than a year. The validity of the use of a single-item to assess stage of change in relation to sun safety measures has previously been demonstrated (Kristjansson, et al., 2001).

Contact details

At the end of the questionnaire respondents were invited to give contact details should they wish to be entered into the prize draw and receive a post-intervention questionnaire.

Chapter 4: Project Phase 2 – Results and Discussion

Response Rate and Respondent Characteristics

A total of 1,279 questionnaires were returned. Following deletion of cases for which no information was given on hours spent working outdoors (*n* = 29) and those that indicated zero outdoor work (*n* = 96), analyses were conducted on a final sample of 1,154 responses. The socio-demographic and occupational characteristics of this sample are shown in Table 1. Responses were drawn from across the UK, trades, and companies (*N* = 22), suggesting that the sample was broadly representative of the UK construction sector.

Table 1: Baseline Survey Respondents' Socio-demographic and Occupational Characteristics

	N (%)		*N* (%)
Socio-demographic characteristics			
Gender		Location	
Male	1,119 (97.0)	South East	158 (13.7)
Female	29 (2.5)	London	89 (7.7)
Not specified	6 (0.5)	South West	34 (2.9)
Age		East Anglia	46 (4.0)
≤20	68 (5.9)	Midlands	228 (19.8)
21-30	284 (24.6)	North	169 (14.6)
31-40	257 (22.3)	North East	140 (12.1)
41-50	268 (23.2)	North West	130 (11.3)
51-60	176 (15.3)	Scotland	85 (7.4)
≥61	36 (3.1)	Wales	25 (2.2)
Not specified	65 (5.6)	Northern Ireland	29 (2.5)
		Not specified	21(1.8)
Occupational characteristics			
Job Type			
Apprentice	36 (3.1)	Plant/Machine operator	41 (3.6)
Asbestos remover	3 (<1.0)	Plasterer	22 (1.9)
Banksman	6 (<1.0)	Plater	1 (<1.0)
Bricklayer	99 (8.6)	Rigger	3 (<1.0)
Civil engineer	12 (1.0)	Roofer	16 (1.4)
Cladder	12 (1.0)	Scaffolder	45 (3.9)
Customer care	9 (<1.0)	Snr Construction Manager	24 (2.1)
Diamond driller	7 (<1.0)	Sign maker/fitter	16 (1.4)
Electrician	78 (6.8)	Site engineer	33 (2.9)
Fence erector	2 (<1.0)	Site foreman	19 (1.6)
Fireproofer	3 (<1.0)	Site office staff	55 (4.8)
Fork lift driver	33 (2.9)	Site manager	60 (5.2)
Ground worker	115 (10.0)	Site supervisor	31 (2.7)
Health and safety professional	20 (1.7)	Steel fixer	26 (2.6)
Insulator	2 (<1.0)	Storeman	4 (<1.0)
Joiner	120 (10.4)	Teacher / instructor	1 (<1.0)
Labourer	100 (8.7)	Tiler	1 (<1.0)
Lift engineer	9 (<1.0)	Traffic management	4 (<1.0)
Mech Tech / Plumber	49 (4.2)	Welder	5 (<1.0)

Painter	15 (1.3)	Window fitter	8 (<1.0)
Plant fitter	2 (<1.0)	Not specified	7 (<1.0)

The researchers considered the securing of a sample in excess of 1,000 participants to be a considerable achievement given that the summer of 2012 - the period during which data collection took place - was the wettest on record in the UK since records began in 1910[1] and in terms of hours of sunshine the second dullest since 1910[2]. In the face of incessant rain and an absence of sunshine the perceived relevance of the project to employers and managers was inevitably low. As a result it proved extremely difficult to secure the active participation of those organisations that earlier in the year had expressed their intent to participate. Furthermore, many of the organisations that did participate appeared to do so reluctantly out of a feeling of obligation rather than in response to a perceived imperative for the research.

Hours Worked Outdoors

Among the 1,154 respondents who indicated that their work involves outdoor activity the mean time spent working outdoors on a typical working day was 6.7 hours (*SD* = 3.1). This finding was consistent with the mean of 6.6 hours found in the pilot study (Madgwick, Houdmont, & Randall, 2011). The distribution of hours worked outdoors was skewed; the majority of respondents worked outdoors for approximately eight hours per day (median = 8.0 hours; mode = 8.0 hours).

Skin Type

Skin type frequencies are shown in Table 2. More than half of respondents were either 'very pale' or 'fair/pale', indicating that the majority of respondents were at high risk for development of skin cancer.

Table 2: Baseline Survey Respondents' Skin Type

	N (%)
Very pale	86 (7.6)
Fair/pale	536 (47.2)
Fair/beige	275 (24.2)
Olive/light brown	185 (16.3)
Dark brown	42 (3.7)
Black	12 (1.1)

There is sometimes an assumption that outdoor workers typically have a skin type that can cope better with solar radiation (Reinau et al., 2013). However, in their systematic review of the literature on sun safety among outdoor workers, Reinau and colleagues showed that although multiple US studies found that construction workers (mostly Latinos) had low sun sensitivity, this was not generally the

[1] BBC (2012, 29 June). *Rainy weather breaks UK record for three months to June*. Retrieved from http://www.bbc.co.uk/news/uk-18653274

[2] BBC (2012, 2 July). *Wettest June on record Met Office figures show*. Retrieved from http://www.bbc.co.uk/news/uk-18678659

case. The current study similarly debunks the myth by showing that within the UK construction sector individuals with high UV radiation sensitivity constitute the majority.

Sunburn Experience

Data on sunburn experience are shown in Table 3. Fewer than half of respondents had not experienced a sunburn that remained red for a day or more within the last 12 months.

Table 3: Baseline Survey Respondents' Sunburn Experience

In the last 12 months how many times have you had a red sunburn that lasted a day or more?	N (%)
0	426 (40.8)
1	291 (27.8)
2	174 (16.7)
3	77 (7.4)
4	28 (2.7)
5	49 (4.7)

This finding is consistent with Reinau et al.'s (2013) review of the literature which found that across nine occupational sun safety studies that reported data on sunburn experience between 50% and 80% of outdoor workers had been sunburned in the year (or season) prior to data collection.

Skin Checking

Table 4 presents findings on skin checking. The vast majority of respondents – four out of five – indicated that they had never had their skin checked by a health professional for signs of skin cancer. Three quarters of respondents indicated that within the last 12 months they had not checked their entire body for moles or skin damage. More than half indicated that they had not checked areas of their body regularly exposed to the sun within the last 12 months.

Table 4: Baseline Survey Respondents' Skin Checking Activities

	N (%)
Have you ever had your skin checked by a health professional?	
Yes	209 (18.2)
No	941 (81.8)
In the last 12 months have you checked your whole body for moles or skin changes?	
Yes	298 (26.6)
No	824 (73.4)
In the last 12 months have you checked areas of your body regularly exposed to the sun for moles or skin changes?	
Yes	419 (39.5)
No	643 (60.5)

Skin Cancer Experience

Table 5 presents findings on skin cancer experience. Ninety nine per cent of respondents indicated that they had not had skin cancer. Approximately one in seven respondents indicated that a family member or close friend had had skin cancer.

Table 5: Baseline Survey Respondents' Skin Cancer Experience

	N (%)
Have you had skin cancer?	
Yes	11 (1.0)
No	1134 (99.0)
Have any members of your family or close friends had skin cancer?	
Yes	175 (15.3)
No	968 (84.7)

Sun Safety Training and Sunscreen Provision

Table 6 shows findings on sun safety training and sunscreen provision by employers. More than half of respondents indicated that sunscreen was supplied in their place of work and almost three quarters indicted that they had never had sun safety training.

Table 6: Baseline Survey Respondents' Occupational Sunscreen Provision and Sun Safety Training

	N (%)
Is sunscreen supplied in your workplace?	
Yes	664 (60.7)
No	429 (39.2)
Have you ever had training on the risks of working in the sun?	
Yes	341 (29.6)
No	810 (70.4)

Sun Safety Knowledge and Attitudes

Table 7 details findings on sun safety knowledge and attitudes. Relatively few respondents – one third - thought they were at risk of skin cancer and a further one third indicated that they did not know if they were at risk. Almost three quarters indicated that they like to have a tan. There was good awareness of sun exposure being the most important risk factor for skin cancer and the importance of wearing sunglasses to protect the eyes. In addition, only one in 10 respondents incorrectly indicated the belief that factor 30 sunscreen need only be applied once per day when working outdoors, and most respondents indicated the belief that sunscreen should be applied even when working outdoors for less than an hour.

Table 7: Baseline Survey Respondents' Sun Safety Knowledge and Attitudes

	N (%)
I don’t need to wear sunscreen on a cloudy/overcast day	
Agree	465 (41.0)
Disagree	527 (46.5)
Don’t know	142 (12.5)
It is important to wear sunglasses to protect the eyes from the sun	
Agree	963 (84.7)
Disagree	72 (6.3)
Don’t know	102 (9.0)
Sun exposure is the most important risk factor for skin cancer	
Agree	962 (85.1)
Disagree	31 (2.7)

Don't know	138 (12.2)
If I apply factor 30 sun screen I need only apply it once per day	
Agree	122 (10.8)
Disagree	730 (64.8)
Don't know	274 (24.3)
I like to have a suntan	
Agree	787 (70.1)
Disagree	248 (22.1)
Don't know	87 (7.8)
I think I am at risk of skin cancer	
Agree	379 (33.6)
Disagree	314 (27.8)
Don't know	435 (38.6)
Sun protection is important when working outside for less than one hour	
Agree	749 (66.2)
Disagree	178 (15.7)
Don't know	204 (18.0)

Sixty six per cent of respondents indicated that they were either not at risk or they did not know if they were at risk for skin cancer. This is of concern given that respondents worked outdoors for an average of almost seven hours per day and the majority were of a high-risk skin type. Nevertheless, the finding is consistent with that found in previous studies. Reinau et al.'s (2013) review of the literature found that across nine occupational sun safety studies that reported data on knowledge of solar UV radiation risk awareness was generally poor. The exception was construction workers in Australia - a country at the forefront of sun safety promotion – who were found to be mostly familiar with the facts surrounding skin cancer.

It is also noteworthy that 70% of respondents indicated that they like to have a suntan. This is consistent with the five previous studies that have posed a similar question to outdoor workers (not necessarily construction workers) (Reinau et al., 2013), and the 'suntan culture' that exists within construction (Cioffi, Wilkes, & Hartcher-O'Brien, 2003).

Table 8 presents sun safety knowledge and attitudes by skin type. For sun safety attitudes, skin type was related to desire to have a tan, with a smaller proportion of those with pale skin types desiring a tan than those with darker skin types. For sun safety knowledge, a greater proportion of those with pale skin types considered that they were at risk of skin cancer than those with darker skin types. Similarly, those with pale skin types were more likely than those of darker skin type to agree that sun protection is required when working outdoors for less than an hour.

Table 8: Baseline Survey Respondents' Sun Safety Knowledge and Attitudes By Skin Type

	Very Pale	Fair/ Pale	Fair/ Beige	Olive/ Light Brown	Dark Brown	Black
	N (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)	*N* (%)
I don't need to wear sunscreen on a cloudy/overcast day						
Agree	34 (41.5)	207 (39.1)	105 (38.6)	87 (47.3)	18 (43.9)	7 (70.0)

Disagree	36 (43.9)	259 (48.9)	134 (49.3)	75 (40.8)	15 (36.6)	2 (20.0)
Don't know	12 (14.6)	64 (12.1)	33 (12.1)	22 (12.0)	8 (19.5)	1 (10.0)
It is important to wear sunglasses to protect the eyes from the sun						
Agree	66 (80.5)	454 (85.5)	222 (81.6)	163 (88.6)	37 (88.1)	8 (80.0)
Disagree	7 (8.5)	31 (5.8)	22 (8.1)	10 (5.4)	1 (2.4)	--
Don't know	9 (11.0)	46 (8.7)	28 (10.3)	11 (6.0)	4 (9.5)	2 (20.0)
Sun exposure is the most important risk factor for skin cancer						
Agree	79 (96.3)	448 (84.4)	225 (83.3)	159 (86.9)	35 (85.4)	6 (60.0)
Disagree	--	13 (2.4)	10 (3.7)	6 (3.3)	1 (2.4)	--
Don't know	3 (3.7)	70 (13.2)	35 (13.0)	18 (9.8)	5 (12.2)	4 (40.0)
If I apply factor 30 sun screen I need only apply it once per day						
Agree	11 (13.8)	52 (9.8)	28 (10.3)	19 (10.5)	11 (26.2)	3 (30.0)
Disagree	51 (63.8)	349 (66.1)	183 (67.5)	118 (65.2)	15 (35.7)	7 (70.0)
Don't know	18 (22.5)	127 (24.1)	60 (22.1)	44 (24.3)	16 (38.1)	--
I like to have a suntan						
Agree	39 (48.8)	362 (68.6)	203 (75.5)	148 (80.9)	27 (64.3)	1 (11.1)
Disagree	35 (43.8)	120 (22.7)	47 (17.5)	27 (14.8)	12 (28.6)	4 (44.4)
Don't know	6 (7.5)	46 (8.7)	19 (7.1)	8 (4.4)	3 (7.1)	4 (44.4)
I think I am at risk of skin cancer						
Agree	37 (46.3)	194 (36.6)	79 (29.4)	54 (29.5)	9 (21.4)	2 (22.2)
Disagree	18 (22.5)	139 (26.2)	83 (30.9)	53 (29.0)	13 (31.0)	4 (44.4)
Don't know	25 (31.3)	197 (37.2)	107 (39.8)	76 (41.5)	20 (47.6)	3 (33.3)
Sun protection is important when working outside for less than one hour						
Agree	59 (72.8)	358 (67.7)	177 (65.3)	116 (63.7)	22 (52.4)	7 (70.0)
Disagree	11 (13.6)	71 (13.4)	51 (18.8)	33 (18.1)	9 (21.4)	1 (10.0)
Don't know	11 (13.6)	100 (18.9)	43 (15.9)	33 (18.1)	11 (26.2)	2 (20.0)

Sun Safety Behaviours

Table 9 shows that the majority of respondents (equal to or more than 50%) could be classified as being in the pre-contemplation or contemplation stage of change for seven of the ten sun safety measures. The minority regularly used measures concerned with minimising direct exposure to UV rays through modifications to work organisation. For example, 21% regularly avoided or minimised their exposure to direct sunlight in the middle of the day; 13% regularly swapped jobs to reduce exposure to direct sunlight; and 24% regularly used a shade or cover when working outdoors in the sun. For clothing, 42% reported that they wore long-sleeved loose-fitting tops and trousers when working outdoors in the summer while 23% wore a safety helmet with neck protection. 88% did not

regularly check the UV index forecast and 59% did not regularly check their skin for moles or unusual changes. For only three sun safety measures – wearing sunglasses, using sunscreen, plentiful water intake – were the majority of respondents in the action or maintenance stage, i.e., regularly applying the measure.

Table 9: Baseline Survey Respondents' Sun Safety Behaviours

	I don't do this and I'm not thinking about starting (*pre-contemplation*)	I don't do this but I'm thinking about starting (*contemplation*)	I don't do this, but I'm planning to start in the next month (*planning*)	I do this and began to do it in the last 12 months (*action*)	I do this and have done so for more than a year (*maintenance*)
			N (%)		
Avoid/minimise work in sunlight in the middle of the day	651 (59.3)	188 (17.1)	32 (2.9)	49 (4.5)	178 (16.2)
Swap jobs to minimise the amount of time working in the sun	751 (69.5)	156 (14.4)	37 (3.4)	43 (4.0)	94 (8.7)
Use a shade/cover when working in the sun	609 (56.8)	178 (16.6)	33 (3.1)	69 (6.4)	184 (17.1)
Wear long sleeved, loose fitting tops and trousers	463 (42.1)	142 (12.9)	39 (3.5)	131 (11.9)	326 (29.6)
Wear a safety helmet with neck protection	594 (55.4)	198 (18.5)	38 (3.5)	59 (5.5)	183 (17.1)
Wear sunglasses	314 (28.8)	137 (12.6)	42 (3.8)	126 (11.5)	472 (43.3)
Use sunscreen	264 (24.2)	159 (14.6)	48 (4.4)	122 (11.2)	498 (45.6)
Drink plenty of water	77 (6.9)	62 (5.6)	29 (2.6)	128 (11.5)	818 (73.4)
Check the UV index forecast for the day	679 (62.8)	223 (20.6)	49 (4.5)	46 (4.3)	85 (7.9)
Regularly check skin for moles or unusual changes	310 (28.2)	257 (23.4)	78 (7.1)	115 (10.5)	339 (30.8)

It may not always possible for construction workers to work in the shade. As such, it is perhaps not surprising that only one in four respondents indicated that they typically erect a shade when working in the sun. Although it might not always be feasible to work in the shade, UVR exposure can be substantially reduced by taking breaks in the shade (Parisi & Kimlin, 1999; Thieden et al., 2005). One Australian study found that 91% of workers took their breaks in the shade (Gies & Wright, 2003). Similarly, 21% of workers in the current study reported that they typically avoid working in the midday sun; a finding consistent with that of the pilot study (Madgwick, Houdmont, & Randall, 2011). Given the operational constraints that may limit workers' ability to work in the shade or avoid the midday sun, it would be interesting for future studies to examine whether construction workers in the UK attempt to mitigate for that by taking breaks in the shade.

Reinau et al.'s (2013) review of the literature showed that across eight studies of farmers and construction workers conducted in the US, Australia, Britain and Japan, more than half (50-80%) reported never or rarely wearing a long sleeved shirt when working in the sun. More recently, a study of New Zealand forestry workers found that 24% wore shirts with long sleeves (Reeder, McNoe, Lovelock, & Gray, 2013). In the context of these findings, the fact that 42% of respondents in the current study reported regularly wearing long sleeved tops and trousers might be seen as encouraging. Little research has been conducted on the extent to which outdoor workers wear helmets with neck protection. The current study found that 23% of workers regularly wore a helmet with neck protection. This compares favourably with 7% found in a study of forestry workers in New Zealand (Reeder et al., 2013).

Sunscreen is the sun safety measure with which people are probably most familiar. Used properly it can be highly effective in the fight against skin cancer: One randomised control trial involving Australian adults found that the regular application of sunscreen reduced the occurrence of squamous cell carcinoma by 40% in a 4.5 year period (Green, Williams, & Point, 2007). Despite the effectiveness of sunscreen when used properly, outdoor workers (with the exception of those employed in the outdoor recreation activities such as ski instructors and lifeguards) appear reluctant to adopt this measure as a standard means of skin protection; indeed the vast majority of agriculture and construction workers report never or rarely using sunscreen (Reinau et al., 2013). Reinau and colleague's review of the literature found that outdoor workers have reported time-consuming application and unpleasant sticky consistency as barriers to the regular use of sunscreen. It is therefore encouraging that 57% of respondents in the current study reported that they regularly use sunscreen when working outdoors.

Fifty five per cent of respondents indicated that they regularly wore sunglasses when working outdoors in the sun. This is encouraging and consistent with other studies (Reinau et al., 2013). However, it is unclear whether sunglasses are primarily worn for their sun-protective purpose; it is possible that they are worn to protect against glare than UVR (Weber et al., 2007) or as a fashion statement.

Only 12% of respondents were in the action or maintenance stage in respect to regular checking of the UV index. Among the 10 sun safety measures this particular measure was the least used. Although the literature on the usage rate for this measure is limited, these results appear to be worse than that found elsewhere; for example, a Danish community survey found that 75% of respondents at least occasionally checked the UV index (Bentzen, Krarup, Munksgaard, & Rasmussen, 2013). The low rate of usage of this sun safety measure suggests that further work is required to bring the concept of checking the UV index on a daily basis to the awareness of the construction worker community.

Reinau et al.'s (2013) review of the literature on sun safety in outdoor workers found that researchers have largely neglected skin checking. 59% of respondents in the current study indicated that they did not regularly check their skin for moles or unusual changes (compared to 52% in the pilot study). In two US studies, 40% of farmers (Robinson et al., 2004) and watermen (Bridges & Ehrlich, 2005) reported that they checked their skin occasionally or never. Although the literature available for comparison purposes is limited, it would appear that skin checking among UK construction workers is particularly poor.

Sun Safety Behaviours by Skin Type

Table 10 presents sun safety behaviours by skin type. A greater proportion of respondents with very pale skin reported (i) wearing long sleeved, loose fitting tops and trousers, (ii) using a helmet with neck protection, and (iii) using sunscreen when working outdoors in the summer than respondents in the remaining skin type categories.

Table 10: Baseline Survey Respondents' Sun Safety Behaviours By Skin Type

	Pre-action	Action/ Maintenance
	N (%)	*N* (%)
	Avoid/minimise work in sunlight in the middle of the day	
Total	871 (79.3)	227 (20.7)
Very pale	62 (78.5)	17 (21.5)
Fair/pale	402 (78.4)	111 (21.6)
Fair/beige	210 (79.2)	55 (20.8)
Olive/light brown	149 (82.3)	32 (17.7)
Dark brown	30 (75.0)	10 (25.0)
Black	9 (100.0)	--
	Swap jobs to minimise the amount of time working in the sun	
Total	944 (87.3)	137 (12.7)
Very pale	73 (92.4)	6 (7.6)
Fair/pale	435 (86.3)	69 (13.7)
Fair/beige	230 (88.8)	29 (11.2)
Olive/light brown	156 (87.6)	22 (12.4)
Dark brown	31 (77.5)	9 (22.5)
Black	9 (100.0)	--
	Use a shade/cover when working in the sun	
Total	820 (76.5)	253 (23.5)
Very pale	60 (75.0)	20 (25.0)
Fair/pale	371 (74.3)	128 (25.7)
Fair/beige	200 (77.8)	57 (22.2)
Olive/light brown	144 (80.9)	34 (19.1)
Dark brown	30 (75.0)	10 (25.0)
Black	8 (77.8)	1 (22.2)
	Wear long sleeved, loose fitting tops and trousers	
	644 (58.5)	457 (41.5)
Very pale	41 (50.0)	41 (50.0)
Fair/pale	292 (56.7)	223 (25.7)
Fair/beige	160 (60.8)	103 (39.2)
Olive/light brown	117 (65.7)	61 (34.3)
Dark brown	22 (52.4)	20 (47.6)
Black	6 (75.0)	8 (25.0)
	Wear a safety helmet with neck protection	
Total	830 (77.4)	242 (22.6)
Very pale	52 (71.2)	21 (28.8)
Fair/pale	392 (77.8)	112 (22.2)

Fair/beige	203 (78.4)	56 (21.6)
Olive/light brown	136 (78.6)	37 (21.4)
Dark brown	35 (85.4)	10 (14.6)
Black	7 (77.8)	2 (22.2)
	Wear sunglasses	
Total	493 (45.2)	598 (54.8)
Very pale	38 (46.3)	44 (53.7)
Fair/pale	230 (45.0)	281 (55.0)
Fair/beige	120 (46.5)	138 (53.5)
Olive/light brown	80 (45.2)	97 (54.8)
Dark brown	16 (38.1)	8 (61.9)
Black	6 (75.0)	2 (25.0)
	Use sunscreen	
Total	471 (43.2)	620 (56.8)
Very pale	29 (35.4)	53 (64.6)
Fair/pale	224 (44.0)	285 (56.0)
Fair/beige	106 (40.6)	155 (59.4)
Olive/light brown	86 (47.8)	94 (52.2)
Dark brown	15 (38.5)	24 (61.5)
Black	7 (77.8)	2 (22.2)
	Drink plenty of water	
Total	168 (15.1)	946 (84.9)
Very pale	12 (14.8)	69 (85.2)
Fair/pale	77 (14.7)	448 (85.3)
Fair/beige	42 (15.6)	228 (84.4)
Olive/light brown	28 (16.0)	147 (84.0)
Dark brown	4 (10.0)	36 (90.0)
Black	4 (40.0)	6 (60.0)
	Check the UV index forecast for the day	
	951 (87.9)	131 (12.1)
Very pale	70 (87.5)	10 (12.5)
Fair/pale	444 (88.1)	60 (11.9)
Fair/beige	227 (87.6)	32 (12.4)
Olive/light brown	159 (89.3)	19 (10.7)
Dark brown	34 (85.0)	6 (15.0)
Black	8 (88.9)	1 (11.1)
	Regularly check skin for moles or unusual changes	
Total	645 (58.7)	454 (41.3)
Very pale	48 (58.5)	34 (41.5)
Fair/pale	295 (57.3)	220 (42.7)
Fair/beige	156 (59.8)	105 (40.2)
Olive/light brown	108 (60.0)	72 (40.0)
Dark brown	22 (53.7)	19 (46.3)
Black	8 (88.9)	1 (11.1)

Summary

This study served two key functions. First, by profiling UK construction workers' sun safety knowledge, attitudes and behaviours important information was produced that may inform the focus of future sector-specific interventions and the occupational health policy agenda. Second, the study provided a baseline (pre-intervention) sun safety profile against which to compare post-intervention knowledge, attitudes and behaviours.

The findings support the need for UK construction sector sun safety interventions. Despite the fact that respondents worked outside for an average of almost seven hours per day and the majority had a high-risk skin type, two-thirds of respondents indicated that they thought they were not at risk for skin cancer or did not know if they were at risk. Moreover, almost three quarters reported that they had

never received any form of occupational sun safety training. These findings point to an imperative for sun safety training that helps construction workers to understand the risk of skin cancer associated with outdoor work and to empower them with risk-reduction measures.

Chapter 5: Project Phase 3

Phase 3 Overview

Phase 3 addressed the third aim of the project: to administer a sector-specific sun safety intervention to a large-scale representative sample of workers from the UK construction sector. This followed Phase 2 in the summer of 2012.

The Intervention

Sun Safety in Construction: A Workplace Health Guidance Film was developed by the current authors under the guidance of the project steering group as a low-cost educational intervention that could be readily integrated into occupational safety and health briefings on construction sites. The intervention took the form of a 12-minute DVD that addressed (i) the risk of skin cancer in the UK construction sector, (ii) sun safety behaviours that might be adopted on construction sites, and (iii) self-checking of skin for signs of skin cancer. The development of the intervention was funded through a grant from the IOSH Development Fund awarded in March 2011.

Sun safety interventions are often ineffective in encouraging people to reduce exposure to the sun or increase use of sun protection behaviours (Cracium et al., 2012). Furthermore, awareness of skin cancer risk and knowledge of protective behaviours does not necessarily lead to the implementation and maintenance of positive behaviours (Jackson & Aiken, 2006; Mahler et al., 2008; Sjöberg, 2003) and sun safety behaviours are often highly context-dependent (Williams, Jones, Caputi, & Iversaon, 2012). With this in mind the research team developed a bespoke intervention that was designed specifically for construction workers in the UK. The aim was to ensure that the intervention had obvious and immediate relevance to the viewer.

Sun safety interventions have been shown to be more effective when they are endorsed and receive the active support of relevant authoritative bodies. For example, in the New Zealand SunSmart Schools project those schools that received input from the Cancer Society demonstrated the greatest pre-post intervention change in terms of sun protection policies and practices (Reeder, Jopson, & Gray, 2012). For this reason IOSH was approached as a potential project funder. The IOSH logo appeared on the DVD box and in the film itself. The UK Health and Safety Executive (HSE) is the most trusted information source cited by UK construction workers and the most influential in shaping workers' risk-related behavioural intentions (Conchie and Burns, 2009). As such, the research team was keen to secure HSE endorsement for the intervention. To this end a number of meetings were held with the HSE, resulting in the granting of a written endorsement from its Chief Inspector of Construction that was placed on the back cover of the DVD box. The HSE, through the agency of Ian

Strudley (Head of Health Risk Management Unit, Construction Division), has been actively involved in each stage of the project.

Stage of Change and Intervention Design

Interventions are likely to be most effective when they are targeted at the stage of change of the target population (Weinstock et al., 2002). On the basis of empirical evidence to suggest that the majority of construction workers in the UK demonstrate poor knowledge of the risks of skin cancer associated with outdoor work and typically fail to use adequate sun safety measures (Madgwick, Houdmont, & Randall, 2011), it was reasonable to assume that the majority of construction workers in the UK might be considered to sit within the pre-contemplation or contemplation stage. This assumption was confirmed as being correct by the Project Phase 2 findings of the current study. Previous sun safety intervention research conducted with a volunteer community sample had shown that individuals who had expressed no intention to change their sun safety behaviours were most receptive to a 'resource communication' intervention, whereas a 'planning intervention' was more effective with those who were planning to change their sun safety behaviours (Craciun, Schüz, Lippke, Schwarzer, 2012). Similarly, Borschmann, Lines, and Cottrell (2012) found evidence to suggest that awareness of the real risks of skin cancer might be a precursor to behaviour change. In view of the empirical data, the current intervention was designed to focus on providing information on the nature of the risk of sun exposure and actions that can be taken to reduce skin cancer risk.

Procedure

The project champion in each participating organisation was provided with one or more copies of the Sun Safety In Construction DVD. To ensure that responses to the baseline questionnaire (Project Phase 2) were not influenced by recent sun safety training project champions were instructed to not show the DVD ahead of questionnaire completion. Workers were shown the DVD between May and August 2012 during health and safety briefings. Small organisations generally dedicated a single health and safety briefing to the DVD. In most of these organisations all employees who attended for work on the day of the health and safety briefing viewed the DVD. The large companies that operated across multiple sites generally dedicated multiple briefings to this task in order to ensure coverage across sites. It is likely that a number of workers who had not completed the baseline questionnaire (due to not being present at the time of administration) nevertheless attended a briefing at which they viewed the DVD. As such, intervention exposure was not restricted exclusively to individuals who had completed the baseline questionnaire.

Chapter 6: Project Phase 4 - Research Methodology

Phase 4 Overview

Phase 4 addressed the fourth aim of the project: to evaluate the Sun Safety In Construction intervention in terms of its influence on sun safety knowledge, attitudes and behaviours. This involved the repeat administration of the questionnaire in the summer of 2013.

Sampling and Procedure

The pre-intervention questionnaire (Project Phase 2) invited respondents to voluntarily provide contact details in order that they could subsequently be sent a follow-up questionnaire. The 906 respondents who provided this information were sent a post-intervention questionnaire in the summer of 2013. The time lag between the baseline and follow-up questionnaires was 12 months (the mean date for completion of the baseline questionnaire was 8th August 2012 and 24th August 2013 for the post-intervention questionnaire). As per the pre-intervention questionnaire, completion and return was incentivised by a prize draw to win a sports car driving day. In order to demonstrate the authenticity of the prize draw offer - and by extension to promote a high response rate - the questionnaire included a photograph of one member of the research team presenting the winner of the pre-intervention questionnaire prize draw with his award. To reduce the likelihood of the questionnaire being assigned to the junk mail each questionnaire was mailed in a hand-addressed padded envelope. In addition, a pen was provided to encourage immediate completion along with a stamped and addressed return envelope.

Intervention and Control Group Allocation

In a study of this type, where the objective is to permit changes in knowledge, attitudes, and behaviours to be attributed to the intervention, it is standard practice to allocate participants to either an intervention group or a control group. In the current study a 'naturally occurring control group' was created that comprised employees who completed pre and post intervention questionnaires but who failed, for whatever reason, to receive the intervention. This design was adopted for three reasons. First, all participating companies wanted to receive the intervention (a wait-list control group was not possible due to temporal constraints). Second, all employees who completed the pre and post intervention questionnaires were unlikely to also be present and available on the day on which the intervention was administered. Third, evidence from sun safety intervention studies suggests that interventions may fail to be administered across the organisations that agree to participate, thereby creating a naturally occurring control group. For example, an evaluation of the Australian Sun Sound intervention that involved a five-second sun safety jingle played at regular intervals over loudspeakers at outdoor recreational settings alongside the prominent display of posters found that only 27% of

participant sites played the jingle while 45% displayed the promotional materials (McIver & Rock, 2013).

The benefits afforded by the use of a naturally occurring control group in occupational health research have been demonstrated empirically (Randall, Griffiths, & Cox, 2005). This design achieves two things: “It measures actual exposure to the intervention to allow a valid evaluation of its effectiveness (thus controlling Type III error) [i.e., the mistaken conclusion that an intervention was unsuccessful that can arise when it is incorrectly assumed that all participants received an intervention as planned], and it permits informative evaluation where [intervention] exposure patterns cannot be planned or tightly controlled” (ibid, 2005, p. 26).

The intervention group consisted of respondents who (i) returned a completed baseline questionnaire, (ii) returned a completed follow-up questionnaire, (iii) indicated on the follow-up questionnaire that they had viewed the Sun Safety in Construction DVD, and (iv) indicated that they worked outdoors. The control group consisted of respondents who (i) returned a completed baseline questionnaire, (ii) returned a completed follow-up questionnaire, (iii) indicated on the follow-up questionnaire that they *had not* viewed the Sun Safety in Construction DVD, and (iv) indicated that they worked outdoors.

Questionnaire Design

A single question with a yes/no response format was used to establish whether the DVD had been viewed: *“Have you viewed the Sun Safety in Construction DVD?”* Responses to this question permitted the identification of intervention- and control-group participants.

In order to facilitate the examination of changes in sun safety knowledge, attitudes, and behaviours, the items that assessed these constructs were identical to those included in the pre-intervention questionnaire.

The focus groups involving managers and workers conducted in March 2013 (Project Phase 5) highlighted the importance of the creation of a sun safety culture in UK construction as a prerequisite to the adoption of sun safety measures. Around the same time a scientific paper was published that demonstrated a relationship between a workplace’s sun safety culture and workers’ use of sun safety measures in a sample of 101 construction workers in New Zealand (Reeder, Gray, & McCool, 2013). In response to these two developments, three items developed by Reeder et al. to measure sun safety culture were inserted into the post-intervention questionnaire. The items required respondents to indicate the strength of their agreement on a 5-point scale of strongly agree (1) to strongly disagree (5) with three statements: “Remembering to use sun protection has high importance within my workplace”, “I feel ok about applying sun screen in front of my work mates”, and “I would tell my work mate if I thought he/she was getting sun burnt”. Scores for the three items were combined to create a workplace sun safety culture score out of a maximum score of 15. The Cronbach alpha coefficient

was .61. Though lower than found by Reeder and colleagues (.70), the coefficient indicated acceptable internal consistency.

In response to the findings of the pre-intervention survey the HSE representative on the project steering group was keen to explore workers' views on whether site rules on the use of sun safety measures might prove an effective means to encourage take up. As such, one further item was included in the questionnaire: "If use of sun safety measures was a site rule I would follow it." Responses were given on a five-point scale from strongly agree to strongly disagree.

Chapter 7: Project Phase 4 - Results and Discussion

Response Rate and Respondent Characteristics

A total of 160 questionnaires were returned from among 906 distributed (18% response rate). Table 11 presents demographic and occupational characteristics for responders and non-responders. For gender, age, skin type, and skin cancer experience no evidence of response bias was found. For location, completed questionnaires were returned from across Britain; none were returned from Northern Ireland. For occupational characteristics similar proportions of responders and non-responders indicated that they had received sun safety training at some point in the past. However, non-responders worked outdoors for significantly longer on a typical day ($P<0.001$) and were more likely to report that sunscreen was provided in their workplace ($P<0.01$).

Table 11: Follow-up Survey Respondents' And Non-respondents' Socio-demographic And Occupational Characteristics

	Responders	Non-responders
Socio-demographic characteristics		
Gender		*N* (%)
Male	152 (95)	721 (96.6)
Female	8 (5)	22 (2.9)
Not specified	--	3 (0.5)
Age		*M* (*SD*)
	42.3 (12.8)	38.0 (12.2)
Location		*N* (%)
South East	18 (11.3)	90 (12.1)
London	5 (3.1)	60 (8.0)
South West	6 (3.8)	16 (2.1)
East Anglia	1 (0.6)	37 (5.0)
Midlands	33 (20.6)	148 (19.8)
North of England	54 (33.8)	102 (13.7)
North East	25 (15.6)	92 (12.3)
North West	9 (5.6)	89 (11.9)
Scotland	4 (2.5)	55 (7.4)
Wales	3 (1.9)	18 (2.4)
Northern Ireland	--	23 (3.1)
Not specified	2 (1.3)	16 (2.1)
Skin Type		*N* (%)
Very pale	9 (5.6)	57 (7.6)
Fair/pale	71 (44.4)	346 (46.4)
Fair/beige	45 (28.1)	175 (23.5)
Olive/light brown	30 (18.8)	121 (16.2)
Dark brown	3 (1.9)	29 (3.9)
Black	1 (0.6)	8 (1.1)
Not specified	1 (0.6)	10 (1.3)
Had skin cancer		*N* (%)
Yes	1 (0.6)	7 (0.9)
No	158 (98.8)	734 (98.4)

Not specified	1 (0.6)	5 (0.7)
Family member or close friend had skin cancer		*N* (%)
Yes	24 (15.0)	113 (15.1)
No	135 (84.4)	627 (84.0)
Not specified	1 (0.6)	6 (0.8)
Occupational characteristics		
Hours spent working outdoors on a typical day		*M* (*SD*)
	4.4 (3.6)	6.6 (3.3)
Sunscreen supplied at workplace		*N* (%)
Yes	74 (46.3)	429 (57.5)
No	81 (50.6)	275 (36.9)
Not specified	5 (3.1)	42 (5.6)
Ever received training on the risks of working in the sun		*N* (%)
Yes	49 (30.6)	210 (28.2)
No	110 (68.8)	535 (71.7)
Not specified	1 (0.6)	1 (0.1)

Intervention and Control Group: Comparison of Baseline Characteristics

One hundred and sixty of the individuals who returned a completed baseline questionnaire also returned a completed follow-up questionnaire. Forty of these individuals failed to indicate whether they had viewed the Sun Safety in Construction DVD or whether they worked outdoors, rendering it impossible to allocate these cases to either the intervention or control group. As a result, analyses were conducted on a sample of 120 cases divided across the intervention group (n = 70) and the control group (n = 50).

Table 12 presents baseline characteristics for the intervention group and the control group. For socio-demographic characteristics, in terms of gender, location, skin type, and skin cancer experience the intervention group and control group were largely comparable. However, the intervention group was significantly younger than the control group ($P<0.05$). For occupational characteristics, the intervention group worked significantly fewer hours outdoors on a typical working day than the control group ($P<0.05$). A larger proportion of the control group than the intervention group had received sun safety training in the past. The two groups were broadly equivalent in terms of the extent to which sunscreen was provided at work.

Table 12: Intervention And Control Group Socio-demographic And Occupational Characteristics

	Intervention Group *N* (%)	Control Group *N* (%)
Socio-demographic characteristics		
Gender		
Male	66 (94.3)	48 (96.0)
Female	4 (5.7)	2 (4.0)
Age (mean; standard deviation)	41.2 (12.3)	45.8 (11.6)
Location		
South East	6 (8.6)	10 (20)
London	3 (4.3)	1 (2.0)
South West	2 (2.9)	3 (6.0)

East Anglia	1 (1.4)	--
Midlands	17 (24.3)	8 (16.0)
North	25 (35.7)	9 (18.0)
North East	13 (18.6)	9 (18.0)
North West	1 (1.4)	5 (10.0)
Scotland	1 (1.4)	2 (4.0)
Wales	1 (1.4)	2 (4.0)
Not specified	--	1 (2.0)
Skin Type		
Very pale	1 (1.4)	4 (8.0)
Fair/pale	29 (41.4)	24 (48.0)
Fair/beige	21 (30.0)	14 (28.0)
Olive/light brown	18 (25.7)	6 (12.0)
Dark brown	1 (1.4)	1 (2.0)
Black	--	--
Not specified	--	1 (2.0)
Had skin cancer		
Yes	--	1 (2.0)
No	70 (100)	49 (98.0)
Family member or close friend had skin cancer		
Yes	12 (17.1)	10 (20.0)
No	58 (82.9)	40 (80.0)
Occupational characteristics		
Hours spent working outdoors on a typical day (mean; standard deviation)	4.4 (2.8)	5.9 (3.5)
Sunscreen supplied at workplace		
Yes	35 (50.0)	24 (48.0)
No	34 (48.6	23 (46.0)
Not specified	1 (1.4)	3 (6.0)
Ever received training on the risks of working in the sun		
Yes	20 (28.6)	22 (44.0)
No	50 (71.4)	27 (54.0)
Not specified		1 (2.0)

Changes in Sun Safety Knowledge and Attitudes

Items measuring sun safety knowledge and attitudes were scored on a three-point response scale of *agree* (3), *unsure* (2), *disagree* (1).

For knowledge and attitude development the strongest positive change in the intervention group concerned knowledge of the need to wear sunscreen on a cloudy day (34 percentage point increase in correct knowledge). The second strongest positive change concerned the post-intervention fall in the proportion of respondents who indicated a desire a suntan (17 percentage point decrease in unhealthy attitude). The third strongest positive change concerned knowledge on the need to wear sunglasses to protect the eyes from the sun (13 percentage point increase in correct knowledge).

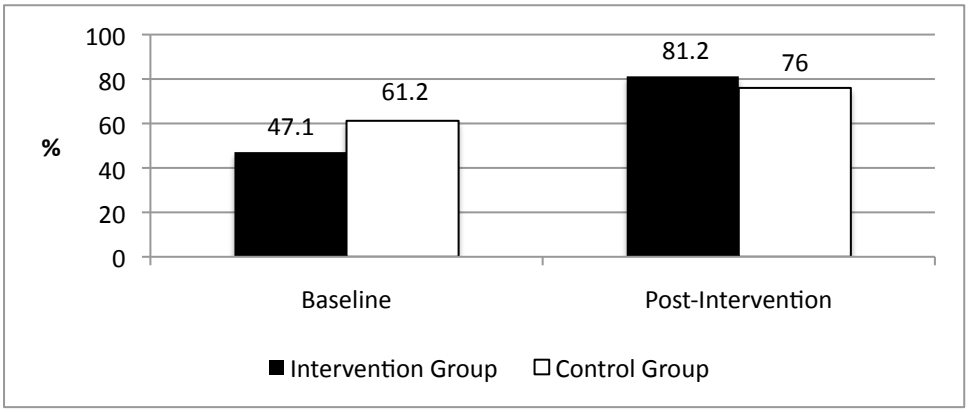
However, on the three remaining indices - knowledge on sun exposure being the most important risk factor for skin cancer, knowledge on the need for sun protection when working outdoors for less than one hour, knowledge on the need to apply sunscreen more than once per day – positive change was

of lesser magnitude or zero. These findings possibly suggest that the intervention may not have adequately conveyed information relating to these issues. These shortcomings should be rectified in future iterations of the intervention.

Knowledge on the need to wear sunscreen on a cloudy day

Figure 1 shows the proportion of respondents who indicated knowledge of the need to use sunscreen when working outdoors on a cloudy day in the summer. For the intervention group the proportion of participants who indicated correct knowledge in this regard increased by 34 percentage points following exposure to the intervention. The control group displayed positive change of lesser magnitude (15%).

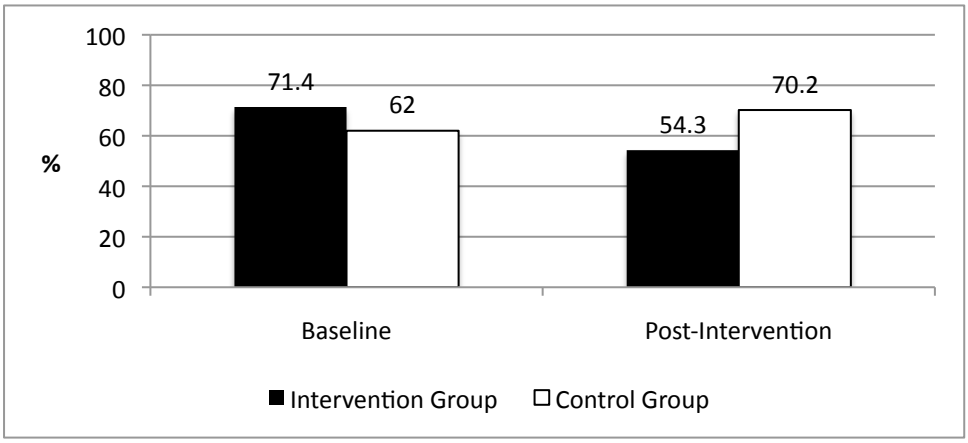
Figure 1: Correct Knowledge On The Need For Sunscreen On A Cloudy Day At Baseline And Follow-up



Desire for a Suntan

Figure 2 shows the proportion of respondents who indicated a desire for a suntan. For the intervention group the proportion of participants who indicated a desire for a suntan fell by 17 percentage points following exposure to the intervention. The proportion of the control group that indicated a desire for a suntan *increased* by eight percentage points at follow-up.

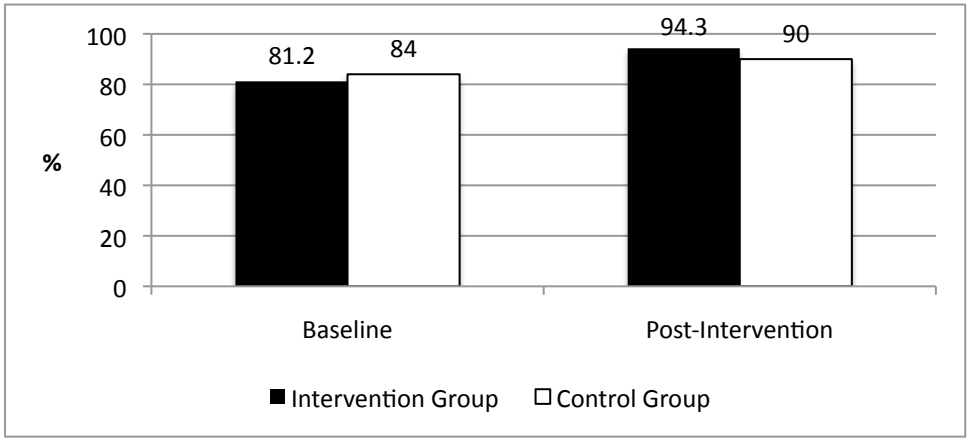
Figure 2: Desire For A Suntan At Baseline And Follow-up



Knowledge on the need to wear sunglasses to protect the eyes

Figure 3 shows the proportion of respondents who indicated correct knowledge of the need to wear sunglasses when working outdoors in the summer. For the intervention group the proportion of participants who indicated correct knowledge in this regard increased by 13 percentage points following exposure to the intervention. The control group displayed positive change of lesser magnitude (6%).

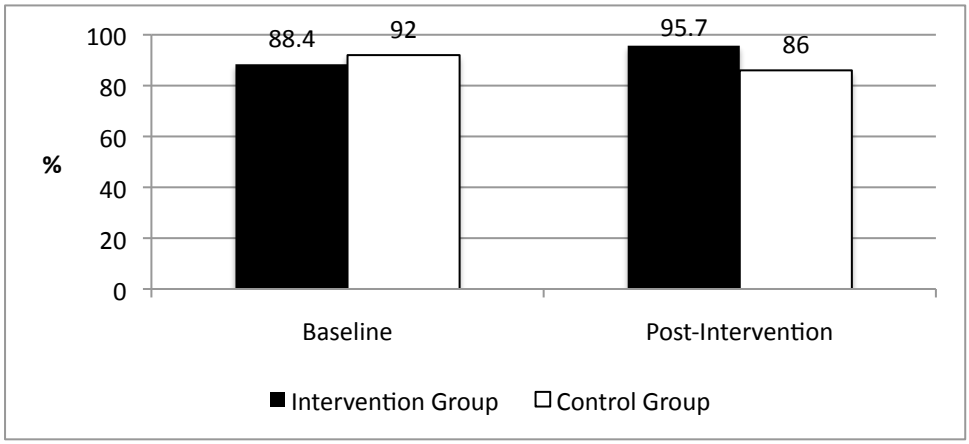
Figure 3: Knowledge On The Need To Wear Sunglasses To Protect Eyes From The Sun



Knowledge on Sun Exposure Being the Most Important Risk Factor for Skin Cancer

Figure 4 shows the proportion of respondents who indicated correct knowledge on sun exposure being the most important risk factor for skin cancer. For the intervention group the proportion of participants who indicated correct knowledge in this regard increased by seven percentage points following exposure to the intervention. The control group displayed *negative* change, with 6% fewer respondents indicating correct knowledge at follow-up than at baseline.

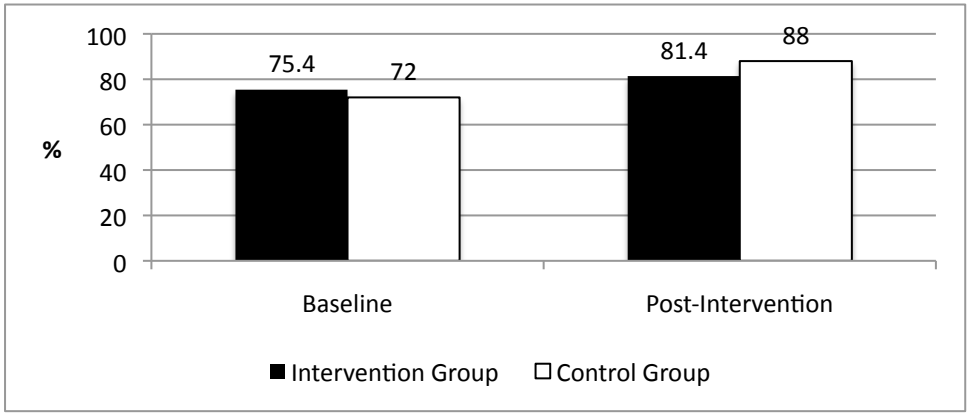
Figure 4: Correct Knowledge On Sun Exposure As A Risk Factor For Skin Cancer



Knowledge on the Need to Apply Sunscreen More Than Once Per Day

Figure 5 shows the proportion of respondents who indicated correct knowledge on the need to apply sunscreen more than once per day when working outdoors in the summer. For the intervention group the proportion of participants who indicated correct knowledge in this regard increased by six percentage points following exposure to the intervention. The control group displayed positive change of greater magnitude (16%).

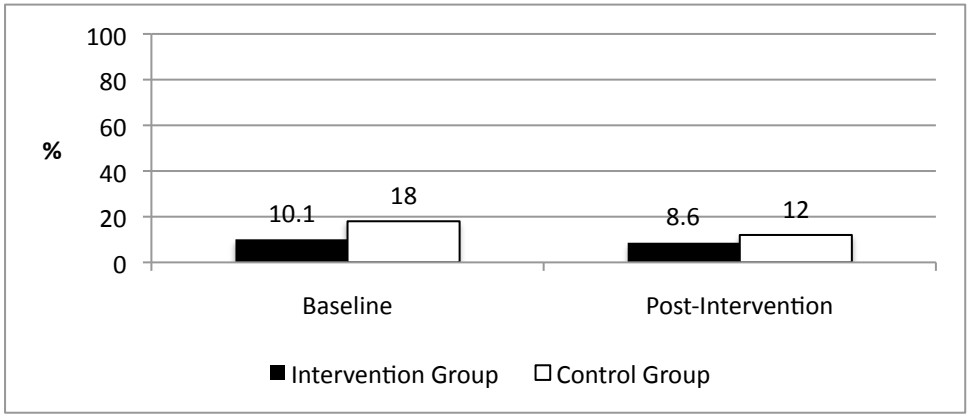
Figure 5: Correct Knowledge On The Need To Apply Sunscreen More Than Once Per Day



Knowledge on The Need for Sun Protection When Working Outdoors for Less Than One Hour

Figure 6 shows the proportion of respondents who indicated correct knowledge on the need for sun protection when working outdoors for less than one hour in the summer. For the intervention group the proportion of participants who indicated correct knowledge in this regard remained virtually unchanged following exposure to the intervention. The proportion of the control group that indicated correct knowledge *decreased* by six percentage points at follow-up.

Figure 6: Correct Knowledge On The Need For Sun Protection When Working Outdoors For Less Than One Hour



Changes in Sun Safety Behaviours

For each of the 10 sun safety measures findings are presented on the proportion of respondents who reported that they were in the action stage (I do this and began in the last 12 months) or maintenance stage (I do this and have done so for more than a year) at baseline and follow-up. This approach to

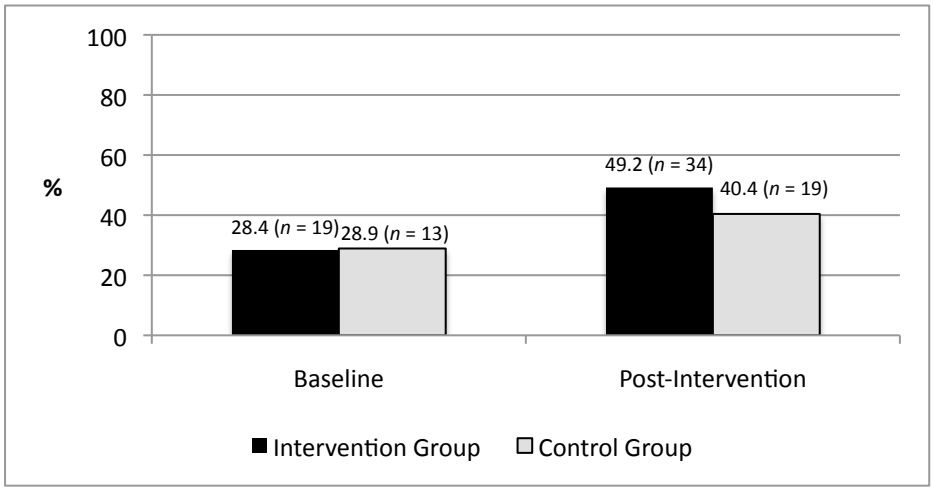
the reporting of the results is consistent with previous sun safety intervention studies that have used the transtheoretical model's stages of change as a framework for evaluation (e.g., Girgis et al., 1994; Weinstock et al., 2002).

The intervention group demonstrated positive change across the set of 10 sun safety behaviours. The magnitude of positive change was marked: On seven of the 10 behaviours the proportion of participants in the action or maintenance stage of change (i.e., those who typically used the measure when working outdoors in the summer) increased by more than 10 percentage points; four of these increases were of more than 20 percentage points. On most of seven behaviours for which the intervention group displayed positive change of more than 10 percentage points the control group showed no improvement or improvement of lesser magnitude, suggesting that positive changes demonstrated by the intervention group can be attributed with a high degree of confidence to the intervention. The magnitude of positive change found in this study is particularly impressive given the 12-month time lag between baseline and follow-up questionnaire administration; it is probable that behaviour decay effects occurred over time and that even stronger effects would have been found with a shorter time lag. It is also noteworthy that positive change was found for the intervention group across all 10 sun safety behaviours included in the study. This contrasts with the findings of Reinau and colleagues' (2013) systematic review of the literature on the effectiveness of sun safety interventions targeted at outdoor workers (none of which included construction workers) which found that among the sixteen studies reviewed none showed comprehensive improvements while three showed no positive change whatsoever.

Avoid/minimise work in sunlight in middle of the day

Figure 7 shows the extent to which respondents avoided/minimised work in direct sunlight in the middle of the day. At baseline an equal proportion of participants in the intervention and control groups reported being in the action/maintenance stages of change. Both groups showed improvement at follow-up, although the magnitude of positive change was greater in the intervention group.

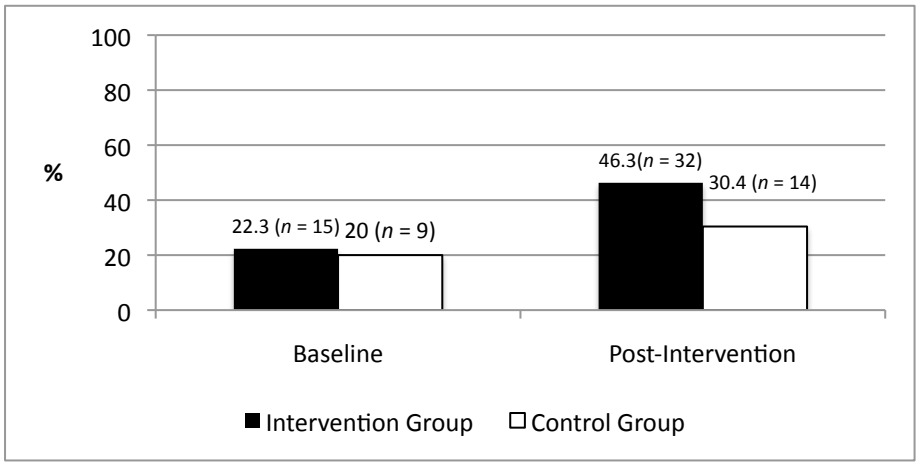
Figure 7: Respondents In Action/Maintenance Stage of Change for Avoid/Minimise Work In Direct Sunlight In Middle Of Day



Swap jobs to minimise amount of time working in the sun

The intervention group showed substantial post-intervention positive change in the use of swapping jobs to minimise the amount of time working in the sun (Figure 8). At baseline almost one quarter of intervention group participants were in the action or maintenance stage of change in relation to use of this sun safety measure; post-intervention almost half of the group was in these stages of change. The control group showed positive change of a lesser magnitude than the intervention group.

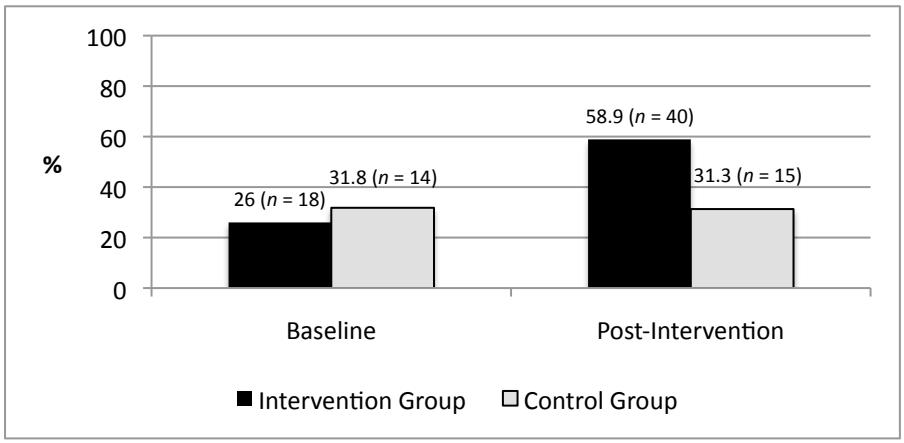
Figure 8: Respondents in Action/Maintenance Stage Of Change For Swap Jobs To Minimise Amount Of Time Working In The Sun



Use a shade/cover when working in the sun

The intervention group showed substantial post-intervention positive change in the use of a shade/cover when working in the sun (Figure 9). At baseline one quarter of intervention group participants were in the action or maintenance stage of change in relation to use of this sun safety measure; post-intervention more than half of the group was in these stages of change. In contrast, the control group showed no change between baseline and follow-up.

Figure 9: Respondents in Action/Maintenance Stage Of Change For Use Of A Shade/Cover When Working In The Sun

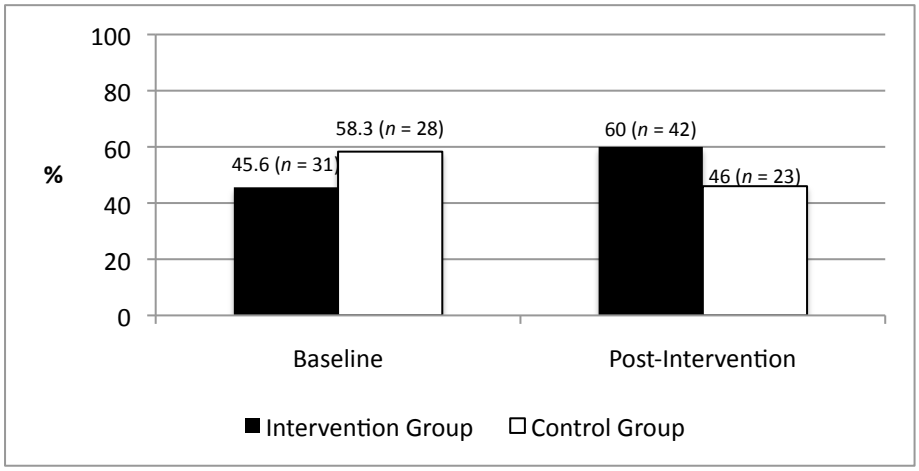


Wearing long-sleeved loose-fitting top and trousers

The intervention group showed a 14 percentage point post-intervention positive change in the wearing of long-sleeved loose-fitting tops and trousers when working in the sun (Figure 10). Contrary to

expectations, the control group showed a substantial negative change between baseline and follow-up.

Figure 10: Respondents In Action/Maintenance Stage Of Change For Wearing Of Long Sleeved Loose Fitting Top And Trousers When Working In The Sun

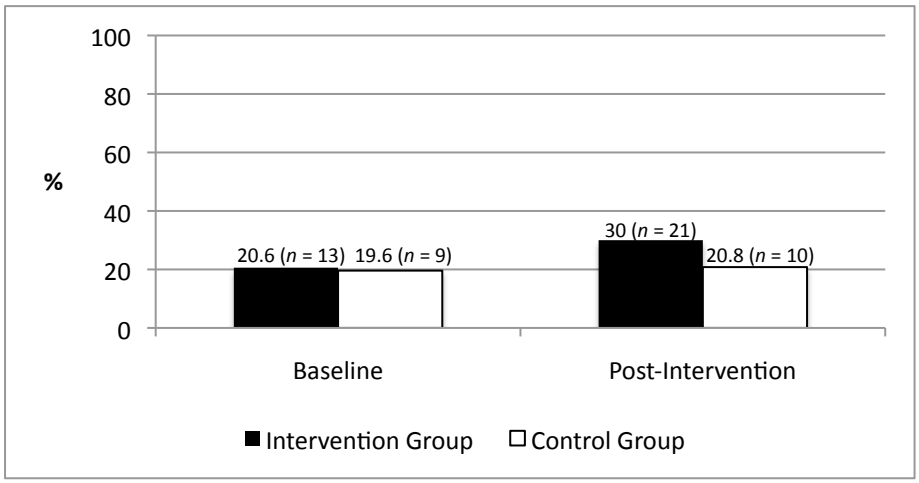


Wearing a safety helmet with neck protection

The intervention group showed substantial post-intervention positive change in the use of a safety helmet with neck protection (Figure 11). At baseline one fifth of intervention group participants were in the action or maintenance stage of change in relation to use of this sun safety measure; post-intervention almost one-third of the group was in these stages of change. In contrast, the control group showed no change between baseline and follow-up.

Though the positive change shown by the intervention group was welcome it remains disappointing that this sun safety measure remained used by fewer than one in three workers. This is particularly so in light of the fact that the neck is one of the most common locations for skin cancer among outdoor workers. It is probable that the low usage rate for neck protectors reflects the limited retail availability of such items in the UK. In view of these findings the UK construction sector and its representative bodies ought to be encouraged to address the availability of sun safety attire on a retail basis.

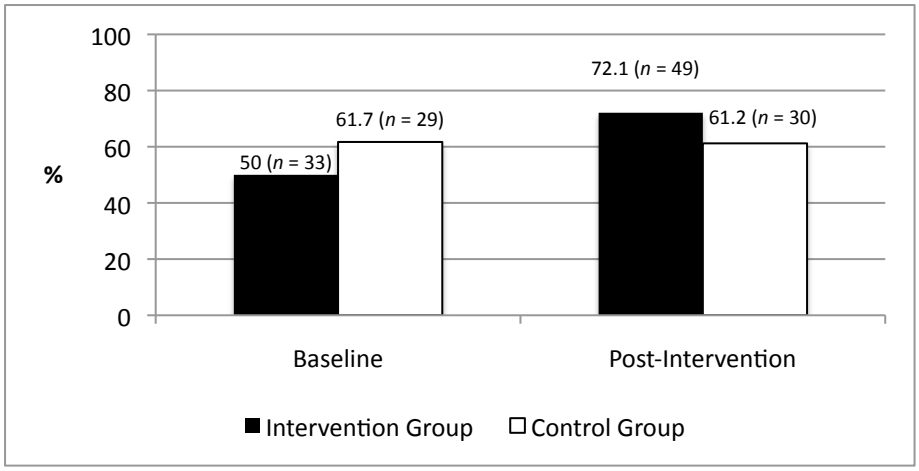
Figure 11: Respondents In Action/Maintenance Stage Of Change For Wearing A Safety Helmet With Neck Protection



Wearing sunglasses

The intervention group showed substantial post-intervention positive change in the use of sunglasses (Figure 12). At baseline half of the intervention group participants were in the action or maintenance stage of change in relation to use of this sun safety measure; post-intervention almost three quarters of the group was in these stages of change. In contrast, the control group showed no change between baseline and follow-up.

Figure 12: Respondents In Action/Maintenance Stage Of Change For Wearing Sunglasses

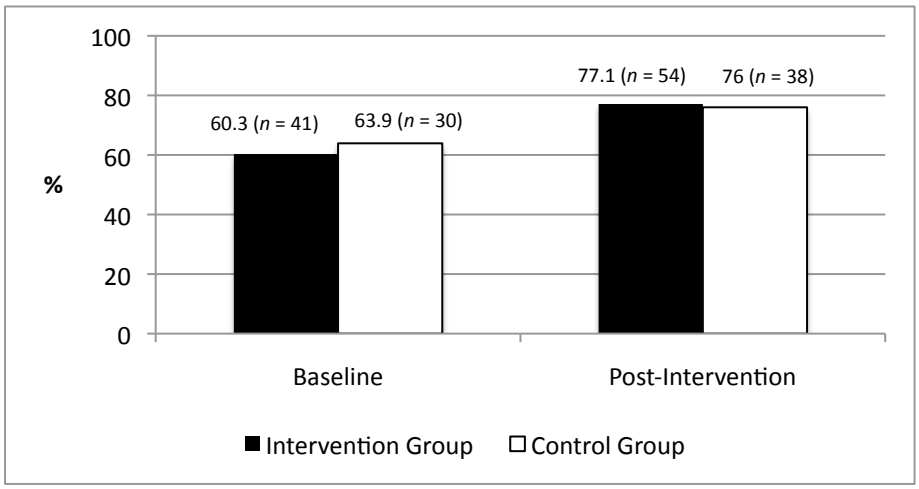


Sunscreen usage

Both the intervention group and control group showed substantial post-intervention positive change of roughly equal magnitude in the use of sunscreen (Figure 13). Two factors that might have accounted for the substantial positive change in the control group are increased provision of sunscreen by employers and the unusually hot weather experienced in the UK during the summer of 2013 when follow-up data collection was conducted. It is possible that had the weather conditions in the summer

of 2013 been similar to that at the time of baseline data collection in 2012 little or no change would have been found in use of sunscreen among control group participants.

Figure 13: Respondents In Action/Maintenance Stage Of Change For Sunscreen Usage

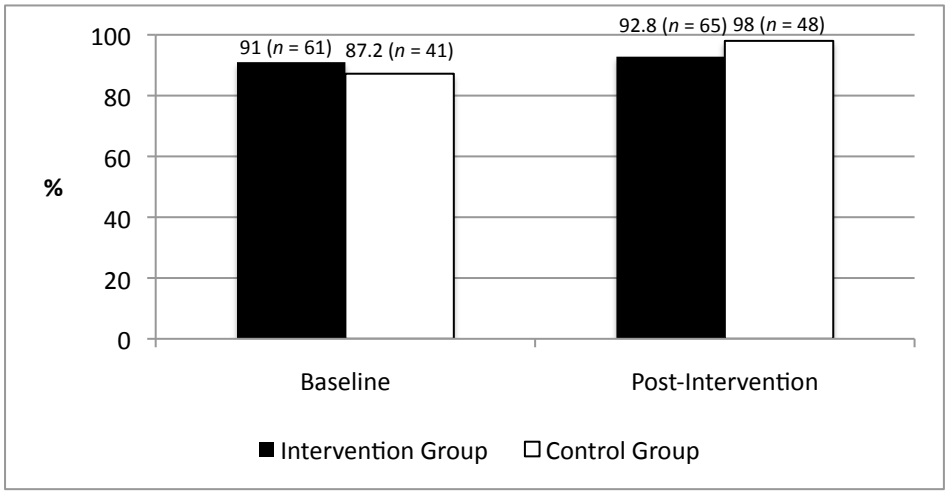


Reinau and colleagues' (2013) systematic review of the literature on the effectiveness of sun safety interventions targeted at outdoor workers (none of which included construction workers) found that among the sixteen studies reviewed positive change was greatest for sunscreen usage. In our study, although the proportion of intervention group participants in the action or maintenance stage of change for this behaviour increased by 17 percentage points, the magnitude of change was less than that found for some of the other sun safety behaviours. This might be due to the high baseline usage level (60.3%) and the possibility that a ceiling effect was reached at the point at which three quarters of respondents used this measure.

Water consumption

The intervention group showed no post-intervention improvement on the high baseline level of water consumption when working outdoors (Figure 14). In contrast, the control group showed an eleven-percentage point increase in the proportion of participants reporting that they drink plenty of water when working outdoors. Given the high baseline usage rate for the intervention group substantial improvements might not be expected at follow-up. In contrast, the control group showed a 16-percentage point positive change which might be explained by the unusually high temperatures experienced in the summer of 2013 during the follow-up questionnaire administration phase.

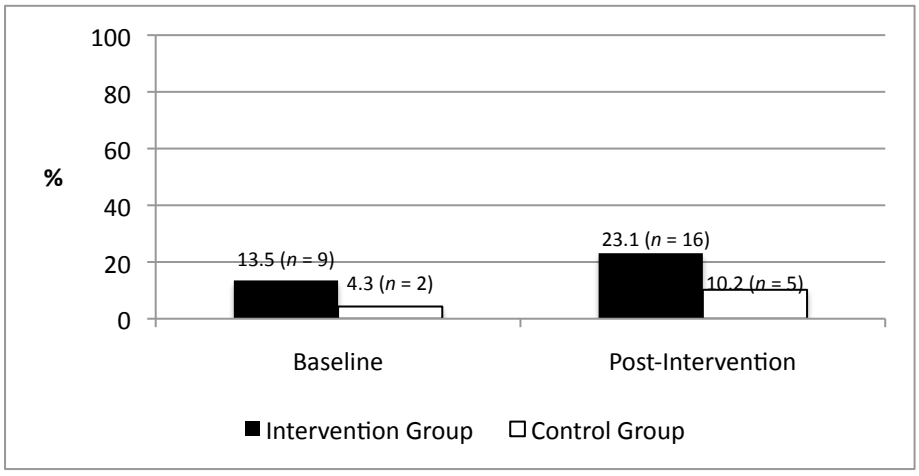
Figure 14: Respondents In Action/Maintenance Stage Of Change For Drinking Plenty Of Water



Checking Daily UV Index

The intervention group showed a 10-percentage point post-intervention increase in checking of the daily UV index (Figure 15). However, post-intervention still fewer than one quarter of the intervention group were in the action or maintenance stage of change in relation to this sun safety measure, suggesting that the utility of the UV index might not have been fully communicated by the intervention. Alternatively, it might suggest that construction workers do not know how to access information on the daily UV index or, alternatively, that doing so requires too much effort. The control group similarly showed a positive though less marked pre-post change.

Figure 15: Respondents In Action/Maintenance Stage Of Change For Daily Checking UV Index

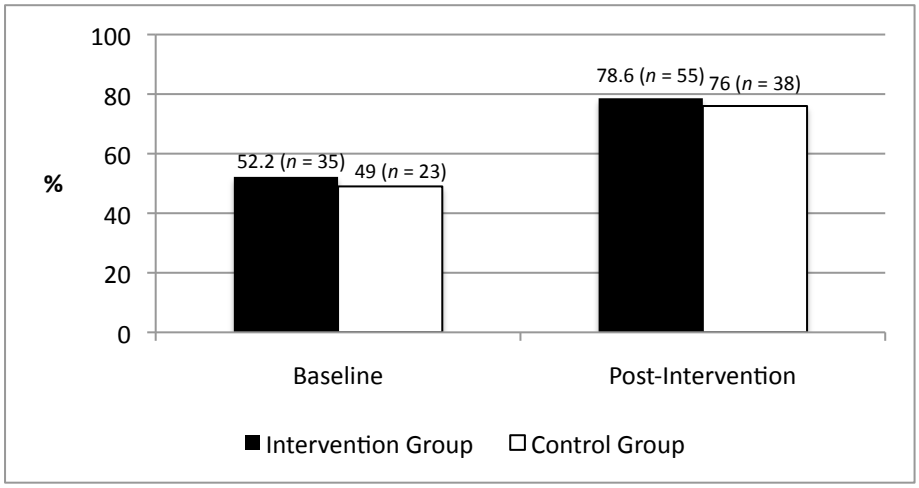


Regularly check skin for moles or unusual changes

The intervention group showed a post-intervention 26-percentage point increase in checking skin regularly for moles or unusual changes, resulting in more than three quarters of respondents reporting that they use this sun safety measure (Figure 16). This is a welcome finding given that the sun safety DVD (the intervention) dedicated a considerable amount of time to a detailed explanation of how to

check the entire body. Contrary to expectations, the control group likewise showed a 27-percentage point increase in the use of this measure. This is contrary to expectations and the study's findings concerning use of other sun safety measures for which zero or small positive changes were found among control group participants. This anomalous finding might be an artefact of sample size or due to control group participants having received guidance on skin checking from source external to this project.

Figure 16: Respondents In Action/Maintenance Stage Of Change For Regularly Checking Skin For Moles Or Unusual Changes



Group Differences for Stage of Change - individuals in Pre-action at Baseline

Some previous sun safety intervention studies designed in accordance with the stage of change perspective have reported the proportion of participants in the pre-action stages (precontemplation, contemplation, preparation) at baseline and compared this figure to the proportion of participants in the action/maintenance stages at follow-up. For example, Weinstock et al. (2002) found that for sunscreen use 22.3% of intervention group participants in the pre-action stages at baseline were in the action/maintenance stage at follow-up. By comparison, 13.5% of control group participants were in the action/maintenance stage at follow-up. This approach to the presentation of the findings enables conclusions to be drawn on the efficacy of the intervention in terms of its ability to shift participants through the stages of change, from pre-action to action/maintenance. The following table presents the sun safety behaviour findings from the current study in this way. Only participants who were in the pre-action stages at baseline are included. As such, Table 13 indicates the extent to which workers who did not use each sun safety measure at baseline subsequently used each measure at follow-up and, by extension, the degree to which participants moved through the stages of change.

Table 13 shows that for six sun safety behaviours a greater proportion of those in the intervention group than those in the control group moved from the pre-action stage at baseline to the action/maintenance stages at follow-up.

The difference in the degree of change between intervention group and control group participants is not significant for nine of the 10 behaviours. This is because statistical significance is sensitive to sample size; it is likely that many of the differences would have been found to be statistically significant had a larger sample been available.

Table 13: Intervention Group And Control Group Differences For Stage Of Change

Intervention Group % in Action/Maintenance Stage (*n*)	Control Group % in Action/Maintenance Stage (*n*)	*P*
Stage of Change for Avoid/Minimise Work in Direct Sunlight in Middle of the Day		
30.4 (47)	32.3 (32)	NS
Stage of Change for Swap Jobs to Minimise Amount of Time Working in the Sun		
31.3 (51)	21.2 (33)	NS
Use a shade/cover when working in the sun		
46.9 (49)	25.0 (28)	0.05
Wear long-sleeved loose-fitting top and trousers		
37.8 (37)	35.0 (20)	NS
Wear a safety helmet with neck protection		
22.0 (50)	13.5 (37)	NS
Wear sunglasses		
51.5 (33)	33.4 (18)	NS
Use Sunscreen		
62.9 (27)	70.5 (17)	NS
Drink Plenty of Water*		
--	--	--
Check Daily UV Index		
17.5 (57)	9.3 (43)	NS
Regularly Check Skin for Moles or Unusual Changes		
62.5 (32)	70.9 (24)	NS

Note. Only individuals in pre-action stage at baseline are included.
* Insufficient cases for analysis.

Workplace Sun Safety Culture

Workplace sun safety culture was scored out of 15, with lower scores indicative of a strong workplace sun safety culture. The mean score in the current study was 5.0 (SD = 1.8). This is considerably better than that found in a previous study for which the workplace sun safety culture scale was developed which produced a mean score of 10.5 (Reeder et al., 2013). The difference in these scores might be due to the current study having involved only construction workers who were sufficiently interested in sun safety to dedicate time to the completion and return of the post-intervention questionnaire (18% of the original sample).

Enforcement

Ninety two per cent of respondents indicated they agreed or strongly agreed that if use of sun safety measures were a site rule they would adhere to it.

Summary

One hundred and sixty construction workers completed the follow-up questionnaire (18% retention rate). After deletion of non-valid cases analyses were conducted on an intervention group comprised of 70 workers and a control group of 50. The intervention group demonstrated positive change across a series of knowledge and attitude dimensions. The strongest positive change concerned knowledge of the need to wear sunscreen on a cloudy day (34 percentage point increase in correct knowledge). The second strongest positive change concerned the post-intervention fall in the proportion of respondents who indicated a desire a suntan (17 percentage point decrease in unhealthy attitude). The third strongest positive change concerned knowledge on the need to wear sunglasses to protect the eyes from the sun (13 percentage point increase in correct knowledge). Among intervention group participants positive changes were found across a set of 10 sun safety behaviours: On five of the 10 behaviours the proportion of participants in the action or maintenance stage of change (i.e., those who typically used the measure when working outdoors in the summer) increased by more than 20 percentage points. Finally, more than nine out of 10 participants across the groups indicated that they would adhere to a site rule, if introduced, requiring use of sun safety measures, suggesting that attempts to enforce sun safety in the sector could potentially prove effective.

Chapter 8: Project Phase 5 - Research Methodology

Phase 5 Overview

The fifth aim of the project was to examine the views of workers and employers on barriers and facilitators to sun safety in the UK construction sector. This was achieved via a set of focus groups conducted in spring 2013.

Introduction

The previous chapter presented data concerning the efficacy of the Sun Safety in Construction intervention in terms of knowledge, attitudinal, and behavioural outcomes. Though the intervention was shown to be effective in the stimulation of positive change in all three respects, an outcome evaluation reveals little about the contextual factors that might facilitate and hinder sun safety.

Only recently have researchers begun to examine the barriers and facilitators to change associated with sun safety. Garside, Pearson, and Moxham (2009) reviewed the findings of sixteen studies and concluded that although on the whole the benefits of adopting sun safe behaviours were acknowledged, two key barriers to the adoption of safe behaviours were apparent: (i) positive perceptions of a tan as healthy and attractive and (ii) the hassle of covering up/using sunscreen. However, among the studies in the review only two included occupational samples, and these both considered the issues from the perspective of school lunchtime staff in relation to the sun safety behaviours of children. To the best of our knowledge, only one study has examined perceived barriers to sun safety among outdoor workers. In a sample of landscapers working around the Northern Mississippi, Nahar et al. (2013) found that heat was identified as the primary barrier to the use of a wide brimmed hat, long sleeved shirt, and long trousers. In contrast 'forgetting' was the main barrier to the use of sunglasses and sunscreen.

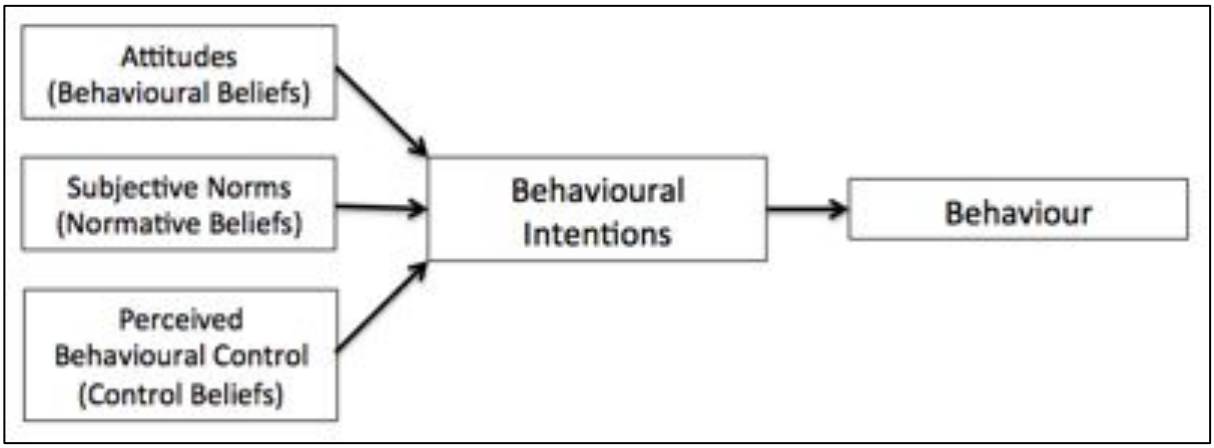
The study presented in this chapter seeks to elicit the barriers and facilitators that might contribute to the potential effectiveness of sun safety interventions in the UK construction sector. It is anticipated that the findings might usefully inform the design and administration of future sun safety in construction interventions.

Theoretical Framework: Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB: Ajzen, 1991) has been used in numerous studies as a guiding framework by which to understand the barriers and facilitators of sun safety behaviours (e.g., Hamilton et al., 2012; Jackson & Aiken, 2000; Myers & Horswill, 2006; Thomson, White, & Hamilton,

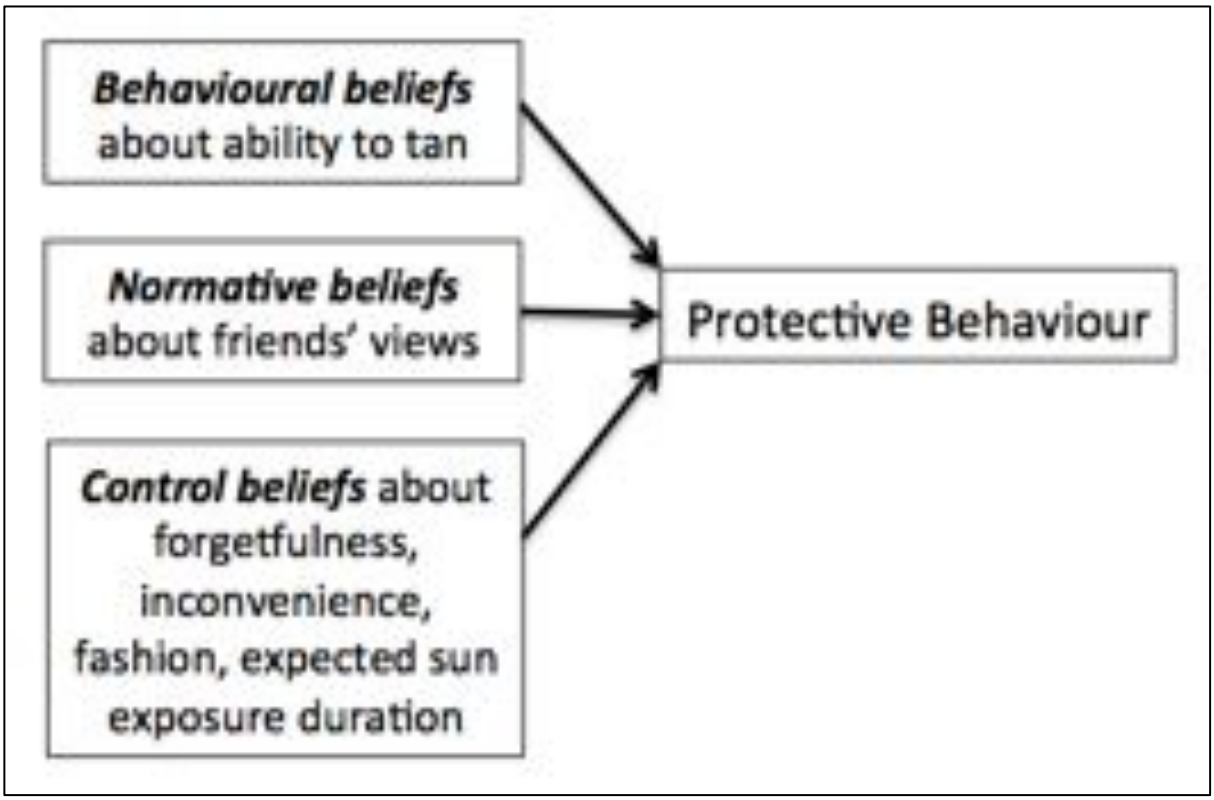
2012; White et al., 2008). It suggests that intention to perform a particular behaviour is informed by three forces: *attitudes* (i.e., beliefs concerning the extent to which the behaviour is favourable/unfavourable), *subjective norms* (i.e., perceived social pressure to perform/not perform the behaviour), and *control beliefs* (i.e., perceived ease/difficulty of performing the behaviour) (Figure 30).

Figure 17: Theory of Planned Behaviour



Two studies are summarised here in order to demonstrate the application of this model to understanding sun safety behaviours. Hamilton et al. (2012) found that sun safety behaviours among Australian adults were explained by behavioural beliefs about ability to tan, normative beliefs about friends' views, and control beliefs about forgetfulness, inconvenience, fashion, and expected duration of sun exposure (Figure 31).

Figure 18: Theory of Planned Behaviour Predicting sun Protective Behaviours Among Australian Adults (Hamilton et al., 2012)



Thomson, White, and Hamilton (2012) similarly investigated factors that predicted mothers' decisions about their child's sun-protective behaviours using the TPB. They found that the theory's variables (appraisal of the behaviour as favourable/unfavourable, perceived social pressure to perform/not perform the behaviour, perceived ease/difficulty with performing the behaviour), explained 82% of the variance in mothers' intentions to apply sun-protective behaviours in relation to their children. Given the demonstrated utility of this framework for understanding sun safety behaviours, the current investigation adopts the TPB as a structure for examining factors that explain the barriers and facilitators to sun safety in the UK construction sector.

Participants

When considering the factors that hinder or contribute to the success of an intervention it seems sensible to explore the perceptions of both those with responsibility for its deployment within the organisational context and its intended recipients. Thus, four focus groups each involving six managers with responsibility for workers' health and safety were conducted in March-April 2013. We sought to achieve breadth of views by ensuring that the focus groups involved managers from across the UK construction industry. The focus groups involved managers drawn from a medium sized construction company (Group 1), a small sized construction company (Group 2), a large national house builder (Group 3), and the public sector (Group 4). Randall and Nielsen (2012) observed that "for interventions to be effective it seems logical that they need to fit the problem as it is perceived by

employees and the context within which it occurs." In response, four focus groups each involving six workers were conducted in the same period. Participants were drawn from the public sector (Group 1), a small specialist contractor (group 2), a large national house builder (Group 3), and a medium-sized construction company (Group 4).

Procedure

Data collection was by means of focus group. This qualitative approach was adopted in order to help eradicate uncertainty in interpretation of the questions given that "misinterpretation of items can be one of the greatest problems encountered with Theory of Planned Behaviour questionnaires" (Thomson et al., 2012, p. 1009) and in order to generate rich narrative data. One member of the research team facilitated each focus group. These were conducted in a quiet room on the construction site at which the participants were employed. A semi-structured question schedule was used to elicit information. To help participants relax and to build rapport with the researcher a brief discussion was initiated concerning the prize draw associated with the pre and post intervention questionnaires. Participants were next asked to consider what factors might encourage sun safety in the construction sector. They were also asked to consider what factors might inhibit developments in sun safety. Finally, they were asked if there was anything else they would like to discuss. The focus group discussions were audio recorded with the participants' permission and subsequently transcribed verbatim. Each lasted approximately 30 minutes.

Analysis

Thematic analysis (Braun & Clarke, 2006) was applied in order to identify the broad themes evident in focus group transcripts. Designed as "a method for identifying, analysing and reporting patterns (themes) within data" (Braun and Clarke, 2006, p. 79), the six-stage process involved: transcribing the data and reading (and re-reading) each transcript in detail in order to become familiar with the data, generating initial broad categories for the responses, guided by the aims of the study, collating the categories into themes and gathering the relevant data within each theme, reviewing the themes and sub-themes against the categories to ensure that the entire data set was represented, defining and naming themes and sub-themes, and production of the report involving the use of extracts from the transcripts illustrating each theme in light of the study's aims. Braun and Clarke's approach has been used extensively in occupational health psychology research where it has been shown to be an effective means by which to identify, analyse, and report themes in qualitative data (e.g. Houdmont, 2013; Leka et al., 2011; Payne et al., 2013).

Chapter 9: Project Phase 5 – Results and Discussion

Results supported the Theory of Planned Behaviour (TPB) constructs as being relevant to the determination of sun safety in construction. A range of attitudes, normative beliefs and control beliefs were identified as important facilitators and barriers to sun safety in the sector.

Attitudes

Responsibility for sun safety

Workers expressed mixed views on where responsibility for sun safety might lie. Some expressed the belief that responsibility rests with the individual (Quote 1: *I don't think it's your employer because it's your own wellbeing*; Quote 2: *You can't always blame someone else. It's your skin and it's yours to look after*), while others felt that responsibility is shared between the employee and employer (Quote 3: *It's 50/50 really*). Some observed that if sun safety were legislatively mandated responsibility would shift entirely to the employer (Quote 4: *If it was mandatory though it would be the employer [in the same way that] it's mandatory for the employer to provide the lads on the books with hard hats and boots*).

In contrast to workers, managers viewed responsibility for sun safety not as existing solely with the individual but as part of a company's obligations: *It's every employer's responsibility; we have a duty of care* (Quote 5). However, managers also noted that though it might be possible to mandate sun safety, ultimately workers would need to be compliant in order for a policy to be effective: *It's like everything practical that you do; at the end of the day it's down to them. You can tell somebody but you can't force them* (Quote 6).

Financial cost

Workers viewed the financial cost of sun safety measures as a barrier to sun safety: *The cost of the sun block cream to buy is extortionate* (Quote 7). In the same way, managers viewed the costs to the company as presenting a possible barrier. Some suggested that if sun safety were stipulated in tender calls this might result in a level playing field between bidders: *It's all money driven though isn't it. If it turns up on PQQs then they will need to prove they are doing it* (Quote 8).

Perceived relevance of sun safety

Workers viewed the UK climate as conspiring to reduce if not eliminate the need for sun safety in the construction sector: *It's like summer for one day here though, so it's [a sun safety policy] never going to happen* (Quote 9); *There's less of a risk in this country isn't there* (Quote 10). There was also evidence of perceived immunity among workers (Quote 11: *Both my grandparents were farmers and*

they were black [i.e., heavily tanned rather than of black skin type] and they didn't put any sun cream on or anything like that) while others reported that there wasn't time to consider sun safety at work (Quote 12: *You don't think about it at work because you just want to crack on*). Consistent with this point, managers noted that some workers would view the introduction of sun safety site rules as *another thing they've chucked in our way to stop us earning money* (Quote 13).

Age-dependent attitudes

Managers viewed the attitudes of some older workers as presenting a possible barrier to sun safety. Older workers were viewed as unlikely to adopt sun safety measures owing to their unfamiliarity with such measures: *The old-school guys that have worked for years on site with no sun cream are not used to it and are not going to be bothered* (Quote 14).

Normative Beliefs

Pressure from colleagues

Workers reported some negative social pressure from colleagues regarding the use of sun safety measures: *There will be some mickey taking* (Quote 15); *There will be a bit of banter and stuff at the start. Like when I put lipsalve on or a bit of sun cream, you get a bit of stick for that* (Quote 16). However, on the whole workers indicated that teasing and banter would be unlikely to dissuade them from using appropriate measures: *I think you're your own person. It depends on how strong a character you are I suppose* (Quote 17).

Desire for a tan

Managers viewed the desire of younger workers to have a sun tan as a barrier to sun safety: *Young people like to have sun tans. A youngster working on a building site would probably rather work with his shirt off and get a sun tan so he can go and impress the women – and vice versa for women going on sun beds* (Quote 18).

Control Beliefs

Negative attitudes towards sun safety measures

Negative attitudes towards sun safety measures, particularly those that might be uncomfortable to wear or apply, were reported by workers as presenting a barrier to sun safety (Quotes 19-21).

> Quote 19: You don't want to be wearing stuff that leaves you wet through and sweaty. I don't know which is the lesser of two evils, getting burnt or wearing that stuff.
>
> Quote 20: If it's hot as well you're going to get dusty so you get gritted and filthed up.
>
> Quote 21: When you put sunscreen on your face and you're sweating it tends to go in your eyes.

Legislation and policy

Legislation and site rules concerning sun safety were viewed as important potential drivers of sun safety by workers (quotes 22-23) and managers (Quote 24).

Quote 22: When it becomes law on site, then we haven't got a choice.

Quote 23: If there was a big sign saying 'no hat, no sun cream, no job' then you'd have to do it.

Quote 24: The only realistic thing is to make them wear long sleeved clothes and neck protection; that's the only was you're going to enforce it.

Managers likewise highlighted legislation as offering a potential driver to sun safety (Quotes 25-27).

Quote 25: In the commercial world we live in, you wouldn't [do anything] unless it was legislated. Same as anything.

Quote 26: Firms won't take it up unless you legislate.

Quote 27: You won't get a big take-up unless there is something to force people to do it. It's the same as everything in health and safety.

In a similar vein, some noted that claims might be required to stimulate the industry into action: *Litigation will be a driver and maybe if someone is getting a bit of kudos for sticking [UV dosimeter] stickers on people's heads they will jump on the bandwagon* (Quote 28).

Inconvenience and availability

The inconvenience of using sun safety measures on a construction site was identified as a barrier to sun safety. Some workers noted that if sun safety measures were convenient in terms of their availability the likelihood of their use might be elevated: *You'd probably put it on when you went to the toilet, when it's at the side of you* (Quote 29). Managers noted the lack of availability of sun safety clothing as a barrier to sun safety: *I know that they're saying clothing is available but it's not readily available* (Quote 30).

Education

Managers viewed the education of the workforce (Quote 31) and management (Quote 32) on solar UV risks as key to the development of a sun safety culture in the sector.

Quote 31: I think you could remove obstacles by education, such as watching that DVD.

Quote 32: Obviously, companies as well as employees need educating as to what the dangers are.

In this regard several managers noted that sun safety could be integrated into company health and safety policies and induction training.

Summary

This study explored perceived barriers and facilitators of sun safety in construction from the perspective of both workers and managers. A range of attitudes, normative beliefs and control beliefs were identified as facilitators and barriers to sun safety in the sector. For attitudes, ambiguity over whether responsibility lies with the employer or employee, financial costs, and the perceived non-relevance of sun safety given the UK climate were viewed as potential barriers to the development of a sun safety culture. Social influences on sun safety included pressure from colleagues and the

fashion for a tan. Legislation, education of the workforce, and the widespread availability of sun safe clothing were viewed as key factors that might influence the development of a sun safety culture in UK construction.

Chapter 10: Overall Discussion and Recommendations

Summary of Findings

The high incidence of skin cancer among construction workers in the UK and the potential preventability of the disease presents an imperative for the development and evaluation of interventions focused on improving sun safety in the sector. The research project described in this report represents a response to that imperative. The project involved five aims; these are reiterated below and key findings reviewed.

Project aim 1: To review scientific knowledge on the epidemiology of skin cancer; sun safety knowledge, attitudes, and behaviours; and sun safety interventions in the UK construction sector. In addition to establish the legal and policy imperatives for action on sun safety in the sector.

The review showed that construction workers in the UK are at increased risk for the development of skin cancer.

- Reports submitted to the Occupational Disease Intelligence Network (ODIN) between 1996 and 2000 indicated that skin cancer accounted for 7% of diagnosed work-related disease among construction workers.
- Estimates based on 2005 cancer mortality data and 2004 cancer incidence data (GB only) showed that 58% of occupational cancer deaths and 55% of occupational cancer registrations attributed to sun exposure involved construction workers.
- Data contributed by clinical specialists, occupational physicians, and general practitioners to the Health and Occupation Reporting (THOR) network over the period 2002-2008 indicated that among skilled tradesmen exposure to UV light was the suspected causal exposure in all but a single reported case of skin cancer. Further, the risk of skin cancer was found to be particularly high for roofers, painters and decorators, and labourers in the building and woodwork trades.

Knowledge on the use of sun safety measures in the UK construction sector is limited. A study from 2011 conducted by the current authors found a positive association between receipt of sun safety training and use of sun safety measures in a sample of 360 workers, suggesting that construction-specific sun safety training interventions hold the potential to lead to behavioural improvements. The study also found that the statistical majority of respondents typically used three specific sun safety measures when working outdoors in the summer: plentiful water intake, sunscreen, wearing of loose fitting long sleeved tops and trousers. Low-cost interventions, such as safety helmet attachments that offer neck protection, were rarely used. In this respect the findings were consistent with those of

studies concerning other outdoor worker groups that have shown this broadly defined group to be particularly poor at using sun safety measures.

Numerous studies have reported on sun safety intervention evaluations targeted at groups such as school children and public pool users as well as those in the outdoor recreation industries such as lifeguards and ski instructors. Fewer have examined the efficacy of sun safety interventions targeted at manual outdoor workers. Only one study has evaluated the efficacy of a sun safety intervention in a group of outdoor workers that in terms of demographic characteristics might share key features with construction workers. That study involved the administration of a sun safety intervention to 65 outdoor workers employed by an electrical supply company in Australia. Results showed that the number of workers who reported using a high level of sun protection post-intervention was 16% higher than pre-intervention, whereas no difference was found for control group participants (n = 77). Both groups showed improvements in sun safety knowledge, though the improvement was greatest in the intervention group; neither group showed any improvement in sun safety attitudes. No sun safety intervention studies have been conducted in the UK construction sector.

In the UK there is a strong policy imperative for sun safety promotion activities. The National Institute for Health and Care Excellence (NICE) (2011) Public Health Guidance '*Skin Cancer: Prevention, Using Public Information, Sun Protection Resources and Changes to the Environment'* made six broad recommendations for stakeholder groups, each of which was responded to in the current investigation. Consistent with the policy perspective, a legal imperative for action on sun safety in construction can be found in three legislative instruments:

- The Health and Safety at Work Act 1974. This requires UK employers to assess health and safety risks within their workplaces and ameliorate these risk factors. This piece of primary legislation effectively requires employers "to do whatever is necessary subject to the qualification of 'reasonably practicable' - to make sure that the employee suffers no detriment to their health, safety or welfare by the mere fact that they have been employed by the particular employer".
- The Management of Health and Safety at Work Regulations 1999. This secondary legislation places an emphasis on risk assessment and, by extension, the prevention of illness and injury. The Regulations are unambiguous in regard to an employer's duty to assess "the risks to the health and safety of his employees to which they are exposed whilst they are at work". The Health and Safety Executive's (2000) Approved Code of Practice and Guidance that accompanies the Regulations makes clear that risk assessments should encompass a wide range of hazards: "a hazard is something with the potential to cause harm (this can include articles, substances, plant or machines, methods of work, the working environment and other aspects of work organisation)".
- The Construction (Design and Management) Regulations 2007. These state that "Every place of work shall, so far as is reasonably practicable, be made and kept safe for, and without risks to health to, any person at work there" (Regulation 26, 2). Moreover, "every place of work

outdoors shall, where necessary to ensure the health and safety of persons at work there, be so arranged that, so far as is reasonably practicable and having regard to the purpose for which that place is used and any protective clothing or work equipment provided for the use of any person at work there, it provides protection from adverse weather" (Regulation 43, 2).

Project aim 2: To profile sun safety knowledge, attitudes and behaviours among a large-scale representative sample of workers from the UK construction sector.

This took place in the summer of 2012. This study had two key purposes. First, by profiling UK construction workers' sun safety knowledge, attitudes and behaviours we aimed to gather data that might inform the focus of future sector-specific interventions and the occupational health policy agenda. Second, the study provided a baseline (pre-intervention) sun safety profile against which to compare post-intervention knowledge, attitudes and behaviours, thereby permitting conclusions to be drawn on the extent to which exposure to an intervention may enhance sun safety.

1,279 construction workers drawn from across the UK, a range of trades, and 22 companies completed a questionnaire in the summer of 2012. Following deletion of cases for which no information was given on hours spent working outdoors and those that indicated zero outdoor work analyses were conducted on a final sample of 1,154 responses.

Results showed that despite the fact that respondents worked outside for an average of almost seven hours per day and the majority had a high-risk skin type, two-thirds of respondents indicated that they thought they were not at risk for skin cancer or did not know if they were at risk. Moreover, almost three quarters reported that they had never received any form of occupational sun safety training.

Use of sun safety measures was generally low. The majority of respondents failed to regularly use seven (from a list of 10) sun safety measures. The minority regularly used measures concerned with minimising direct exposure to UV rays through modifications to work organisation. For example, 21% regularly avoided or minimised their exposure to direct sunlight in the middle of the day; 13% regularly swapped jobs to reduce exposure to direct sunlight; and 24% regularly used a shade or cover when working outdoors in the sun. For clothing, 42% reported that they wore long-sleeved loose-fitting tops and trousers when working outdoors in the summer while 23% wore a safety helmet with neck protection. 88% did not regularly check the UV index forecast and 59% did not regularly check their skin for moles or unusual changes. The majority of respondents regularly used three measures: sunglasses (55%), sunscreen (57%), and plentiful water intake (86%).

These findings point to an imperative for sun safety training that helps construction workers to understand the risk of skin cancer associated with outdoor work and to empower them to adopt risk-reduction measures.

Project aim 3: To administer a sector-specific sun safety intervention to a large-scale representative sample of workers from the UK construction sector.

Sun Safety in Construction: A Workplace Health Guidance Film was developed by the current authors under the guidance of the project steering group as a low-cost educational intervention that could be readily integrated into occupational safety and health briefings on construction sites. The intervention took the form of a 12-minute DVD that addressed (i) the risk of skin cancer in the UK construction sector, (ii) sun safety behaviours that might be adopted on construction sites, and (iii) self-checking of skin for signs of skin cancer. The development of the intervention was funded through a grant from the IOSH Development Fund awarded in March 2011. Following administration of the baseline questionnaire the DVD was shown to workers in 31 construction companies across the UK in the summer of 2012.

Project aim 4: To evaluate the intervention in terms of its influence on sun safety knowledge, attitudes and behaviours.

One hundred and sixty construction workers completed a 12-month post-intervention follow-up questionnaire (18% retention rate). After deletion of data contributed by workers who reported that they did not work outdoors or had neglected to indicate whether they had been exposed to the intervention analyses were conducted on an intervention group comprised of 70 workers and a control group of 50.

The intervention group demonstrated positive change across a set of knowledge and attitude dimensions. The strongest positive change concerned knowledge of the need to wear sunscreen on a cloudy day (34 percentage point increase in correct knowledge). The second strongest positive change concerned the post-intervention fall in the proportion of respondents who indicated a desire a suntan (17 percentage point decrease in unhealthy attitude). The third strongest positive change concerned knowledge on the need to wear sunglasses to protect the eyes from the sun (13 percentage point increase in correct knowledge). However, on the three remaining indices - knowledge on sun exposure being the most important risk factor for skin cancer, knowledge on the need for sun protection when working outdoors for less than one hour, knowledge on the need to apply sunscreen more than once per day – positive change was of lesser magnitude or zero. These findings possibly suggest that the intervention may not have adequately conveyed information relating to these issues. These shortcomings should be rectified in future iterations of the intervention.

Among intervention group participants positive changes were found across a set of 10 sun safety behaviours: On five of the 10 behaviours the proportion of participants in the action or maintenance stage of change (i.e., those who typically used the measure when working outdoors in the summer) increased by more than 20 percentage points. Key results included: The intervention group showed substantial post-intervention positive change in the use of a shade/cover when working in the sun. At

baseline one quarter (26%) of intervention group participants were in the action/maintenance stage of change (i.e., regularly used this sun safety measure); post-intervention more than half of the group (59%) was in these stages of change. In contrast, the control group showed no change between baseline and follow-up. The intervention group showed substantial positive change in the use of a safety helmet with neck protection. At baseline one fifth (21%) of intervention group participants were in the action/maintenance stage of change in relation to use of this sun safety measure; post-intervention almost one-third (30%) of the group were in these stages of change. The control group showed no change between baseline and follow-up. The intervention group showed substantial positive change in the use sunglasses. At baseline half (50%) of intervention group participants were in the action/maintenance stage of change; post-intervention almost three quarters (72%) of the group were in these stages of change. The control group showed no change between baseline and follow-up.

Project aim 5: To examine the views of workers and employers on barriers and facilitators to sun safety in the UK construction sector.

Four focus groups involving managers and four involving workers (N = ~6 per group) were conducted in March 2013. A range of attitudes, normative beliefs and control beliefs were identified as facilitators and barriers to sun safety in the sector. For attitudes, ambiguity over whether responsibility lies with the employer or employee, financial costs, and the perceived non-relevance of sun safety given the UK climate were viewed as potential barriers to the development of a sun safety culture. Social influences on sun safety included pressure from colleagues and the fashion for a tan. Legislation, education of the workforce, and the widespread availability of sun safe clothing were viewed as key factors that might influence the development of a sun safety culture in UK construction.

Implications for Practice: The Role of Employers and Regulatory Bodies

The strongest results found in this project in terms of positive behaviour change were in relation to behaviours concerned with reducing the amount of time spent working in the sun. Post-intervention, the proportion of intervention group participants who reported that they regularly avoided/minimised work in direct sunlight in the middle of the day increased by 21 percentage points; the proportion who reported that they regularly swapped jobs to minimise the amount of time spent working in the sun increased by 24 percentage points; and the proportion who reported that they regularly used a shade or cover when working in the sun increased by 33 percentage points. That the strongest results should centre on these behaviours might be considered surprising given the often-limited influence that workers are able to exert on the management and organisation of their work. Though these positive findings are welcome it is important to note that post-intervention approximately half of the intervention group remained in the earlier stages of change, i.e., did not regularly use these measures when working outdoors in the summer. This suggests that in isolation an intervention of this type is possibly unlikely to result in comprehensive sun safety adherence and that, by extension, employer-led leadership and enforcement on the issue might result in higher compliance rates and the

development of a culture of sun safety in the sector. Indeed, there is evidence to suggest that the strength of a workplace sun safety culture is associated with the extent of an employer's involvement in sun safety activities and provision of sun safety measures (Reeder et al., 2013; Walkosz, Buller, Anderson, & Cutter, 2013).

Legislation has not been used to enforce sun safety in the UK; elsewhere, such as Australia, recent compensation payments by employers for occupational skin cancer have served to focus attention on sun safety at work (Cancer Council Western Australia, 2011). Reeder et al. (2013) suggest that in countries where no such compensation system exists but where employers nevertheless have a legal duty to protect workers, a successful legal case is likely to be required to highlight the issue and focus minds. In the absence of such a case they posit, "given the estimated treatment costs associated with skin cancer, the quantification of skin cancers among outdoor workers may assist in highlighting the need for primary prevention" (p. 85). This suggestion might equally apply in the UK context.

During the two-year period in which this investigation was conducted the research team had a number of conversations with individuals within host organisations that centred on the importance of sun exposure for the synthesis of vitamin D. Perhaps as a result of recent media reports on vitamin D and sun exposure a surprising number of individuals suggested that sun safety interventions might lead to vitamin D deficiency diseases such as rickets. It is important that the myth of sun safety posing a health risk does not become propagated. Though UV light is indeed required for the generation of Vitamin D this does not create an argument against sun safety. Indeed, ten to twenty minutes midday summer sun exposure to arms, hands, and face two or three times a week at 56° N (the latitude at which Edinburgh sits) has been shown to give Caucasians adequate Vitamin D (Thieden et al., 2008).

The nationwide survey (Project Phase 2) showed that the extent to which workers checked their entire body regularly for moles or unusual changes was low (27%). Similarly, the proportion of workers who had had their skin checked by a healthcare professional was low (18%). Given the well-established reluctance of men to visit their GP, construction companies might consider the introduction of annual skin checks by a trained health professional as a means to catch possible skin cancers in the early stages.

The Sun Safety in Construction intervention was shown to be efficacious in terms of stimulating positive change in relation to sun safety knowledge, attitudes and behaviours. Thus, an evidence base has been created to support the widespread rollout of the intervention across the industry. The authors recommend that IOSH, in collaboration with other vested interest parties, seeks to ensure that the intervention is made freely available online and that employers are made aware of its existence through appropriate promotion.

Implications for the Market

A neck cover that attaches to a safety helmet represents an example of an inexpensive and easy-to-

apply sun safety measure. In the current study the proportion of intervention group participants who regularly used this measure when working outdoors in the summer rose from 21% pre-intervention to 30% post-intervention, while the proportion of control group participants that regularly used this measure remained constant. Though this finding is encouraging, it remains the case that two-thirds of construction workers in the intervention group continued to neglect this particular sun safety measure despite it involving little expense, application effort, and disruption to work activities. This is in contrast to other sun safety measures included in the study for which improvement of as much as thirty percentage points was seen. One probable reason for the comparatively small improvement in the use of neck covers is their lack of availability. Indeed, the current authors struggled to source a suitable neck cover when producing the DVD that formed the basis of the intervention used in this project and were repeatedly informed by suppliers that such a product was available in geographic markets such as Australasia but not in the UK. It is clear that the market has a role to play in making available affordable and effective sun safety products. Items might include, for example, sun shades, neck covers that attach to safety helmets, and high-wicking long-sleeved high-visibility UV tops. The question is one of whether supply might generate demand or vice versa. It is possible that employer- and government-led efforts on sun safety might stimulate manufacturers and distributers into better supplying the UK construction sector.

Implications for Research

Given that this study showed that a theory and evidence-based sector-specific sun safety intervention is efficacious in the UK construction context, research is warranted concerning the development and evaluation of similar interventions for other high-risk outdoor worker groups. Interventions of the type created for the current study can be developed at relatively little expense. Furthermore, given that much of the material in the Sun Safety In Construction intervention is generic, sector-specific variants could be produced with ease.

The creation of a sun safety culture in UK construction will require a multi-faceted approach. The findings of this investigation suggest that in isolation sun safety interventions of the type described here might not generate wholesale cultural change. Alongside video-based interventions one potentially promising intervention might involve the provision of a daily text message to workers that communicates the weather forecast and sun safety warning for the day. Although research remains in the early stages, initial indications are that this approach holds promise. For example, Armstrong et al. (2009) sent a community sample of participants two daily text messages. The first, a "hook" text, detailed local weather information for the day. The second, a "prompt" text, reminded participants to apply sunscreen. Upon completion of a six-week trial 56% of participants who received the intervention reported having used sunscreen throughout the study period, compared to 30% of the control group. Moreover, 69% of intervention group participants indicated that they would continue to use the text message reminder service after completion of the study. Given the low-cost nature of interventions of this type, research might be warranted to explore their feasibility within the UK construction sector.

In an intervention study of this type, where a key objective is to permit any changes in knowledge, attitudes, and behaviours to be causally attributed to an intervention, it is standard practice to allocate participants to either an intervention group or a control group. In the current study a 'naturally occurring control group' was created that comprised workers who completed baseline and follow-up questionnaires but who failed, for whatever reason, to receive the intervention. The rationale for the adoption of this design was set out in Chapter 6. One of the interesting methodological findings of this study is that 42% of participants who completed both questionnaires did not view the Sun Safety in Construction DVD (the intervention). As such, a control group of almost equal size to the intervention group was created 'naturally', avoiding the need for the research team to allocate participants to groups. This situation reinforces the utility of adapted study designs in occupational health intervention studies and indicates that it may be unsafe to assume that all participants who are supposed to receive an intervention will indeed do so. Such an assumption can lead to a Type III error whereby the mistaken conclusion that an intervention was unsuccessful arises due to the incorrect assumption that all participants received an intervention as planned (Randall, Griffiths, & Cox, 2005). The designers of future worksite intervention studies might consider the naturally occurring control group design as a viable alternative to the traditional allocation of participants (or organisations) to intervention and control groups.

There is evidence to suggest that the effectiveness of occupational health and safety training/education interventions is related to the degree of engagement with the intervention required of the recipient (Burke et al., 2006). Robson et al. (2012) suggest that low-engagement methods such as passive, information-based methods, such as lectures or videos are likely to be less effective than high engagement methods which they suggest might include activities such as behavioural modelling, simulation, and hands-on training. The film-based intervention applied in the current study was evidently passive. Despite the evidence to suggest that passive interventions are typically less effective than high-engagement ones, the decision was made by the research team to employ a passive intervention because priority was given to (a) the speed with which the intervention could be delivered – in order to minimise disruption to work activities - and (b) elimination of the need for trained trainers to be present at the point of intervention delivery. The fact that the intervention generated considerable positive change suggests that in the construction context passive interventions might be appropriate. Nevertheless, on each knowledge, attitude and behaviour dimension there remained room for further improvement, post-intervention. As such, a possible extension of this investigation could involve the development and evaluation of a high-engagement intervention. The task of developing high engagement sun safety interventions that are acceptable to construction companies is likely to be a particularly difficult one. The experience of the research team in the current study was that many companies took a great deal of convincing to permit the administration of a passive intervention that required very little effort on their part and caused minimal disruption to work schedules. It might well be possible to design a high-involvement intervention that

is highly effective; however, it is unlikely that such an intervention would find substantive real-world take up.

Limitations of the Study

The key strength of this investigation is the large and representative sample size that permits generalisation of the findings to the UK construction sector. In addition, the provision of a control group allows for conclusions to be drawn on the effectiveness of the intervention. Nevertheless, the study possessed a number of limitations.

First, the participant retention rate for the follow-up (post-intervention) questionnaire was 18%. This was disappointing because it resulted in an intervention group and control group that, though sufficient to facilitate whole-group comparisons, prevented more detailed analysis of pre-post intervention change by socio-demographic and occupational characteristics. For example, it would have been interesting to examine whether respondents with high-risk skin types reported greater post-intervention behaviour change than those with lower risk skin types. Similarly, it would have been desirable to examine whether differences in pre-post change rates were evident across trades. Further studies are required that involve larger participant samples; this would facilitate the examination of change by socio-demographic and occupational characteristics which, in turn, would produce data capable of informing the design of bespoke interventions tailored for the needs of specific trades and socio-demographic groups. The response rate is somewhat lower than found in previous occupational sun safety studies; Reinau et al.'s (2013) review of 16 occupational sun safety intervention studies found that the retention rate varied between 38% and 91%. Similarly, in a review of response rates in longitudinal organisational research Taris (2013) found that the proportion of participants who participated in all waves of the study varied from 14 per cent to 90 per cent, with an average of 52 per cent of those who completed the first wave of data collection also completing the last. (Note that this review was based on a sample of 19 articles published in two management journals in 2011. Taris also noted that his review was based on articles published in top-tier journals and that lower rated journals "with less rigid reviewing procedures and lower rejection rates" (p. 28) are likely to accept papers with higher non-response rates. On this basis it can be concluded that the response rate achieved in the second wave of data collection in the current study might not be atypical). The lower retention rate found in the current study might be explained by the transitory nature of construction work; many participants who completed the pre-intervention questionnaire had changed employer by the time of post-intervention data collection. As such, the follow-up questionnaire was mailed to a home address, where such was given on the baseline questionnaire. Whereas managers dedicated a period of time for workers to complete the baseline questionnaire, it was necessary for respondents to complete the follow-up questionnaire in their own – unpaid – time, which may explain the high attrition rate. In addition, the poor retention rate might be ascribed to the general lack of importance given to sun safety in the industry, as revealed by the baseline questionnaire and the focus group findings.

Second, the possibility of non-response bias cannot be disregarded given that non-responders worked outdoors for significantly longer on a typical day and were more likely to report that sunscreen was provided in their workplace than responders. However, this is mitigated by the absence of differences between groups in terms of demographic characteristics; the groups were almost identical in terms of gender, age, skin type, personal skin cancer experience, and experience of family or close friends with skin cancer. Furthermore, both groups were geographically dispersed.

Third, uncontrollable meteorological conditions might have had a possible influence on the reporting of sun safety behaviours. Pre-intervention baseline data collection took place in the summer of 2012, the wettest since records began in 1910. Post-intervention data was collected in the summer of 2013, the sunniest and hottest since 2006. As such, respondents might have reported greater use of sun safety measures post-intervention not as a result of exposure to the intervention but simply as a result of climactic conditions making the need for sun protection unavoidable and obvious. However, the fact that the control group showed no change or change of lesser magnitude on most of the 10 sun safety measures mitigates against the likelihood of this situation having arisen. In order to control for the possible confounding effect of dramatic meteorological differences pre- and post-intervention, future studies ought to run over a period of several years, with different worker groups receiving the intervention each year, thereby ensuring that within the overall investigation period there is likely to be a sub-group of participants that contributed pre- and post-intervention data in consistent weather conditions.

Fourth, the study relied on self-report measures of sun safety behaviours. Sole reliance on self-report data is sometimes reported as a methodological weakness on the grounds that it could lead to common method variance. To eliminate the possibility of this, future studies could measure by objective means variables that are receptive to measurement in this way – such as clothing worn while working in the sun. Self-report measures can be more responsive to experimenter demands or other uncontrolled influences. However, it is unlikely that responses will have been biased given that participants were able to complete the questionnaires in a time and place that suited them, and return completed questionnaires directly to the researchers. Moreover, self-reports represent the standard approach to the assessment of sun safety behaviours and are typically consistent with researcher observations of sun safety behavior (Oh et al., 2004).

Fifth, it is possible that the sun safety behaviours of control group participants were influenced by the behaviours of those in the intervention group. For example, if a worker who viewed the DVD subsequently began to use sunscreen when working outdoors, and that individual worked alongside someone who had not viewed the DVD (but who did complete both the baseline and follow-up questionnaires), it is possible that the sun safety behaviours of the latter individual might have been influenced by the former. This could help to explain, in part, improvements in sun safety behaviours among control group participants. It is very difficult to protect against such a possibility in a real-world

intervention study where it is not possible to prevent interactions between workers in the intervention and control groups. Preventing such interactions is particularly problematic in the UK construction industry due to the transience of the population.

Finally, it is possible that companies that agreed to participate in the study had a more positive and proactive occupational health culture than companies that chose not to participate. If so, this might have resulted in the generation of an inflated – overly optimistic - sun safety profile, suggesting that the true profile is worse than presented in the current study.

Overall Conclusions and Recommendations

In sum, the project findings indicate that:

- Despite the high incidence of skin cancer among construction workers in the UK and the potential preventability of the disease, sun safety knowledge, attitudes and behaviours are generally poor across the sector.
- The Sun Safety In Construction DVD-based intervention is effective in producing significant positive change in construction workers' sun safety knowledge, attitudes and behaviours.
- Interventions designed to stimulate positive change in construction workers' sun safety knowledge, attitudes, and behaviours are likely to be effective but not wholly sufficient when applied in isolation. Initiatives that combine employee-focused educational interventions in the context of an employer-led drive on the issue are likely to represent the most effective approach, particularly where underpinned by enforcement. In short, the development of a sun safety culture in UK construction is likely to require action from employers and government.
- It is recommended that the Sun Safety in Construction film is made freely available online and construction sector employers are encouraged to integrate the intervention into annual health and safety briefings. Sun safety interventions can take as much as two decades to produce a decline in skin cancer rates (Staples et al., 1998; 2006). Alongside the nationwide rollout and promotion of this intervention, and the prioritization of sun safety within the UK occupational health research agenda, a concerted focus is required on research concerned with the development of efficacious interventions for other outdoor worker groups.

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