Testing a belief-based intervention encouraging sun safety among adolescents in a high risk area

Katherine M. White\textsuperscript{1,*}, Melissa K. Hyde\textsuperscript{1}, Erin L. O'Connor\textsuperscript{1}, Lisa Naumann\textsuperscript{2}, and Anna L. Hawkes\textsuperscript{2,3}

\textsuperscript{1} School of Psychology and Counselling, Queensland University of Technology, Kelvin Grove, Queensland, 4059, Australia.

\textsuperscript{2} Cancer Council Queensland, 553 Gregory Terrace, Fortitude Valley, Queensland, 4006, Australia

\textsuperscript{3} School of Public Health, Queensland University of Technology, Kelvin Grove, Queensland, 4059, Australia.

*Correspondence concerning this article should be addressed to Katherine M. White, School of Psychology and Counselling, Queensland University of Technology, Victoria Park Road, Kelvin Grove, Brisbane, Queensland, 4059, Australia. Telephone: +61 7 3138 4689. Fax: +61 7 3138 0486.

Email: km.white@qut.edu.au
Abstract

**Objective.** To provide a preliminary test of a Theory of Planned Behavior (TPB) belief-based intervention to increase adolescents’ sun protective behaviors in a high risk area, Queensland, Australia.

**Methods.** In the period of October-November, 2007 and May-June, 2008, 80 adolescents (14.53 ± 0.69 years) were recruited from two secondary schools (one government and one private) in Queensland after obtaining student, parental, and school informed consent. Adolescents were allocated to either a control or intervention condition based on the class they attended. The intervention comprised three, one hour in-school sessions facilitated by Cancer Council Queensland employees with sessions covering the belief basis of the TPB (i.e., behavioral, normative, and control [barrier and motivator] sun-safe beliefs). Participants completed questionnaires assessing sun-safety beliefs, intentions, and behavior pre- and post-intervention. Repeated Measures Multivariate Analysis of Variance was used to test the effect of the intervention across time on these constructs.

**Results.** Students completing the intervention reported stronger sun-safe normative and motivator beliefs and intentions and the performance of more sun-safe behaviors across time than those in the control condition.

**Conclusion.** Strengthening beliefs about the approval of others and motivators for sun protection may encourage sun-safe cognitions and actions among adolescents.

Keywords: sun-safety; intervention; beliefs; adolescents; theory of planned behavior
Introduction

The effects of exposure to ultraviolet radiation are an important concern for Australians, particularly in the state of Queensland, which has the highest incidence of skin cancer in the world (Giles et al., 1988). Adolescents comprise an important target group for reducing sun exposure as they practice few sun protection behaviors despite high levels of knowledge about the dangers of skin exposure to the sun (Cokkinides et al., 2001).

One model that can be used for intervention development is the theory of planned behavior (TPB; Ajzen, 1991). The TPB proposes intentions as the most proximal predictor of behavior. Intentions are influenced by a person’s attitude (positive/negative evaluation), subjective norm (social pressure/approval), and perceived behavioral control (PBC; perceived control or efficacy; also thought to predict behavior) related to behavioral performance. Attitude, subjective norm, and PBC are informed by underlying behavioral (costs and benefits), normative (referents’ approval or disapproval), and control (barriers and motivators) beliefs, respectively.

Limitations to previous TPB sun-safety interventions, including deviations from the traditional TPB constructs (Jackson and Aiken, 2006; Mahler et al., 2008) and a lack of assessment of the role of social influence and efficacy in behavior change (Lowe et al., 1999), make it difficult to determine the model’s success in changing sun-safety behavior. The present study, therefore, comprised a preliminary test of a TPB belief-based intervention. It was expected that adolescents exposed to a belief-based intervention targeting previously identified (e.g., Robinson et al., 2008; White et al., 2008) costs and benefits, important referents, and barriers and motivators would report a significant improvement in their beliefs, intentions, and behavior for sun-safety from pre- to post-intervention compared to those adolescents in the control condition. For all constructs except for control belief barriers (where a decrease was expected), a significant increase over time on responses for intervention as opposed to control participants was hypothesized.

Methods

Participants

Adolescents aged 13-16 years (n = 80; 14.53 ± 0.69 years; 59.5% female; 64% fair-skinned) were recruited from two secondary schools in metropolitan areas in Queensland between October and November, 2007 (n = 26 from a government state secondary school) and May and June, 2008 (n = 54 from a private secondary school), after obtaining student, parental, and school informed consent. Students were allocated to either the intervention (n
Sun Safety Intervention 4

=34; 14.59 ± 0.56 years; 53% female; 62% fair-skinned) or control condition (n = 46; 14.49 ± 0.79 years; 63% female; 59% fair-skinned).

Design and Procedure

Ethical approval was obtained from the University’s Ethics Committee and relevant education bodies. Participants completed a questionnaire approximately 1 week pre-intervention (T1). Participants were then allocated to either the intervention or control group based on the class they were attending as we were subject to each School’s agreement to participate contingent on randomization based on their scheduled timetabling of classes. Neither the participants nor the facilitators were blind to group assignment. To encourage participation, an incentive was provided in the form of entry into a prize draw to win one of two Apple iPods (valued at AUD$99). Participants in the control group had the opportunity to receive the intervention materials after project completion.

The in-class intervention was facilitated by trained Cancer Council Queensland employees and comprised three sessions, an hour a week over 3 weeks. Session 1 encouraged supportive behavioral beliefs about sun protection (advantages and disadvantages). Session 2 fostered perceptions of normative support for sun protection (normative beliefs). Session 3 enhanced perceptions of control over using sun protection (control beliefs). University research team members attended sessions to check program fidelity. Participants completed a second questionnaire 1 week post-intervention (T2) which measured constructs identical to the first questionnaire.

Measures

The target behavior was: “Performing sun protective behaviors (i.e., using SPF 30+ sunscreen, wearing protective clothing such as a hat, long-sleeved shirt and sunglasses, and seeking shade between 10am and 3pm) every time you go in the sun for more than 10 minutes during the next week”. All measures included a context (every time I go out in the sun for more than 10 minutes) and a timeframe (during the next week) (Ajzen, 1991) (Table 1). Scores were summed and averaged to create each belief scale.

Results

Across the intervention period, 26 participants dropped out due to absence from class or failure to return a completed questionnaire at T2 (32.5%, 9/34 in the intervention condition, 14.54 ± 0.59 years, 58% female, 79% fair-skinned; 17/46 in the control condition, 14.24 ± 0.74 years; 62% female, 55% fair-skinned). Analyses did not identify any differences
between T1 questionnaire completers and those who completed questionnaires at both T1 and T2 on the pre- and post-intervention constructs, age, gender, or skin type.

**Repeated Measures MANOVA Analysis**

Initially, the repeated measures analysis included gender, age, and skin type as covariates. These variables were not significant and a similar pattern of results was obtained; therefore, the results from analyses without age, gender, and skin type are presented. A 2 (intervention, control) by 2 (pre-intervention, post-intervention) Repeated Measures MANOVA was performed on the belief constructs, intention, and behavior. Condition (intervention group vs. control group) was the between participants factor and the within-participants factor was Time (pre-intervention [T1] vs. post-intervention [T2]). The belief measures, intention, and behavior served as the dependent variables. Table 2 presents the means and standard deviations of the beliefs, intention, and behavior, pre- and post-intervention, confidence intervals, and $p$ values.

**Insert Table 2**

Results revealed no significant effect for Condition or Time; however, there was a significant multivariate Time x Condition effect, $F(6,46) = 3.19, p = .011, \eta^2 = .29$. Univariate tests showed a significant Time x Condition effect for normative beliefs, $F(1,51) = 4.86, p = .033, \eta^2 = .09$, motivator beliefs, $F(1,51) = 14.53, p < .001, \eta^2 = .22$, intention, $F(1,51) = 5.72, p = .020, \eta^2 = .10$, and behavior, $F(1,51) = 5.58, p = .022, \eta^2 = .10$. For normative beliefs, there was a difference approaching significance across time in the intervention condition, $F(1,23) = 3.31, p = .082, \eta^2 = .13$, but not in the control condition, $F(1,28) = 1.49, p = .233, \eta^2 = .05$. Pairwise comparisons for the simple effects of Time within the intervention condition showed an increase in endorsement of normative beliefs over time. For motivator beliefs, there was a significant difference across time in the intervention condition, $F(1,23) = 7.38, p = .012, \eta^2 = .24$, and in the control condition, $F(1,28) = 6.76, p = .015, \eta^2 = .19$. Pairwise comparisons for the simple effects of Time within the intervention condition showed an increase in endorsement of motivator beliefs across time and a decrease in the control condition over time.

For intention, there was a significant difference across time in the intervention $F(1,23) = 5.34, p = .030, \eta^2 = .19$, but not the control condition, $F(1,28) = .75, p = .395, \eta^2 = .03$. Pairwise comparisons for the simple effects of Time within the intervention condition showed that pre-intervention levels of intentions increased at the post-intervention follow up. For behavior, there was a difference approaching significance across time in the intervention condition $F(1,23) = 3.75, p = .065, \eta^2 = .14$, but not the control condition, $F(1,28) = 1.72, p$
= .200, $\eta^2 = .06$. Pairwise comparisons showed that pre-intervention levels of behavior increased at the post-intervention follow up for the intervention condition.

**Discussion**

This preliminary test of a TPB belief-based intervention found, for the intervention condition, an increase in adolescents’ intentions to sun-protect and reported behavior (trend only) from pre- to post-intervention but no corresponding change in the control condition. Together, these results provide some preliminary evidence that the intervention was successful in facilitating change in both the immediate precursor to (intentions) and self-reported behavior.

There was a trend in the intervention condition showing an increase in adolescents’ belief that a range of important people (e.g., family, friends, teachers) would want them to sun-protect, with no associated change in the control condition, a finding that is broadly consistent with related studies (Jackson and Aiken, 2006). In accord with other sun-safety interventions (e.g., McClendon et al., 2002), adolescents in the intervention condition also reported an increase in their belief that motivating factors (e.g., fashionable protective gear) would encourage them to sun-protect whereas adolescents in the control condition reported a decrease across time.

**4.1 Study Limitations**

Despite the strength of a theory-informed intervention, a small sample and self-reported measures were limitations. Some findings approached significance only, with the main reason for the weaker findings most likely due to the absence of statistical power. The absence of randomization to conditions and the inability to assess any long-term change were additional limitations.

**Conclusion**

This study provides preliminary evidence for the role of motivators (e.g., fashionable sun-safe products) and normative factors (e.g., the approval of friends and teachers) in encouraging sun-safety among adolescents, and for an intervention that produced changes in intentions and sun-safe behavior. Despite the study’s limitations and the absence of stronger differences in findings between the intervention and control groups, the results offer initial support for a TPB-based intervention including strategies targeting significant others’ approval and motivating factors as a useful approach to engendering sun-safety behavior change among adolescents.
Acknowledgements

This study was funded by Cancer Council Queensland. The two Cancer Council Queensland authors on the manuscript were not part of the Committee allocating funding but were involved with the study design, data collection, analysis and interpretation, and the writing and submission of the manuscript. Members of the Committee allocating funding had no further involvement in the study after the allocation of funds.

Conflict of interest

The authors declare there is no conflict of interest.
References


Table 1

Constructs and Corresponding Measures Assessed Pre- and Post- Intervention for the data collection period of October-November, 2007 and May-June, 2008, in Queensland, Australia

<table>
<thead>
<tr>
<th>Construct</th>
<th># items</th>
<th>Scale</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavioral beliefs(^a)</td>
<td>6</td>
<td>1 (extremely unlikely) to 7 (extremely likely)</td>
<td>“If I performed sun-protective behaviors(^b) I would...” look unfashionable (disadvantage), decrease the risk of skin cancer (advantage), be less affected by glare (advantage), be uncomfortable (e.g., too hot, sweaty, greasy) (disadvantage), decrease the risk of sunburn (advantage), be less likely to tan (disadvantage)</td>
</tr>
<tr>
<td>Normative beliefs</td>
<td>5</td>
<td>1 (extremely unlikely) to 7 (extremely likely), 8 (doesn’t apply to me)</td>
<td>“The following people would think that I should perform sun-protective behaviors(^b)” : Mum, Dad, other family members, close friends, other friends</td>
</tr>
<tr>
<td>Control beliefs - Barriers</td>
<td>8</td>
<td>1 (extremely unlikely) to 7 (extremely likely)</td>
<td>“The following factors would stop me from performing sun-protective behaviors(^b)” : forgetting, sun-protection unavailable, laziness, too expensive, cold or overcast weather, thinking that I won’t be out in the sun, being too busy, and others reminding you to sun-protect(^c)</td>
</tr>
<tr>
<td>Control beliefs – Motivators</td>
<td>6</td>
<td>1 (extremely unlikely) to 7 (extremely likely)</td>
<td>“The following factors would help me to perform sun-protective behaviors(^b)” : meeting skin cancer sufferers, user-friendly sunscreen (e.g., thickness, smell), more fashionable hats and sun-protective clothing, sunscreen stations at the beach and/or school, cheaper sun-protection products, and others reminding you to sun protect(^c)</td>
</tr>
<tr>
<td>Intention</td>
<td>2</td>
<td>1 (strongly disagree) to 7 (strongly agree)</td>
<td>“I intend to perform sun-protective behaviors(^b)” and “It is likely that I will perform sun-protective behaviors (^*)” , (r(77) = 0.85, p &lt; 0.001) (T1), and (r(66) = 0.57, p &lt; 0.001) (T2).</td>
</tr>
<tr>
<td>Behavior</td>
<td>1</td>
<td>1 (never) to 7 (always)</td>
<td>“Think about the past week. In general how often did you perform sun-protective behavior(^b)”</td>
</tr>
</tbody>
</table>

\(^a\) Internal consistency for the belief scales are not reported as there is no expectation that beliefs will correlate highly with each other (Ajzen, 2006).

\(^b\) Each question had the stem: “every time I go in the sun for more than 10 minutes during the next week”
“Others reminding you to sun protect” was raised in previous research (e.g., Robinson et al., 2008; White et al., 2008) as both a potential barrier to and motivator for sun-safety behavioral performance.
Table 2
Means (Standard Deviations), Confidence Intervals, and Significance Levels Examining Time by Condition Effects for Belief Constructs, Intention, and Behavior, at Pre- and Post-Intervention (N = 54) for the data collection period of October-November, 2007 and May-June, 2008, in Queensland, Australia

<table>
<thead>
<tr>
<th>Construct</th>
<th>Condition</th>
<th>Time 1 (Pre-Intervention)</th>
<th>Time 2 (Post-Intervention)</th>
<th>Confidence Intervals (T1-T2)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower</td>
<td>Upper</td>
</tr>
<tr>
<td>Behavioral beliefs</td>
<td>Intervention</td>
<td>4.54 (.14)</td>
<td>4.58 (.17)</td>
<td>-.38</td>
<td>.29</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.02 (.13)</td>
<td>4.78 (.16)</td>
<td>-.06</td>
<td>.55</td>
</tr>
<tr>
<td>Normative beliefs</td>
<td>Intervention</td>
<td>4.58 (.21)</td>
<td>5.07 (.25)</td>
<td>-1.00</td>
<td>.02</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.17 (.19)</td>
<td>4.90 (.22)</td>
<td>-.20</td>
<td>.73</td>
</tr>
<tr>
<td>Control beliefs</td>
<td>Intervention</td>
<td>4.11 (.24)</td>
<td>4.45 (.21)</td>
<td>-.83</td>
<td>.14</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>4.08 (.22)</td>
<td>4.16 (.19)</td>
<td>-.52</td>
<td>.37</td>
</tr>
<tr>
<td>Control beliefs (Barriers)</td>
<td>Intervention</td>
<td>4.19 (.26)</td>
<td>4.84 (.20)</td>
<td>-1.06</td>
<td>-.23</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.39 (.24)</td>
<td>4.97 (.18)</td>
<td>.04</td>
<td>.80</td>
</tr>
<tr>
<td>Intention</td>
<td>Intervention</td>
<td>4.48 (.32)</td>
<td>5.31 (.27)</td>
<td>-1.50</td>
<td>-.17</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>5.24 (.29)</td>
<td>5.00 (.25)</td>
<td>-.37</td>
<td>.85</td>
</tr>
<tr>
<td>Behavior</td>
<td>Intervention</td>
<td>2.96 (.37)</td>
<td>3.88 (.37)</td>
<td>-1.81</td>
<td>-.03</td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td>3.93 (.33)</td>
<td>3.44 (.33)</td>
<td>-.31</td>
<td>1.30</td>
</tr>
</tbody>
</table>