Factors Influencing Anticipated Decisions about Sunscreen Use

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Abstract

The present study examined influences on the decision-making processes relevant to sun-damage preventive behaviour, namely sunscreen use. Participants were randomly assigned to a positive, a negative or a control group and underwent two successive experimental manipulations: (1) information and (2) focus. They made pre-experimental, post-information and post-focus ratings of likelihood of using sunscreen and susceptibility to skin cancer. The results suggested that decision making changes as a function of the information present, and the information which individuals focus on at the time of decision making. The findings are described with particular emphasis on the implications for future intervention strategies.

Keywords

decision making, health protection, sunscreen use, susceptibility, utility theory

MEDICAL research suggests that the incidence of skin cancer in the United Kingdom has risen by at least 30 per cent over the last decade (e.g. Eiser, Eiser, Sani, Sell, & Casas, 1995), while the Skin Cancer Foundation (2002) has advised that the incidence of melanoma, which is the most lethal form of skin cancer, is rising more rapidly than any other form of cancer (Mahler, Kulik, Gibbons, Gerrard, & Harrell, 2003). The increase is at least in part due to a number of factors related to increased exposure to ultra violet radiation (UVR), namely sun exposure without protection.

Early psychosocial research on sun exposure (e.g. Keesling & Friedman, 1987) proposed that the use of sunscreen or the amount of time spent in the sun is dependent upon knowledge about the risks of sun exposure. More recently, however, it has been argued that establishing a causal relationship between skin cancer knowledge and sun protective precautions is considerably more complicated than originally postulated (Leary & Jones, 1993; Prentice-Dunn, Jones, & Floyd, 1997; Turrisi, Hillhouse, Gebert, & Grimes, 1999). Although knowledge levels are generally high, many adults and adolescents often fail to incorporate skin protective behaviours into their everyday routine, and it has been suggested that the complexity of this knowledge–behaviour link might in part be influenced by factors such as imminence and giving up a better tan (Lupton & Gaffney, 1996; Scerri, Aquilina, Amato Gauci & Dalmas, 2002). Such findings point to a need to determine the individual's subjective estimates of the probability and seriousness of the effects.

On this basis, the emphasis, in myriad psychological investigations, has turned to the prediction of risk and risk-taking behaviours. Consequently, different social cognitive correlates (e.g. risk, susceptibility and control) have been integrated into structured models in an attempt to predict health-related behaviours. A consistent feature of such models is their assumption that a person's engagement in health behaviour is dependent upon a rational process of weighing up the relative costs and benefits of the behaviour. Nevertheless, for the most part, research investigating sunscreen use has been conducted within a relatively atheoretical framework (e.g. Campbell & Birdsell, 1994; Cody & Lee, 1990; Hillhouse, Stair, & Adler, 1996), with the result that findings are of limited utility. Indeed, Hillhouse, Turrisi and Kastner advocated the utilization 'of strong theoretical decision making models which are not restricted to the examination of the health orientations or general attitudes' (2000: 406).

According to Turrisi et al. (1999) sunscreen use should be conceptualized as having multivariate cognitive influences including perceived likelihood of using sunscreen (e.g. Jones & Leary, 1994), perceived efficacy and social-normative pressures (e.g. Fishbein & Ajzen, 1975; Prentice-Dunn et al., 1997). Indeed, within general health research, perceived likelihood or susceptibility to developing an illness, and the perceived severity of the illness are often construed as forming the expression of risk (e.g. van der Pligt, 1998). Hence, it is sensible to assume that precautionary behaviour is most likely to occur when the perceived severity and vulnerability are high, the benefits of the precautionary behaviour are judged to be significant and the costs of the behaviour change are low (Janz & Becker, 1984; van der Pligt, 1998).

Utility theory

Psychological theories of behavioural decision making have been based, for the most part, on a framework of laws of probability and normative models originating from utility theory (von Neumann & Morgenstem, 1947). According to this theory the individual endeavours to obtain a maximum of utility based on the assumption that rational decision making involves the systematic weighing up of alternatives which results in the maximization of positive outcomes compared to negative outcomes (Wroe, Salkovskis, & Rimes, 1998). Thus, utility theory specifies that an individual will decide on a course of action that, at the time of making the decision, is judged to be the most useful, i.e. the decision that maximizes utilities. Within a health-related framework it is assumed that any attempt to predict when an individual will take precautions against an illness must take into account the nature of the threat (Weinstein, 2000). In this way utility theory would consider a decision as a simple multiplicative relationship between the perceived probability of

developing the disease and the perceived severity of the disease, meaning that the motivation to act is predicted to be zero when either variable is zero.

Experimental research (e.g. Lichtenstein, 1973; Tversky & Kahneman, 1981), however, indicates that such rational decisions are an inconsistent phenomenon as deviations occur frequently. Indeed, within the health domain individuals often partake in what might appear to be objectively inappropriate decisions. This led Wroe and Salkovskis to suggest that utility theory ought to be modified within a 'more explicitly cognitive framework' (1999: 20) based on Beck's cognitive model (Beck, 1976), such that the emphasis shifts to more subjective premises. In other words, the reasoning behind a given decision is idiosyncratically determined according to a person's prevailing internal logic (Wroe & Salkovskis, 1999; Wroe et al., 1998).

Accordingly, Wroe and colleagues (1998, 1999) demonstrated that one's anticipated decision to undergo genetic testing is influenced by at least two factors: (1) the information available at the time of making the decision; and (2) the issues on which focus is being directed. In other words, a person will base a decision on their own subjective premises and specific information which is deemed to be of relevance at the time of making the decision, even if this information is factually wrong. Specifically, they manipulated experimentally; (1) the information that individuals received about genetic testing; and (2) the information that they focus on and measured the impact on likelihood of decision making. Wroe et al. (1998, 1999) consistently found that a person's likelihood of deciding to undergo predictive genetic testing was influenced, to a significant degree, simply by directing the individual's focus to certain issues. In this way, for example, women who were asked to focus on the possible actions they could take to reduce the chances of developing breast cancer (positive group), reported a significant increase in the likelihood of opting for genetic testing. Furthermore, women who were asked to focus on the outcomes of getting a negative result of such a test (negative group), showed a significant decrease in likelihood of opting for testing. In addition, it was found that the increase reported by women in the positive group was accompanied by an increase in anxiety about breast cancer, whereas, women in the negative group experienced a decrease in anxiety. The same pattern was also observed for perceptions of severity. Consequently, such findings highlight the relevance of research into the decision processes involved in health behaviours.

Prospect theory (Kahneman & Tversky, 1979) would make similar predictions about the impact of the presentation of positive and negative information (i.e. framing) albeit that it does not make precise predictions about anxiety.[1] Specifically, Rothman and colleagues would suggest that, as sunscreen use is a preventative behaviour, there would be a gain frame advantage (e.g. Rothman & Salovey, 1997). However, to ensure comparability with Wroe and colleagues and to account for the information and focus condition differences, we limited the discussion here to utility theory.

Gender differences

Major differences occur in the health prospects of men and women, for example there are reported differences in condom use (Campbell, Peplau, & DeBro, 1992) and smoking (Grunberg, Winders, & Wewers, 1991). Therefore it is not surprising that previous research (e.g. Campbell & Birdsell, 1994; Lowe et al., 2000; Schofield, Freeman, Dixon, Borland, & Hill, 2001) also suggests significant gender differences with respect to sunscreen use: women exhibit higher rates than men. What is more, research also indicates that women appear to have a higher level of knowledge about skin cancer (Clarke, Williams, & Arthey, 1997; Robinson, Rigel, & Amonette, 1997), and believe they are more susceptible to skin cancer (Arthey & Clarke, 1995), than men. Despite such a clear gender distinction in skin cancer relevant attitudes, little research effort has been aimed at investigating possible determinants of these differences, which should be of considerable value to the successful development of sun protection interventions (Abroms, Jorgensen, Southwell, Geller, & Emmons, 2003). Hence, we felt it important to investigate gender differences across anticipated sunscreen use.

In the present study we investigated whether utility theory could be successfully applied to a behaviour (sunscreen use), which people, in general, know a lot about (possess a high level

of baseline knowledge). In short, can it be used to modify one's anticipated likelihood to use sunscreen and perceived susceptibility?

Specifically, it was hypothesized that:

1. Participants who received positive information about the value of sunscreen use (positive group) would exhibit an increase in their estimates of: (a) anticipated likelihood of using sunscreen; and (b) severity of finding out that one has an 80 per cent increase of developing skin cancer (information manipulation).
2. Participants who were provided with information about the limitations of sunscreen use (negative group) would demonstrate a decrease in their estimations of the two dimensions outlined above.
3. A similar pattern of results (as outlined above) would emerge when individuals are asked to contemplate further/focus on specific aspects of sunscreen use (focus manipulation).
4. Women would provide higher ratings than men across all dimensions.

Method

Participants

One hundred and seventy-one participants were recruited from two industrial companies, both situated in central Scotland. All potential participants were given a brief introduction about the nature of the study (that it was a 10–15 minute interview about health psychology) and informed that participation was voluntary, confidential and that they could withdraw at any time. Ethical approval had been obtained from the Department of Psychology's Research Ethics Committee. The demographic composition of the participants was as follows: 72 males and 99 females with a mean age of 41.25 years (SD = 12.38; range 18 to 73 years). There was no significant effect of age by gender.

Materials and procedure

Those who agreed to take part were provided with basic information about the prevalence of skin cancer and then asked to give ratings to two questions adapted from Wroe and Salkovskis (1999). Both ratings were on a 0–100 scale with 0 stating the most negative response and 100 stating the most positive response: (1) *Anticipated likelihood* (decision 1) of using sunscreen was assessed using one item 'How likely are you to use sunscreen? (0 = "never", 100 = "always")'; and (2) the severity of the knowledge that one has an 80 per cent likelihood of developing skin cancer was measured using one item 'How bad would you feel if you found out you had an 80 per cent chance of developing skin cancer? (0 = "not bad at all", 100 = "the worst thing that could ever happen to anyone")'. This item is referred to as *susceptibility* hereafter (susceptibility 1).

Participants were then allocated randomly to one of three experimental groups: *positive* information manipulation (n = 62; 21 males and 41 females), *negative* information manipulation (n = 55; 28 males and 27 females) and *control* information manipulation (n = 54; 23 males and 31 females). As each of the three groups received different information, this was known as the *information manipulation*. The information in the positive manipulation condition included descriptions of the efficacy of sunscreen use, the different types of sunscreens and how a history of sunscreen usage can dramatically reduce skin cancer. The negative manipulation condition outlined the problems with sunscreen usage and that most sunscreens still allow some UV rays through (thereby offering limited protection against photo-ageing of the sun). In the third condition, the control manipulation, participants received sunscreen irrelevant information describing the characteristics of the common cold. The information manipulations, devised by the first author, were collated from various health promotion and medical sources and were matched for word length (negative = 226 words, positive = 218 words and control = 218 words; $F_{(1, 2)} = 3.00$, NS). By way of a pilot study, 12 participants were asked to rate, on 5-point unipolar scales, the degree to which the information was positive or negative. A paired samples t-test demonstrated that there was a significant difference between the value attached to the negative information and the value attached to the positive information ($t = -4.600$, d.f. = 11, $p < 0.001$) in the predicted direction.[2]

Next, the two experimental groups (but not the control group) were asked to make a second rating about the likelihood of using sunscreen in

Table 1. Demographics and means (standard deviations in parentheses) of the pre-experimental ratings by group

	POSITIVE (n = 62)		*NEGATIVE (n = 55)*		*CONTROL (n = 54)*	
GROUP	*Male (n = 21)*	*Female (n = 41)*	*Male (n = 28)*	*Female (n = 27)*	*Male (n = 23)*	*Female (n = 31)*
Likelihood of sunscreen use	2.15	(1.77)	2.80	(1.44)	1.89	(1.86)
Severity of an increased susceptibility to skin cancer	74.47	(20.97)	74.44	(18.17)	72.20	(18.55)

the future (i.e. decision 2). Next, all three groups were asked to respond to a series of open-ended questions. This was known as the *focus manipulation*. They were asked to describe in their own words the main points of the information that they had just read. Hence, the positive group was asked to describe possible actions that could be taken to reduce the likelihood of developing skin cancer. Similarly, the negative group was asked to describe the limitations of sunscreen use and the control group was asked to describe methods to reduce the spread of the common cold.

Participants were then asked to rate 10 replies to a statement relevant to each group (e.g. the control group was asked to rate replies to the statement: 'If I have a cold coming on . . .'). The 10 statements for the positive and the negative groups were adapted from Wroe and Salkovskis' (1999) study. Furthermore, the participants were asked to rate how much the information presented previously would affect their life. Finally, participants were asked again to rate the question 'How likely are you to use sunscreen?' (decision 3) as well as the measure of susceptibility. Although this is only the second time that susceptibility is measured, for the purpose of consistency during data analysis, and consonant with Wroe and Salkovskis (1999), it is referred to as 'susceptibility 3'. All participants were subsequently thanked and fully debriefed. See Table 1 for the demographics and means of the pre-experimental ratings by group.

Results

A one-way ANOVA yielded no significant differences ($F_{(2, 168)} = 1.744$, NS) in age by group and the distribution of gender by group was also similar ($\chi^2 = 3.48$, d.f. = 2, NS). Preliminary analysis of decision 1 (i.e. likelihood of using sunscreen) using a one-way ANOVA showed that there was a significant difference between the three groups in the initial estimation of likelihood of using sunscreen ($F_{(2, 168)} = 5.07$, $p < 0.01$); however, post hoc tests revealed that this difference was entirely accounted for by the negative group–control group comparison ($p < 0.01$). This suggests that the positive and negative groups were equally likely to use sunscreen.[3]

Likelihood of using sunscreen

Exploratory analysis revealed that the likelihood scores were negatively skewed, hence, as recommended by Tabachnick and Fidell (2001, p. 81), the raw scores were reflected and log transformed before inclusion in ANOVA. The ratings for estimated likelihood of using sunscreen were analysed using a three-way mixed ANOVA (i.e. positive versus negative by male versus female by decision 1 versus decision 2 versus decision 3). Mean ratings for the decisions by group are shown in Fig. 1. Consistent with Wroe and Salkovskis (1999), the control group was not included in this analysis as members of this group did not rate likelihood of using sunscreen at decision 2.

The subsequent analysis of variance revealed that there was a significant main effect of decision (decision 1 versuss decision 2 versus decision 3; $F_{(2, 230)} = 8.69$, $p < 0.001$), that is, there was a significant increase in ratings of likelihood of using sunscreen. There was also a main effect of group: individuals in the negative group indicated a higher likelihood of using sunscreen than individuals in the positive group (positive ($M = 2.05$) versus negative ($M = 2.61$); $F_{(1, 115)} = 4.04$, $p < 0.05$) and a main effect of gender ($F_{(1, 115)} = 5.59$, $p < 0.05$), but none of the interactions were significant. However, it should be

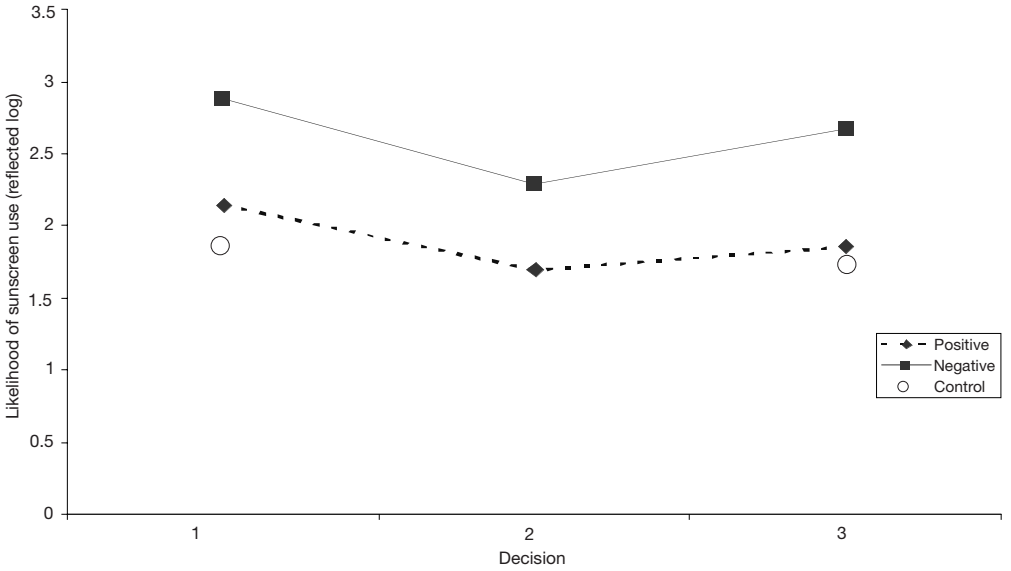

Figure 1. Mean ratings of likelihood of using sunscreen.
Note: The likelihood scores are reflected logs, therefore, a lower score represents higher sunscreen use

noted that there was some evidence of a decision × gender interaction ($p = 0.29$). As expected females reported significantly higher likelihood to use sunscreen than men ($M = 2.00$ versus 2.66 for males and females).[4] Next, planned comparisons were carried out consistent with the hypotheses outlined earlier. To reduce the likelihood of making a Type I error the more stringent $p < 0.01$ level of significance was adopted. The comparisons identified the existence of a significant difference between decision 1 and decision 2 for both the positive and the negative groups respectively ($t = -3.11$, d.f. = 61, $p < 0.005$; $t = -3.04$, d.f. = 54, $p < 0.005$). As expected the positive group showed a significant increase in likelihood of using sunscreen following the information manipulation. However, contrary to the hypothesis, this effect was also demonstrated for the negative group. For the positive group there was no significant change between decision 2 and decision 3 ($t = -1.65$, d.f. = 61, NS), whereas the negative group showed a significant decrease in ratings ($t = -2.89$, d.f. = 54, $p < 0.01$). That is, not until after the focus manipulation did the negative group show the expected decrease in likelihood of using sunscreen. The control group, as predicted, showed no significant difference in ratings between decision 1 and decision 3 ($t = -0.74$, d.f. = 53, NS).

Susceptibility

On the question of whether the knowledge that one has an 80 per cent increase in the likelihood of developing skin cancer would affect the perceived severity of skin cancer, a three-way mixed ANOVA (decision × gender × group) was performed to look at the changes between the pre-experimental and post-manipulation ratings by group. The mean ratings of susceptibility 1 and 3 across the groups are shown in Fig. 2.

Analysis shows a significant main effect of susceptibility ($F_{(1, 168)} = 15.06$, $p < 0.001$), and a significant susceptibility by group interaction ($F_{(2, 168)} = 8.40$, $p < 0.0001$), but not a main effect of group ($F_{(2, 168)} = 1.42$, *NS*). Post hoc *t*-tests elucidated the interaction effect – a significant decrease in ratings of susceptibility (pre- and post manipulations) was evident in the negative group only ($t = 5.495$, d.f. = 54, $p < 0.0001$). Similar to the likelihood findings, women reported significantly higher susceptibility than men ($M = 75.78$ vs $M = 63.88$ for women and men respectively).

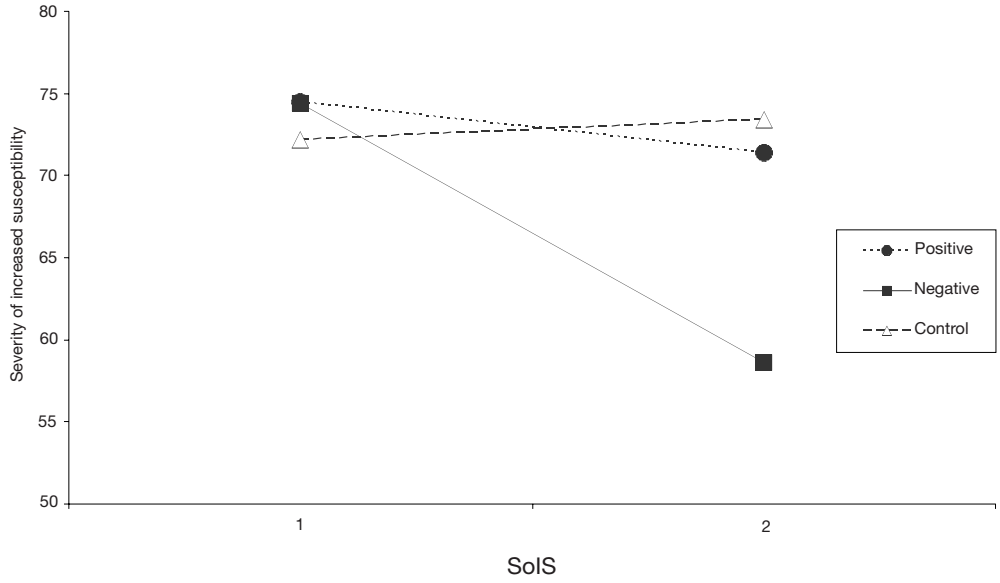

Figure 2. Mean ratings of severity of finding out that one has an 80 per cent increase in likelihood of developing skin cancer (Susceptibility; SoIS).
Note: The likelihood scores are reflected logs, therefore, a lower score represents higher sunscreen use

Discussion

Overall the experimental hypotheses were partially supported. Although it was found that positive information did result in an increase in perceived likelihood of using sunscreen, this was also the case when presented with negative information. As predicted negative information resulted in a decrease in perceived susceptibility of contracting skin cancer; however, the positive information did not result in the predicted increase in perceived susceptibility. Finally, the hypothesized link between gender and ratings of likelihood of sunscreen use and susceptibility to skin cancer was confirmed. The findings point to a more complex relationship between the manipulations and their influence on anticipated decisions about sunscreen use, than was hypothesized.

The results suggest that a person's decision about whether or not to use sunscreen can be influenced by the information that is available at the time of decision making. Furthermore, they indicate that decisions can also be influenced by the issues on which one focuses. However, due to the fact that ratings are only provided pre-experimentally and post-focus, it is unclear which manipulation led to the change in the susceptibility rating. Wroe and Salkovskis (1999) suggest that the exact role of the focus manipulation is ambiguous, as this manipulation could work independently by affecting individuals' perceptions, but it could also simply be magnifying the change already experienced following the information manipulation.

One possible explanation for the likelihood result could be that, in contrast to deciding whether to undergo predictive genetic testing, the decision about whether to apply sunscreen or not is qualitatively different, as it is associated with a higher level of baseline knowledge prior to any manipulations. Therefore any new information would probably be processed in terms of relevance to an existing schema, rather than as completely new information.

Detweiler, Bedell, Salovey, Pronin and Rothman (1999) further argued that a critical difference between performing a detection behaviour (e.g. screening) and a prevention behaviour (e.g. sunscreen use) lies in the perceived degree of proximal risk. That is, detection behaviours are conceptualized as being

risky at the time of engaging in the actual behaviour as there are immediate inherent costs and benefits to engaging in the behaviour; whereas a prevention behaviour, such as sunscreen use, is a low-risk behaviour in as far as although its use will directly reduce the risk of skin cancer in the future, it offers little or no current risk to the individual.

It seems that providing information about sunscreen use, whether it be positive or negative, leads to an increase in perceived likelihood of using sunscreen. However, the focus manipulation did result in a significant decrease in ratings of likelihood of using sunscreen for the negative group (decision 2 versus decision 3) albeit weakly, relative to the increase found after the information manipulation. Such findings may be indicative of differential information processing strategies. Most health behaviour models focus on controlled information processing thereby assuming that decisions about risk behaviours are based on conscious actions (van der Pligt, 1998). As a result, less work has investigated the relative importance of automatic information processing. Such an interpretation would, therefore, be consistent with the decrease in likelihood after the focus manipulation as a result of the more elaborate encoding strategies employed in the focus condition (participants are asked to describe in their own words the limits of sunscreen use).

The role of gender

The unexpected increase in likelihood of using sunscreen experienced by the negative group may be due to the women's ratings. Although, the gender x decision interaction was not significant, there was a non-significant trend to this end. As the women's pre-experimental ratings of this dimension were already higher than men's, it could be argued that women started off with a more positive state of baseline knowledge about sunscreen use. Another possible explanation could be that it is more difficult to override a baseline knowledge level that is already very positive, than one that is neutral. Indeed, it appears likely that an attempt to override a very positive schema by presenting negative information is counter-productive—as seems to have been the case in the information manipulation. Those in the negative information manipulation may have rejected the negative information as it did not conform with their existing sunscreen schema; rather it consolidated their existing schema leading to an increase in likelihood of use of sunscreen. This argument is supported by research in the social psychological domain. For example, Rothbart (1981) posits that a schema will not be converted or changed until a critical mass is attained. Hence the information manipulation does not reach critical mass, but does so after the focus manipulation where we see a significant decrease in likelihood of sunscreen use in the negative group.

Moreover, it would be of interest to determine whether there are pre-existing differences in these baseline knowledge levels, such that women may possess higher knowledge levels than men (Cody & Lee, 1990; Keesling & Friedman, 1987). In short, the present results suggest that when the consequences of a behaviour are well known, namely a well-established schema has been formed, processes other than those suggested in the modified utility theory operate. That is, information or strategies that are used to construct attitudes may be contingent upon and predictable from a diversity of task, context and individual difference factors (Payne, Bettman, & Johnson, 1992). It is also worth noting, that these findings are also consistent with a gain frame advantage if interpreted within prospect theory.

The interaction effect concerning how one would feel if they discovered they had an 80 per cent risk of developing skin cancer is of considerable interest. The groups did not differ pre-experimentally, however, after the manipulations those in the negative group decreased in their rating of how severe it would feel to be so diagnosed. It is difficult to be certain of the precise mechanism that resulted in this change. However, it is possible to consider these findings in terms of cognitive dissonance theory (Festinger, 1957). This theory is based on the premise that individuals tend to seek consistency among their beliefs and opinions (i.e. cognitions), and that when attitudes or behaviours become inconsistent it is necessary to eliminate such dissonance. In this way Festinger argued that an individual will avoid information (e.g. negative information about sunscreen efficacy) that is likely to result in or increase dissonance.

Wicklund and Brehm (1976) added to this

theory by suggesting that, in particular, personal responsibility for undesirable consequences is the ultimate cause for dissonance. In this way, a sense of responsibility or accountability is only present when, despite being able to foresee problems, we persist with a given behaviour. If this thinking is then applied to the current research finding it can be proposed that when one realizes how futile the use of sunscreen is in the fight against skin cancer the perception of control is reduced and so there is no point in worrying about it.

Consistent with previous research (e.g. Campbell & Birdsell, 1994) women rated their likelihood of using sunscreen higher than men. This can, perhaps, be explained in terms of anxiety concerning the possible negative consequences of unprotected sun exposure (Keesling & Friedman, 1987). This is supported by the finding that female participants also expressed significantly higher levels of risk susceptibility about skin cancer than men did. Such an interpretation is also consistent with recent research by Abroms et al. (2003), which indicates that it is possible to conceptualize female sunscreen use in terms of preventive behaviour (i.e. they are more likely to wear it on an everyday basis, while also being more likely to apply it prior to or soon after sun exposure). In contrast, male sunscreen use is better thought of in terms of a reactive behaviour, as they are less likely to use sunscreen on a regular basis, and will more commonly apply sunscreen after sun exposure or sunburn.

Although the pre-experimental likelihood ratings suggest that participants were well aware of the health-related benefits of sunscreen use, it is unclear whether such estimates were made on the basis of use on a specific occasion (e.g. foreign holidays), or whether they were estimates of daily use. Furthermore, it is unknown what sun protective factor is used by participants, and whether female participants included use of facial creams and foundations with SPF in their self-reported use.

The present study presents a novel framework for understanding the decision-making processes relevant to sunscreen use. Thus, any intervention programme aimed at increasing the levels of sunscreen use ought to take cognizance of the differential importance of type of information and focus. Although we have extended the previous work in this area, potential limitations of this study should not be ignored. As this study relied on self-reported data we recognize that demand characteristics may have been at play. However, it is argued that sunscreen use is a relatively neutral behaviour compared to, for example, smoking, and therefore, should be less susceptible to such problems. What is more, in contrast to many studies in this area the participants in this investigation were not students hence they are more likely to be representative of the general population. Finally, a number of key variables were not included in this study. To aid theoretical development, future research should incorporate, for example, past behaviour, proximal risk, levels of future risk, self-efficacy and other social cognitive factors.

To conclude, this study offers some support for Wroe and Salkovskis' (1999) study by showing that the type of information present at the time of decision making can influence an individual's perceived likelihood of using sunscreen as well as how they would feel if they discovered that they were particularly susceptible to skin cancer. We have also extended Wroe and Salkovskis' findings, to incorporate a high baseline knowledge health behaviour, which yielded significant gender differences across all measures. Indeed, the premise that decisions are based on a process of internal subjective logic appears to be of some relevance to a high baseline knowledge behaviour such as sunscreen use. However, due to the complex nature of sunscreen use, a number of limitations of utility theory are also proposed. Thus, further modifications might be necessary to accommodate the influences of high baseline knowledge on intentions and subsequent behaviour. The results of this study add to the existing pool of research that highlights the need to consider subjective decision making in terms of conscious and automatic processing of health-related information.

Notes

1. Wroe and Salkovskis' modified version of utility theory is based on Beck's cognitive theory (e.g. Beck, 1976).
2. Full details of the information are available on request from the corresponding author.
3. Therefore, this does not interfere with the likelihood analyses as the control group was not included.

4. Because the likelihood scores were reflected before being log transformed, a *lower* score represents *increased* likelihood to use sunscreen.

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