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Illness risk representations and motivations to engage in protective behavior: The case of skin cancer risk

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Abstract

This study evaluates the contents of representations of skin cancer risk and their associations with risk appraisals, worry, and protection intentions and behaviors. The Assessment of Illness Risk Representations (AIRR) was used to measure conceptual and imagery contents of risk representations, as delineated by the Common-Sense Model. University students ($N = 120$) completed the AIRR; measures of likelihood and severity appraisals, and worry; and measures of skin self-examination, clinical skin examination, and sun protection intentions and behaviors. Beliefs about identity, causal, and timeline risk were positively associated with likelihood appraisals, whereas consequences and timeline risk beliefs were positively associated with severity appraisals. Identity and timeline risk independently predicted worry. Representational attributes, including imagery vividness and valence, independently predicted intentions and behaviors, whereas likelihood and severity appraisals did not. Symptom imagery interacted with worry to predict detection and prevention intentions: worry predicted greater intentions for participants with symptom imagery but not for those without symptom imagery. The findings support the utility of the AIRR for assessing risk representations and identify ways in which risk representations may guide protective behavior.

Keywords: *Risk perception, illness representations, health behavior, cancer, skin cancer*

Introduction

Risk perceptions are identified by many theories as primary motivators of health behaviors (Brewer, Weinstein, Cuite, & Herrington, 2004; Floyd, Prentice-Dunn, & Rogers, 2000) and there is increasing recognition that worry and other risk-related affect also influence protective intentions and actions (Loewenstein,

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Weber, Hsee, & Welch, 2001; McCaul, Schroeder, & Reid, 1996). Yet it remains to be determined what information serves as the basis for these risk appraisals and affect. Likelihood and severity estimates are probably made ''on the spot'' rather than retrieved from memory (Windschitl, 2002), and so they will be shaped by accessible beliefs and memories. In order to change risk perceptions and worry in ways that motivate protective behavior, it is important to identify the mental contents underlying these risk appraisals and affect as well as the various ways in which these contents may influence motivations to engage in protective behavior. This study evaluates the relationships of representations of skin cancer risk with risk appraisals, worry, and protection intentions and actions. The study focuses on skin cancer because it is a familiar threat to young adults in New Zealand, where skin cancer incidence rates are among the highest in the world (Stewart & Kleihues, 2003). Moreover, protection involves regular use of both prevention and detection behaviors and so there is the opportunity to evaluate the roles of risk representations for both types of protective action. Evidence suggests that cognitions and affect may differentially influence prevention and detection motivations (Cameron, 2003a).

   The Common-Sense Model (CSM) provides a framework for identifying the contents of health threat representations, and for understanding how these cognitions and associated emotions motivate protective behavior (Leventhal, Brisette, & Leventhal, 2003). According to the CSM, representations include five attributes: identity (the illness label and symptoms), cause (factors responsible for its occurrence), timeline (time of onset and course of the illness), consequences (expected pain, psychosocial effects, and death) and control/cure (personal and medical control over illness progression). These representations elicit emotional arousal such as worry, and both representations, and emotions guide decisions to engage in protective behavior. The CSM delineates abstract–conceptual processes and concrete–experiential processes in cognitive and emotional systems (Epstein et al., 2004; Paivio, Walsh, & Bons, 1994; Kreuter et al., 1999; Stacy, Ames, & Knowlton, 2004a), with representations including both abstract beliefs and concrete images. Despite recognition of the potential role of imagery processes in health behavior (Stacy et al., 2004a; Stacy, Pearce, Zogg, Unger, & Dent, 2004b), there has been little systematic exploration of these processes to date.

Representations of illness risk

Although research with illness groups has yielded considerable information regarding illness representations and their associations with affect and behavior (Hagger & Orbell, 2003), there has been little effort to explore representations of illness risk held by healthy people (for exceptions see Figueiras & Alves, 2007; Kelly et al., 2005; Marteau & Weinman, 2006). It is proposed that illness risk representations are distinct from illness representations in that they develop from the process of matching characteristics of the self with illness representation attributes (Cameron, 2003b). For example, one's representation of causal factors

relating to skin cancer risk (''my history of sunburns puts me at risk of skin cancer'') is based on matching self-characteristics (''I've had a lot of sunburns'') with beliefs about the causes of skin cancer (''sunburns cause skin cancer''). When aspects of self-representations do not match with corresponding elements of illness representations, then risk beliefs will be low (''I've had a lot of sunburns, but sunburns don't cause skin cancer and so I'm not at risk'').

It is proposed that the five attributes of illness risk representations link directly with risk-related appraisals and worry (Cameron, 2003b). The attributes of identity, cause, and timeline are expected to serve as the basis for the generation of likelihood estimates. Within the context of skin cancer, identity may include conceptual beliefs that one's features (e.g., pale skin) puts one at risk as well as images of risk symptoms, such as large moles on one's back. Causal risk beliefs, which relate to personal experiences that place one at risk, may include beliefs such as ''skin cancer runs in my family'' as well as memories and images, such as those of one's father dying of melanoma. Timeline beliefs that are of potential importance for risk responses concern the potential time of illness onset; these contents may include conceptual beliefs, such as ''I'm too young to get skin cancer'' and concrete contents, such as images of old people with skin cancer lesions. The remaining two representational attributes, consequences and controllability, are expected to serve as the basis for severity estimates. Contents relating to physical and disability consequences of an illness should promote greater severity appraisals, whereas beliefs that the illness could be controlled through treatment should reduce perceived severity. Control over prevention may be an additional, unique attribute of illness risk representations. Beliefs that one can take actions to prevent the illness may reduce likelihood estimates and worry. These beliefs overlap with the theoretical concepts of self-efficacy and response efficacy, coping resources beliefs which often predict protection motivation (Floyd et al., 2000). Given their richness and structure, illness risk representations may influence protection intentions and behavior in ways that are independent of their influences on likelihood and severity appraisals or worry.

Imagery contents of representations

Information represented as images may have stronger influences on behavior relative to information represented at an abstract level (Metcalfe & Mischel, 1999; Paivio et al., 1994; Stacy et al., 2004a). Mental images are linked with coping skills and knowledge, such as the scripts for taking action, and so they may be particularly potent cues to protective action (Leventhal et al., 2003; Stacy et al., 2004a). For example, vivid images of sunscreen bottles and hats evoked when thinking about skin cancer may prompt intentions to use sunscreen and wear protective clothing when going outside. Moreover, positive imagery may trigger approach motivation processes, orienting attention to the gains in adopting a behavior. Research suggests that approach motivations are particularly effective in promoting prevention behaviors (Rothman, Kelly, Hertel, & Salovey, 2003).

Symptom imagery is likely to be a common type of imagery associated with illness risk, as symptoms are primary identity features of illness (Leventhal et al., 2003). Moreover, just as symptom experiences are primary motivators of protective behavior (Cameron, Leventhal, & Leventhal, 1993; Leventhal et al., 2003), symptom imagery may be a powerful trigger for protective actions. For illness risk behavior, the elicitation of symptom imagery may serve as a catalyst for decision-making processes for taking protective action. As concrete signs of danger, symptom images may activate the controlled consideration of the need to protect oneself, given one's risk-related beliefs and worry. Concrete–experiential and emotional systems are closely linked (Epstein, 1994), and so symptom imagery may be particularly likely to trigger the affective processes through which worry promotes motivations for protective behavior. In effect, symptom imagery may moderate the influence of worry on decisions to engage in protective action. The activation of symptom imagery may trigger the affective processes of decision-making, with higher worry leading to greater intentions and actions. In the absence of symptom imagery, worry may not be sufficient to motivate action. Associations between worry and protection motivations are variable, ranging from moderate to weak or nonsignificant (e.g., McCaul et al., 1996), suggesting that other risk-related cues may influence the impact of worry with protective intentions and actions. Symptom imagery may be one such cue, in which the combination of worry with symptom imagery may be needed to induce decisions to engage in protective actions.

Study aims

This study explores the contents of skin cancer risk representations using a new measure, the Assessment of Illness Risk Representations (AIRR). The AIRR is based on a measure of illness representations (the Illness Perceptions Questionnaire-Revised or IPQ-R; Moss-Morris et al., 2002), but it is adapted to address unique aspects of risk representations as well as imagery contents. This measure applies principles underlying free-association and top-of-mind awareness techniques designed to elicit contents with the strongest associations with a construct (Nelson, McEvoy, & Dennis, 2000; Stacy et al., 2004b). The study also assesses the relationships of risk representational attributes with perceived likelihood and severity, worry, and protection and detection motivations. In terms of abstract–conceptual contents, the study tests the hypotheses that: (a) Identity, cause, and timeline risk beliefs will be positively associated with likelihood perceptions; (b) Greater consequences beliefs and lower control risk beliefs will be associated with greater severity perceptions; (c) All representational beliefs will be associated with worry; and (d) Representational beliefs will be directly associated with intentions when likelihood, severity, and worry are controlled. In terms of imagery contents, it is predicted that: (a) Positive and vivid imagery will be associated with greater prevention intentions and actions; and (b) Skin symptom imagery will moderate the

relationship between worry and protection motivation, with worry more strongly associated with motivation when symptom imagery is present than when it is not.

Method

Participants and procedure

Participants ($N = 120$) were recruited from classes at the University of Auckland during either the first week ($N = 94$) or the last two weeks ($N = 36$) of the academic year, when warm weather and high UV levels were expected over the upcoming month. The sample consisted of 75 women and 45 men (age range $= 18$–53 years, $M = 25.84$), none of whom had ever been diagnosed with skin cancer. Participants identified their ethnicity as New Zealand European (76%), Asian (10%), Maori or Pacific Island (9%), or other (6%).

Participants completed a survey with the AIRR for skin cancer and measures of likelihood, severity, worry and intentions for detection and prevention behaviors. Those recruited at the beginning of the year received a second survey during classes held four weeks later. This survey included measures of detection and prevention behavior, and the AIRR subscales warranting assessments of test–retest reliability. Of these 94 participants, 79 (84%) completed the follow-up survey. Participants recruited at the end of the year did not receive the second survey because classes were no longer in session. They did not differ from the other participants on any of the AIRR, perceived risk, worry, or intention variables.

Assessment of illness risk representations (AIRR)

The AIRR begins with an imagery subscale, followed by subscales assessing the abstract contents of the risk representations. Many items of the abstract belief subscales (Appendix) were adapted from items used in the IPQ-R. Subscale score ranges, internal consistencies, and test–retest reliabilities are presented in Table I.

Imagery.   The imagery subscale begins with the following instructions:

> "We are interested in understanding some of the images that immediately enter your mind when you think about a specific topic. In order to investigate this, we would like you to list five images that you immediately associate with a particular topic. These may be single words, or small phrases. It is important that you do this quickly—do not spend too much time thinking over your answers. Remember that it is your immediate impressions that we are interested in. Think for a moment about: Skin Cancer. What are the first five images that come to your mind when you think about this condition? Please list these images below."

Five numbered lines are provided, after which are the instructions:

> "Now we want to be sure we understand if these images mean something positive or negative to you. Please rate your images in the order in which you gave them on the scales below."

Each image is then rated on a scale with response options of *very negative/very bad, somewhat negative, neutral, somewhat positive* and *very positive/very good.*

Table I.   Descriptive statistics and correlations for the subscales of the Assessment of Illness Risk Representations (AIRR) technique.

	1	2	3	4	5	6	7	8	9	10	11
1. Identity risk	–										
2. Causal risk	0.49**	–									
3. Timeline risk	0.04	0.20*	–								
4. Pain consequences	0.21*	0.00	0.11	–							
5. Shortened life consequences	0.09	-0.09	0.23*	0.36**	–						
6. Psychosocial consequences	-0.07	-0.20*	0.07	0.44**	0.41**	–					
7. Personal control-prevention	-0.04	0.05	0.18*	0.18*	0.12	0.07	–				
8. Personal control-cure	-0.10	-0.16	-0.02	0.06	-0.03	0.12	0.38**	–			
9. Treatment control	0.04	0.03	-0.09	-0.06	-0.12	-0.14	0.26**	0.54**	–		
10. Imagery positivity	-0.06	0.02	0.13	-0.22*	-0.03	-0.18*	0.07	-0.08	0.01	–	
11. Imagery vividness	-0.10	-0.12	0.11	-0.01	0.07	0.06	0.22*	0.04	0.01	0.04	
Mean	14.76	39.80	4.58	3.49	3.18	3.12	4.03	3.60	3.75	-0.78	3.66
SD	10.19	20.81	1.63	0.69	0.63	0.75	0.62	0.64	0.55	0.68	0.67
Possible range	0–47	0–100	1–10	1–5	1–5	1–5	1–5	1–5	1–5	-2–+2	1–5
Internal consistency α	0.67[a]	0.47[a]	0.79	0.75	0.67	0.72	0.74	0.56	0.65	0.49[a]	0.34[a]
Test–retest reliability	0.85**	0.72**	0.67**	0.53**	0.67**	0.67**	0.58**	0.42**	0.65**	0.36**	0.37**

Note: $*P < 0.05$; $**P < 0.01$.
[a]Although internal consistency α values are reported, items on these subscales were not assumed to covary.

These response options were later coded as −2, −1, 0, 1, and 2, respectively. The final section read,

> "Now we would like you to rate how vivid your images were overall. Please circle a number for each image using the following scale, ranging from "no image at all (you only "know" that you are thinking of something)" to "perfectly clear and as vivid as normal vision."

Each image is rated on a scale with response options of *no image at all* (1), *vague and dim* (2), *somewhat vivid* (3), *reasonably vivid* (4), and *perfectly clear and vivid* (5). Responses are used to generate three sets of imagery scores: content, positivity, and vividness. For imagery content, each image is categorized into one of the categories listed in Table II. For each content category, respondents are coded as "1" if one of the five images falls into that category and as "0" if none of the images fall into that category. Inter-rater reliability was high; Cohen's Kappa = 0.92. Positivity is calculated as the average positivity rating for the five images and vividness is calculated as the average vividness rating for the images.

Identity risk beliefs. The identity risk subscale yields scores reflecting the combination of beliefs about having certain characteristics or symptoms (Appendix) and beliefs about the risk potential of these features. Responses of whether one has a feature are coded as 1 (*yes*) and 0 (*no*). Each feature is then rated from 0 (*definitely not*) to 4 (*definitely*) in response to "Do you think that this characteristic puts a person at risk for skin cancer?" (features 1–8) or "Do you think that this symptom or feature may be a sign of skin cancer?" (features 9–23). Scores are generated by calculating the product of the two ratings for each feature, and then summing the products: Identity risk = Σ [Feature: 0 or 1] × [Risk potential of feature: 0 to 4].

Causal risk beliefs. The causal risk subscale yields scores reflecting the combination of beliefs about experiences that cause skin cancer and beliefs about one's history of those experiences. The subscale uses the standard IPQ-R instructions and response format to assess agreement that the items (Appendix) are potential causes of skin cancer. The responses are coded as follows: *strongly disagree* (0), *disagree* (0), *neither agree nor disagree* (1), *agree* (2), *strongly agree* (3). The starred items are used to generate causal risk scores. The personal history items are coded as indicated in the Appendix. Causal risk scores are generated by calculating the product of the cause rating and the personal history for each of four causes: heredity, bad sunburns, minor sunburns and sun exposure without sunscreen. These four products are then summed: Causal risk = Σ[Cause rating × Personal history].

Timeline risk beliefs. The 3-item subscale assessing timeline risk beliefs is presented in the Appendix. The item ratings are averaged to generate scores.

Control risk beliefs. Three subscales assess control beliefs about illness risk: personal control over prevention, personal control over cure, and treatment control (Appendix). Ratings are averaged after reverse-scoring

Table II. Skin cancer images ($n = 585$) reported by participants ($N = 120$).

Imagery category	Examples	% Respondents reporting image	% of all images reported
Skin symptom	Crusty sores; blackened skin; ugly, black area on skin; disgusting scab	45	13
Sun exposure	A sunny beach; scorching, hot sun; sunshine; sunbathing; UV rays	44	13
Mole	Moles; black moles; brown spots; moles and freckles	41	10
Medical treatment	Scalpels; chemotherapy; getting moles cut out; operation; hospital	39	11
Prevention behavior	Sunscreen; floppy hat; sun block; glasses; sun hat	33	8
Sunburn	Sun burn, burned skin, red skin	30	7
Death	Person dying in bed; death; dying	24	5
Disfigurement, treatment effects	Scars, facial deformity; limbs with huge chunks of skin missing	23	6
Melanoma	Melanoma	18	4
Aging	Elderly man; old people; wrinkly old people	9	2
Pale skin	People with fair skin; pale complexion; bland and white skin	9	2
Pain	Pain, someone in pain	11	2
Body part	Nose, skin, lips	11	2
Detection behavior	Mole map, skin check; doing test for cancer	5	1
Other	New Zealand, cells, Cancer Society, lobster; children	42	13

the negatively-phrased items. A principal components analysis (with varimax rotation) of all control risk items yielded three factors, with each item loading most highly ($>|0.55|$) onto the factor reflecting its respective subscale.

Consequences risk beliefs.   Three subscales assess consequences risk beliefs about pain, shortened life, and psychosocial effects. For each subscale, the item ratings are averaged after reverse-scoring negatively phrased items. A principal components analysis (with varimax rotation) of all consequences risk items yielded three factors representing the subscales. Items loaded most highly (with loadings $>|0.50|$) onto the expected factors, with the exception of the item, "...it would cause difficulties for those who are close to me", for which loadings ranged from 0.25 to 0.41 across the factors. This psychosocial effects item was retained because of its conceptual relevance and importance, and because its inclusion increased the subscale's α whereas, for each of the other two subscales, its inclusion decreased the α.

Additional measures

Perceived likelihood, perceived severity, and worry.   Items used in prior research (Cameron & Reeve, 2006; Weinstein, 2000) were adapted to relate to skin cancer: "How likely do you think it is that you will develop skin cancer at any time in the future?", rated from *no chance* (0) to *certain to happen* (10); and "How vulnerable do you think you are to getting skin cancer at some point in your life?", rated from *not at all* (0) to *extremely* (10). The ratings were averaged; $\alpha = 0.80$. Likelihood scores were moderately stable over the 4 week assessment period; $r = 0.55$. A 1-item severity measure (Weinstein, 2000) was used: "How serious do you think it would be if you were to develop skin cancer?" Ratings ranged from 0 (*innocuous, no harm at all*) to 10 (*extremely devastating*); test–retest reliability $r = 0.46$. Worry was assessed with three items (Cameron & Reeve, 2006; McCaul, Mullens, Romanek, Erickson, & Gatheridge, in press): (1) To what extent are you worried about skin cancer?; (2) How much does thinking about skin cancer bother you?; and (3) To what extent are you concerned about getting skin cancer? Ratings of 0 (*not at all*) to 10 (*extremely*) were averaged; $\alpha = 0.87$, test–retest reliability $r = 0.66$.

Detection and prevention intentions and behavior.   A 3-item intention measure (Ajzen, 2002) was adapted to assess intentions for skin self-examination (SSE; e.g., "In the next month, to what extent do you plan to carry out a skin self-examination? ") and clinical skin examination (CSE; e.g., "In the next month, how likely is it that you will go for a clinical examination by a doctor or other health professional?"). Ratings ranged from 1 (*not at all/extremely unlikely*) to 5 (*definitely/extremely likely*) and were averaged. For both measures, $\alpha = 0.94$. The Sun Protective Behaviors Index (SPBI; Cokkindides et al., 2001) was adapted to assess prevention intentions. The items were preceded with the stem, "In the next month, when you are going outside on a sunny day for more than 15 min, how often do you plan to..." The items were: (1) stay in

the shade; (2) wear a hat; (3) wear a long sleeved shirt and long skirt, shorts or trousers; and (4) apply sunscreen regularly. Ratings ranged from 1 (*never*) to 5 (*always*), and were averaged; $\alpha = 0.58$.

To assess detection behaviors, participants were asked, ''In the last 4 weeks, did you ... (1) carry out a skin self-examination (*yes* or *no*); and (2) go for a clinical skin examination by a doctor or other health professional (*yes* or *no*). Prevention behaviors were assessed with an adapted version of the SPBI consisting of four items preceded by the stem, ''In the last 4 weeks, when you were outside on a sunny day for more than 15 min, how often did you ...'' The items were: (1) stay in the shade; (2) wear a hat; (3) wear a long sleeved shirt and long skirt, shorts, or trousers; and (4) apply sunscreen regularly. Ratings ranged from 1 (*never*) to 5 (*always*) and were averaged.

Results

Analyses of the normality of distributions revealed positive skewness in CSE intentions, and preliminary assessments revealed slight differences in the patterns of findings of analyses using original scores *versus* logarithmic transformations of scores. The latter were therefore used in the final analyses. No other variables exhibited problematic skewness.

Descriptive assessments of risk representation contents

Prior to generating identity risk and causal risk scores, the mean risk ratings of items were calculated to identify those most and least associated with skin cancer risk. Identity features rated as creating the most risk were skin that sunburns easily ($M = 3.37$), pale skin ($M = 3.00$), mole with irregular borders ($M = 2.89$), skin with 20 or moles ($M = 2.85$), blue–black mole ($M = 2.67$) and mole with two colors ($M = 2.66$). Features seen as least risky were light-colored eyes ($M = 1.00$), sleep difficulties ($M = 1.08$), breathlessness ($M = 1.13$), loss of strength ($M = 1.34$) and light hair ($M = 1.37$). Causal factors receiving the highest risk ratings were sun exposure without using sunscreen ($M = 2.50$), bad (blistering) sunburns ($M = 1.77$), pollution or hazards in the environment ($M = 1.61$), and many minor sunburns ($M = 1.51$). Causal factors receiving neutral ratings on average included aging ($M = 1.35$), poor immune function ($M = 1.32$), heredity ($M = 1.13$), and exposure while using sunscreen ($M = 1.12$). All other factors had mean ratings less than 1.0.

Table I presents the means, SDs, and correlations of the risk representation subscales. Consequences and control risk beliefs tended to be neutral, although beliefs of personal control over prevention were generally high. Imagery vividness and valence scores also had reasonable variance, and the central tendency was towards negative imagery. Test–retest reliabilities were lower for imagery vividness and valence than for the other risk representation subscales, suggesting that imagery contents are more variable over time. Correlation analyses revealed meaningful patterns of associations among the risk representation subscales.

Causal risk beliefs were associated with greater identity and timeline risk beliefs. Timeline risk beliefs were positively associated with beliefs of personal control over prevention. There were significant correlations among the three sets of personal control beliefs, as well as among the three sets of consequences risk beliefs. The subscales exhibited reasonable discriminant validity, with no correlations over $r = 0.54$.

Imagery contents

Overall, 115 (95%) of the 120 respondents reported five images; only one participant failed to report at least one image. As shown in Table II, the types of images reported by the greatest proportion of participants related to identity (skin symptoms, moles, melanoma and pale skin) and cause (sun exposure and sunburns). Many participants reported imagery relating to control (prevention behavior and medical treatment), and consequences (death, disfigurement, and pain). Fewer participants reported imagery associated with timeline (e.g., aging) or detection procedures. Just over 40% of the participants reported at least one image that did not fall into the 14 content categories; these images represented only 13% of the total images reported. In sum, concrete representations of skin cancer included some idiosyncratic types of images, but most images fell into common categories.

Point–biserial correlations revealed several weak but meaningful associations between concrete and conceptual contents of risk representations. Mole imagery was associated with stronger identity risk beliefs ($r = 0.19$, $P < 0.05$) and death imagery was associated with stronger beliefs of shortened life consequences ($r = 0.23$, $P < 0.01$). Disfigurement imagery correlated with lower beliefs of treatment control ($r = -0.19$, $P < 0.05$) and aging imagery correlated with timeline risk beliefs that skin cancer was unlikely to occur at one's age ($r = 0.18$, $P < 0.05$). Skin symptom imagery correlated with beliefs of greater control over cure ($r = 0.24$, $P < 0.05$).

Predictors of risk appraisals and worry

Correlation and multiple regression analyses assessed the zero-order and independent relationships of risk representation variables with likelihood, severity, and worry. For the regression analyses, the predictors included variables that correlated with the dependent measure at a significance level of $P < 0.10$. Variables that were not significant predictors in the initial regression were removed. Table III presents the results for the final regression models.

As predicted, the attributes of identity, cause, and timeline were positively associated with greater perceived likelihood. Unexpectedly, beliefs of greater personal control over cure were associated with lower likelihood perceptions. When these four variables were entered into a regression analysis, all but causal risk beliefs independently predicted likelihood perceptions. A supplementary regression analysis confirmed that causal risk did not uniquely predict likelihood appraisals due to its moderate correlation with identity risk: when identity risk

Table III.   Correlation and multiple regression analyses of relationships of risk representation attributes with risk appraisals and worry.

	r	β	Model F/total R^2	Mean (SD)
Likelihood			14.22**/0.28	4.85 (0.84)
Identity risk	0.41**	0.38**		
Causal risk	0.39**	–		
Timeline risk	0.27**	0.26**		
Personal control-cure	−0.23*	−0.19*		
Severity			13.72**/0.26	6.68 (1.67)
Pain consequences	0.40**	0.29**		
Shortened life consequences	0.40**	0.24**		
Psychosocial consequences	0.33**	–		
Timeline risk	0.31**	0.19*		
Worry			22.10**/0.28	4.11 (2.10)
Identity risk	0.43**	0.43**		
Causal risk	0.32**	–		
Timeline risk	0.31**	0.28**		
Pain consequences	0.20*	–		

Note: *$P < 0.05$; **$P < 0.01$.

was omitted from the set of independent variables, causal risk was independently associated with higher likelihood appraisals; $\beta = 0.30$, $t = 3.47$, $P < 0.001$.

For perceived severity, all three consequences beliefs were correlated with greater severity as predicted. Contrary to predictions, control risk beliefs were not associated with perceived severity. Unexpectedly, timeline beliefs that skin cancer is likely to affect a person of one's age were associated with greater severity perceptions. Regression analysis revealed that shortened life consequences, pain consequences, and timeline risk beliefs accounted for unique variance in perceived severity. Worry was positively correlated with identity risk, causal risk, timeline risk, and pain consequences beliefs. Regression analysis revealed that identity and timeline risk beliefs accounted for unique variance in worry.

Predictors of detection and prevention intentions

Table IV presents the results of correlation and multiple regression analyses (final models) assessing correlates and independent predictors of intentions. For the regression analyses, the predictor variables included: (a) variables correlating with the dependent measure at a significance level of $P < 0.10$; and (b) a set of variables to assess the worry × symptom image interactions, with worry scores centered about the mean. Variables that were not significant predictors in the initial regression were removed, except worry and symptom image were retained when the worry × symptom image interaction was significant.

For SSE intentions, the risk representation factors of identity, cause and timeline risk were associated with higher intentions. In addition, perceived

Table IV. Correlation and multiple regression analyses of relationships of risk representation attributes with protection intentions and behavior.

	r	β	Model F/total R^2	Mean (SD)
Skin self-exam intentions			5.25**/0.15	2.49 (1.30)
Identity risk	0.25**	0.20*		
Causal risk	0.18*	–		
Timeline risk	0.18*	–		
Likelihood	0.21*	–		
Worry	0.23*	−0.06		
Skin symptom image	0.12	0.15		
Worry × skin symptom image	–	0.32**		
Clinical skin exam intentions			11.26**/0.28	1.77 (1.13)
Identity risk	0.20*	–		
Timeline risk	0.36**	0.25**		
Likelihood	0.24**	–		
Severity	0.22**	–		
Worry	0.35**	−0.06		
Skin symptom image	0.12	0.18*		
Worry × skin symptom image	–	0.34**		
Prevention intentions			5.65**/0.23	3.08 (0.70)
Personal control-cure	0.19*	0.22*		
Imagery vividness	0.30**	0.23**		
Imagery positivity	0.14+	0.18*		
Worry	0.17+	−0.08		
Skin symptom image	0.13	0.13		
Worry × skin symptom image	–	0.32**		
Prevention behaviors			16.32**/0.31	2.67 (0.70)
Prevention intentions	0.51**	0.52**		
Treatment control-cure	−0.21*	−0.21*		
Imagery vividness	0.29**	–		

Note: $+P < 0.10$; $*P < 0.05$, $**P < 0.01$.

likelihood and worry were correlated as expected with higher intentions; perceived severity was unrelated to these intentions. Multiple regression analysis revealed that perceived likelihood did not independently predict SSE intentions, when worry and the risk representation beliefs were controlled. Instead, SSE intentions were independently predicted by higher identity risk beliefs and the interactive effects of worry and skin symptom imagery (Figure 1). For individuals reporting symptom images, increments in worry were associated with higher SSE intentions. For individuals without symptom images, intentions were low regardless of the worry levels. Analyses of the correlations between worry and intentions for the two symptom imagery groups confirmed the correlation was significant for participants with a symptom image ($r = 0.44$, $P < 0.01$) but not for participants with no symptom image ($r = −0.03$, ns).

CSE intentions were positively associated with two risk representation beliefs, identity and timeline risk, and with perceived likelihood, perceived severity and worry. Regression analysis revealed that timeline risk was independently associated with intentions whereas likelihood, severity, worry and identity risk
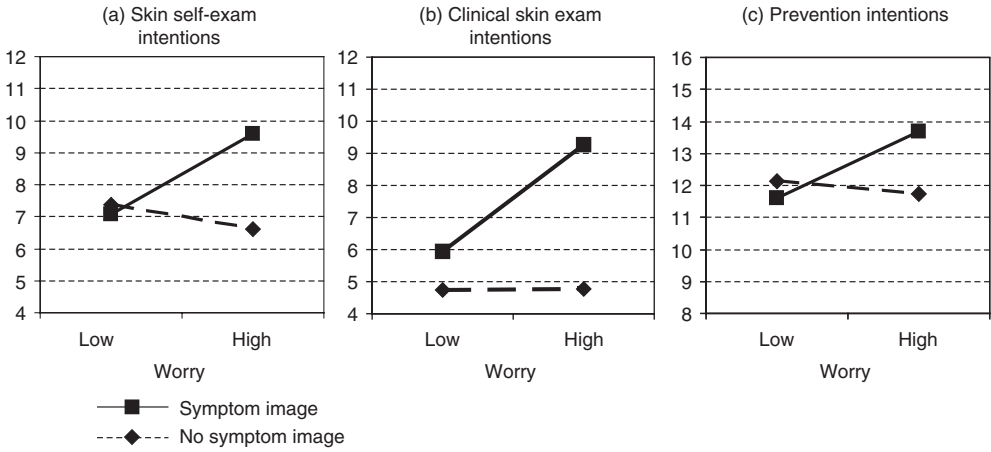
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Figure 1.   Worry × skin symptom image interaction effects on (a) skin self-examination intentions; (b) clinical skin exam intentions; and (c) prevention intentions. The values were estimated by setting the high and low worry scores in the regression equation to one SD above and below the mean, respectively.

were not. A worry × symptom image interaction effect mirrored that observed for SSE intentions (Figure 1). As predicted, individuals with a symptom image reported greater intentions when worry was also high, whereas individuals with no symptom image reported low intentions regardless of worry levels. For participants with a symptom image, the correlation between worry and intentions was $r = 0.59$ ($P < 0.01$); for participants with no symptom image, the correlation was $r = 0.09$ (ns).

The risk representation variables associated with (greater) prevention intentions were beliefs of high control over cure and greater imagery vividness. There were trends for positive associations of imagery positivity and worry with intentions. These intentions were not associated with perceived likelihood or severity. Regression analysis revealed that personal control over cure beliefs, imagery vividness, and imagery positivity accounted for unique variance in intentions. As with SSE and CSE intentions, a worry × symptom image interaction revealed that individuals with symptom images reported higher intentions, when worry was also high whereas individuals with no symptom images reported low intentions regardless of worry levels. The correlations between worry and intentions were $r = 0.41$ ($P < 0.01$) for participants who reported symptom imagery and $r = 0.03$ (ns) for those who did not.

Additional analyses evaluated each of the other top eight image categories in terms of their main effects and imagery × worry interaction effects on SSE, CSE, and prevention intentions; none were significant. Moreover, assessments of symptom imagery × likelihood interaction effects on intentions revealed that the interaction effects were not significant. The interaction effects appear to be specific to the factors of symptom imagery and worry.

Detection and prevention behaviors

Of the 79 participants who completed the follow-up survey 4 weeks later, only 11 (14%) reported having conducted a skin self-exam and only three (4%) reported having obtained a clinical exam. These proportions were too low to permit analyses to identify potential predictors. For prevention behavior (Table IV), correlational analyses revealed that use of sun protection was associated with greater intentions, beliefs of poor disease control through treatment and greater imagery vividness. Regression analysis revealed that only intentions and treatment control independently predicted sun protection behavior.

Discussion

This study provides descriptive information regarding the contents of risk representations for skin cancer held by a sample of adults. It identified physical features (e.g., moles with irregular borders) and causes (e.g., sun exposure without use of sunscreen) that were readily identified as risk factors, as well as those less likely to be regarded as risk factors (e.g., heredity). In addition, the use of an imagery measure yielded insights about the nature of imagery contents of risk representations. The majority of skin cancer images reported by participants fell into categories relating to representational attributes identified by the CSM: identity, cause, control, and consequences. Symptom imagery was highly prevalent, with 45% of the sample reporting at least one symptom image. The other types of images most commonly reported by respondents related to sun exposure, moles, and treatment procedures.

A primary goal was to identify how contents of risk representations are associated with likelihood and severity appraisals and worry. As predicted, likelihood appraisals were positively associated with beliefs about causal risk, identity risk, and timeline risk. Both identity risk and timeline risk accounted for unique variance in likelihood appraisals; causal risk did not uniquely predict likelihood appraisals due to its moderate correlation with identity risk. Beliefs of low personal control over cure were also associated with greater likelihood appraisals. This relationship could reflect an influence of disease threat on perceived vulnerability: Beliefs that one would not be able to cure the disease may fuel appraisals that one is vulnerable to it and this sense of vulnerability may, via nonreasoned processes, transfer to appraisals of vulnerability to developing the illness. Alternatively, the two cognitions may be linked by way of a third variable, such as dispositional pessimism or anxiety (Gerend, Aiken, & West, 2004; McGregor et al., 2004).

As predicted, severity appraisals were associated with beliefs about pain, shortened life, and psychosocial consequences. Severity appraisals were also associated with timeline risk beliefs, with those believing that skin cancer could occur at one's age appraising the disease as more severe. It is possible that age relevance of skin cancer may enhance appraisals of its seriousness.

Because it might occur in the near future, individuals may be motivated to process information about it and thus develop more detailed representations of its potential consequences (Cameron, 2003a; Kreuter, Bull, Clark, & Oswald, 1999).

Worry was associated with the risk attributes of identity, cause, timeline, and pain consequences, although only identity and timeline risk accounted for unique variance in worry. These correlational findings suggest the utility of health communications research to assess whether worry is enhanced by information about identity risk, such as information about physical features that increase susceptibility, and timeline risk, such as information that skin cancer can occur in people of a comparable age. On the other hand, the findings suggest that information about psychosocial consequences, mortality rates, or disease control may have little influence on skin cancer worry. Media appeals that focus on providing information about these aspects of skin cancer may fail to increase worry over the longer term.

Identity, cause, and timeline risk were associated with one or both of the detection intentions. Identity risk independently predicted SSE intentions, whereas timeline risk independently predicted CSE intentions. Although likelihood and severity appraisals were also correlated with detection intentions, their associations were not significant when entered simultaneously with the risk representational attributes. Similarly, likelihood and severity appraisals did not independently predict prevention intentions. These findings suggest that the risk representation attributes are directly linked with intentions and that they, rather than likelihood and severity appraisals, are cognitions upon which protection intentions are based.

Prevention intentions were associated with beliefs about personal control over cure and with imagery contents. As predicted, vivid and positive imagery was associated with greater intentions; vivid imagery was also positively associated with subsequent prevention behavior, although it was not a significant predictor after controlling for prevention intentions. Vivid imagery is likely to enhance the salience and accessibility of skin cancer risk, thereby increasing motivations for prevention behavior when exposed to sunny conditions (Stacy et al., 2004a). The association of positive imagery with prevention intentions is consistent with the thesis that positive imagery is linked with approach motivation processes that enhance attentional focus on skin cancer prevention. These findings complement prior research indicating that positive cues elicit approach tendencies that can, in turn, promote prevention behaviors (Chen & Bargh, 1999; Rothman et al., 2003).

As predicted, skin symptom imagery interacted with worry to predict both prevention and detection intentions. For participants reporting a symptom image, worry was associated with greater intentions; for those who did not report a symptom image, worry was unrelated to intentions. These findings suggest one way in which imagery processes interact with affective processes to influence

protection motivation. In particular, mental images of illness symptoms may activate considerations of protective actions, with intentions being influenced by affective processes in which worry serves as an affect heuristic (Slovic, Finucane, Peters, & MacGregor, 2002). With a symptom image prompting illness concern, worry may be interpreted as a gut-level indicant of one's vulnerability and need for protection. Research is needed to investigate whether interventions that enhance both accessibility of symptom images and worry will increase motivations for protective action.

The associations of imagery attributes with protection intentions and behavior suggest the potential utility of intervention efforts that instill vivid and positive images as well as images of disease symptoms. These findings complement research on the persuasiveness of health messages containing graphic images. For example, skin cancer messages containing vivid imagery were found to be more persuasive than messages with nonvivid material, although this effect held only when recipients had high self-efficacy for the protection behaviors (Block & Keller, 1997). Similarly, graphic images of cancer symptoms on cigarette labels increase negative reactions and quit attempts among smokers (Hammond, Fong, McDonald, Brown, & Cameron, 2003). As noted by Green (2006), imagery may be most powerful when presented within a coherent narrative structure such as a story. Such messages are likely to foster coherent risk representations in which images are meaningfully linked with cognitions and protection motivations.

Prevention control beliefs did not correlate with prevention intentions or behavior. Participants generally reported high prevention control and so there may not have been sufficient variance to detect associations with prevention intentions and behavior. Further research may find that this measure is useful in predicting protection intentions and behaviors for illnesses where there is less agreement on personal control over prevention.

Prevention intentions were the primary predictor of subsequent prevention behavior, although beliefs about treatment control independently predicted (lower) prevention behavior as well. It may be that, when faced with the temptation to be in the sun without protection, individuals with high treatment control beliefs may discount the health risk by rationalizing that skin cancer can be treated effectively. Despite their intentions, they may succumb to the temptation on the basis of this rationalization. Replication of this relationship is needed.

The findings provide new evidence regarding representations of skin cancer risk, although several constraints must be noted. The sample consisted of adults attending a university in New Zealand, and so the findings may not generalize to populations with different educational and cultural backgrounds. The study materials focused on skin cancer in general rather than melanoma or another form of skin cancer, because pilot research with this population revealed high awareness of skin cancer in general but low awareness of melanoma (Ong, 2001).

This difference in awareness is consistent with the focus on skin cancer (and not melanoma) by New Zealand's sun protection campaigns. For people who are cognizant of the different types of skin cancer, their representations for melanoma may differ from their representations for other skin cancers primarily in terms of consequences beliefs: They are likely to have stronger consequences beliefs for melanoma than for basal and squamous cell carcinomas. For these people, the patterns of relationships involving consequences beliefs may vary from those observed in this study. The use of SSE and CSE was low, reflecting the low rates in the absence of interventions aimed at promoting these behaviors. Future studies will require the use of SSE and CSE promotion materials in order to assess the relationships of risk representations with these detection behaviors. Finally, the imagery measure utilizes verbal instructions and verbal reports of mental images and so it provides a limited understanding of the nature of the concrete images within the risk representation. Techniques such as drawing mental images (Stacy et al., 2004b) or selecting images that are similar to one's mental images, may provide supplementary assessments of imagery contents.

To conclude, the findings suggest ways in which the contents of risk representations may serve as the basis for appraisals of likelihood and severity, worry, and motivations for protective behavior. The results also support the utility of the AIRR as a technique for assessing risk representations. The subscales demonstrated acceptable internal consistency and stability over time, and their intercorrelations revealed meaningful patterns as well as relative independence. The imagery subscale opens up opportunities to systematically explore imagery associated with illness risks. Use of the AIRR can lead to a richer understanding of illness risk representations and their influence on protective behaviors.

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Appendix

Identity

1. White or pale skin
2. Light-colored eyes: blue, green, grey, or hazel
3. Skin with 20 or more moles
4. Skin with 5–19 moles
5. Naturally light-colored hair
6. Skin doesn't tan easily
7. Skin tends to freckle
8. Skin sunburns easily
9. Loss of strength
10. Unusual lump under skin
11. Dark blue or black mole
12. Mole with irregular borders
13. Unusual sweating
14. Mole with two or more colors
15. Fatigue
16. Unusual skin blemish
17. Breathlessness
18. Mole larger than diameter of a pencil
19. Fever
20. Sleep difficulties
21. Nausea
22. Painful area on the skin
23. Sudden change in weight

Causal risk (*items with a* ⋆ *are used to generate causal risk scores*)

1. Skin cancer is hereditary – it runs in the family[1]⋆
2. Diet or eating habits[1]
3. Pollution or hazards in the environment[1]
4. Poor immune function
5. Stress or worry[1]
6. Having one or more bad (blistering) sunburns during one's lifetime⋆
7. Having many minor sunburns during one's lifetime⋆
8. Chance or bad luck[1]
9. Poor medical care in the past[1]
10. Accident or injury[1]
11. A germ or virus[1]
12. Lots of sun exposure to skin without using sunscreen⋆
13. Lots of sun exposure to skin while using sunscreen
14. Mental attitude – thinking about life negatively[1]
15. Lack of exercise[1]
16. Overwork[1]
17. Aging[1]
18. Emotional state – feeling down, anxious, lonely, empty[1]
19. Smoking tobacco[1]
20. Alcohol use[1]

Have any family members had skin cancer?⋆   Yes____   No____
Values: 10   0

How many times in your life have you had a bad (blistering) sun burn?⋆
                    None   1 or 2   3 or more
Values: 0   5   10

How many sunburns have you had in your life?⋆
                0   1–5   6–10   11–15   16–20   21 or more
Values: 0   2   4   6   8   10

Over your life, how much time have you spent in the sun without sunscreen?⋆
        0   1   3   4   5   6   7   8   9   10
None at all   A great deal

Values: As given

Timeline risk

People of my age are likely to develop skin cancer at this time in their lives.
        0   1   2   3   4   5   6   7   8   9   10
Strongly disagree   Neither agree   Strongly agree
                                     nor disagree

How likely is it that a person your age would get skin cancer now – at this age:

0	1	2	3	4	5	6	7	8	9	10
No chance		Probably will not happen			50–50 chance		Probably will happen			Certain to happen

How likely is it that a person of your age would get skin cancer *in the next 10 years*:

0	1	2	3	4	5	6	7	8	9	10
No chance		Probably will not happen			50–50 chance		Probably will happen			Certain to happen

Consequences risk (PS = psychosocial; P = pain; SL = shortened life)

If I had skin cancer, it would cause difficulties for those who are close to me.[1] *PS*

Skin cancer is a painful condition. *P*

Having skin cancer would have no effect on how long I live. *SL*

If I had skin cancer, I would not be able to participate in some work activities. *PS*

If I had skin cancer, I would have to undergo painful treatments. *P*

Having skin cancer would affect the way others see me.[1] *PS*

Having skin cancer would shorten my life. *SL*

If I had skin cancer, I would not be able to participate in some social or leisure activities. *PS*

If I get skin cancer, I will die fairly quickly. *SL*

Skin cancer would have serious financial consequences for me.[1] *PS*

Personal control over prevention

There is a lot that I can do to prevent skin cancer.[1]

What I do will determine whether or not I get skin cancer.[1]

My actions will have no effect on whether or not I get skin cancer.[1]

Personal control over cure

If I get skin cancer, there is a lot I can do to control or cure it.[1]

If I get skin cancer, my actions will have no effect on whether it gets better or worse.[1]

If I get skin cancer, the course of the illness will depend on me.[1]

Treatment control

There is little that can be done to treat skin cancer.[1]

If I get skin cancer, then it can be controlled or cured through medical treatment.[1]

If I get skin cancer, the negative effects of the illness could be controlled or avoided by medical treatments.[1]

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[1] Item adapted from the Illness Perception Questionnaire-Revised (IPQ-R).