



Facilitating Sunscreen Use in Women by a Theory-Based Online Intervention: A Randomized Controlled Trial

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Abstract

This study compares a motivational skin cancer prevention approach with a volitional planning and self-efficacy intervention to enhance regular sunscreen use. A randomized controlled trial (RCT) was conducted with 205 women (mean age 25 years) in three groups: motivational; volitional; and control. Sunscreen use, action planning, coping planning and coping self-efficacy were assessed at three points in time. The volitional intervention improved sunscreen use. Coping planning emerged as the only mediator between the intervention and sunscreen use at Time 3. Findings point to the role played by coping planning as an ingredient of sun protection interventions.

Keywords

action planning, coping planning, randomized controlled trial, self-efficacy, sunscreen use

The rising incidence of skin cancer (Lens and Dawes, 2004), as well as the ease of preventing its occurrence, make it a suitable target for prevention campaigns. Sun protection methods comprise sunscreen use, wearing protective clothing and seeking shade. Sunscreen use has been proven to be an efficient prevention method (Gonzalez et al., 2008). Studies have tried to find out how to get people to use sunscreen when they are in the sun. Barriers towards sunscreen use have been identified, such as having a positive attitude towards tanning (Arthey and Clarke, 1995), holding high appearance norms and having low risk perception (Paul et al., 2008). On the other hand, several predictors of

sunscreen use have been found, such as age, with older people using more sunscreen (Baum and Cohen, 1998), perceived susceptibility for developing skin cancer (Mermelstein and Riesenber, 1992), self-efficacy towards sun protection (Myers and Horswill, 2006) and positive outcome expectancies (De Vries

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et al., 2005). Women in particular were shown to value a tan and deliberately seek tanning (Jackson and Aiken, 2000). Therefore, they constitute an important target group for sun protection interventions.

Research on sunscreen use promotion interventions has mainly focused on motivational factors, such as risk perception (McClendon and Prentice-Dunn, 2001), self-efficacy and image norms (Jackson and Aiken, 2006). Few studies have found evidence that planning represents a mediator of the intention–sunscreen use relation, arguing for the inclusion of post-intentional factors in sun protection interventions (Jones et al., 2001; Van Osch et al., 2008b). However, previous studies did not examine different kinds of planning in conjunction with coping self-efficacy in sunscreen use. Instead, some focused on planning and others on the role of self-efficacy in intention formation, which is influential at a motivational (not volitional) stage of the behaviour change process (Jackson and Aiken, 2000). Moreover, despite the body of evidence for successful interventions in sun protection, studies are lacking that specifically test the comparative effectiveness of motivational and volitional interventions in changing sunscreen use are lacking.

Motivational and volitional factors in behaviour change

The theoretical backdrop of the present study is the Health Action Process Approach (HAPA; Schwarzer, 2008), which suggests dividing the health behaviour change process into two phases. First comes the motivation phase, in which people develop their intentions to act. Afterwards, they enter the volitional phase, when a switch of mindset occurs and they move from deliberation to action. Within the two phases, different patterns of social-cognitive predictors may emerge. In the motivational phase, risk perception (e.g. 'I am at risk for developing skin cancer'), positive outcome expectancies (e.g. 'If I use sunscreen, I will

reduce my risk for developing premature wrinkles') and perceived self-efficacy (e.g. 'I can use sunscreen, even if it feels sticky on my skin') are considered important for forming an intention.

After a person is motivated towards adopting a particular health behaviour, the 'good intention' has to be transformed into detailed instructions on how to perform the desired action. Moreover, once an action has been initiated, it needs to be maintained. This is not achieved through a single act of will, but involves self-regulatory skills and strategies. Thus, the post-intentional phase should be further broken down into more proximal factors represented by volitional constructs, such as self-efficacy and planning.

Good intentions are more likely to be translated into action when people generate plans. Meta-analyses have summarized the findings on the effects of planning (or 'implementation intentions') on health behaviours (for an overview, see Gollwitzer and Sheeran, 2006). Randomized controlled trials have documented the evidence in favour of such planning interventions to improve the adoption and maintenance of health behaviours (Chapman et al., 2009; Luszczynska, 2006).

Planning has been further broken down into action and coping planning. The former refers to the when, where and how to perform the target behaviour. The latter implies the anticipation of barriers and the generation of alternative behaviours to overcome them (Sniehotta et al., 2006; Wiedemann et al., 2011). People are asked to imagine scenarios that would hinder them in performing their intended behaviour and then to develop one or more plans to cope with a challenging situation. Coping planning might be a more effective self-regulatory strategy than action planning, partly because it implies the former. After people contemplate the when, where and how to act, they go on to imagine possible barriers and generate coping strategies. Thus, coping planning comes on top of action planning (Scholz et al., 2008).

Self-efficacy is another facilitating factor in health behaviour change. It refers to individuals believing that they can master the challenges they encounter while trying to adopt and maintain behaviour change (Bandura, 1997). Coping self-efficacy is a volitional construct. It refers to the belief that one can cope with the barriers that could hinder behaviour maintenance. Such a phase-specific variant of self-efficacy has been found to be predictive of health behaviour maintenance in several studies (Luszczynska et al., 2010; Schwarzer, 2008).

The HAPA allows for a prediction of behaviour as well as for an understanding of the mechanisms involved in behaviour change. Empirical evidence has been accumulated to support the assumptions of the model for diverse behaviours, such as healthy eating, physical exercise, dental flossing, condom use, breast self-examination, seat belt use or vaccinations (Gutierrez-Dona et al., 2009; Lippke et al., 2009; Luszczynska et al., 2010; Payaprom et al., 2011; Schwarzer et al., 2007; Teng and Mak, 2011). However, no studies up till now have explored the effectiveness of motivational versus volitional interventions in promoting sunscreen use.

Aims of the study

The present study aimed to compare the effectiveness of motivational and volitional interventions in changing sunscreen use in women. We expected that the volitional intervention will be more effective than the motivational and the control conditions in increasing sunscreen use. We also set out to explore the mediators that would explain the intervention effectiveness. We hypothesized that coping self-efficacy, action planning, and coping planning would constitute mediators of the intervention effect on increasing sunscreen use in participants who have received the volitional intervention because these three putative mediators constitute the ingredients of the volitional treatment.

Method

Participants and procedure

Participants were recruited through announcements placed world-wide on university websites, blogs and discussion forums starting in June 2010. The online intervention was available in four languages: English, German, Portuguese and Romanian. Persons who were interested in the study gave their informed consent for participation and filled in their e-mail address to which they would receive the follow-up questionnaire. At Time 1 (T1), 279 participants completed an online questionnaire on their sun protection habits and related cognitions based on the HAPA model. Participants were not included if the following criteria were present: (a) they did not complete the entire questionnaire at T1; or (b) they did not provide an e-mail address. Two weeks later at Time 2 (T2) and one month later at Time 3 (T3) all participants received an e-mail asking them to fill in a follow-up questionnaire. A sample of 222 individuals completed the questionnaire at all three points in time. Men ($n = 17$) were excluded from this analysis in order to obtain a more homogeneous sample of women, who are known to value a tan in particular. The final sample consisted of 205 women, with a mean age of 25.04 years ($SD = 8.66$), ranging from 18 to 66 years. These were randomized into the volitional, motivational and control intervention groups (see Fig. 1).

Research design

An experimental 3 (conditions) x 3 (time) design was chosen. Participants were assigned on an individual basis to each of the three experimental groups. Randomization was achieved by assigning a computer-generated random number to each participant upon log-in on the online platform. After logging in, participants were randomly assigned to one of three groups: control ($n = 61$, received feedback on skin type), motivational intervention ($n = 74$, received resource communication), volitional

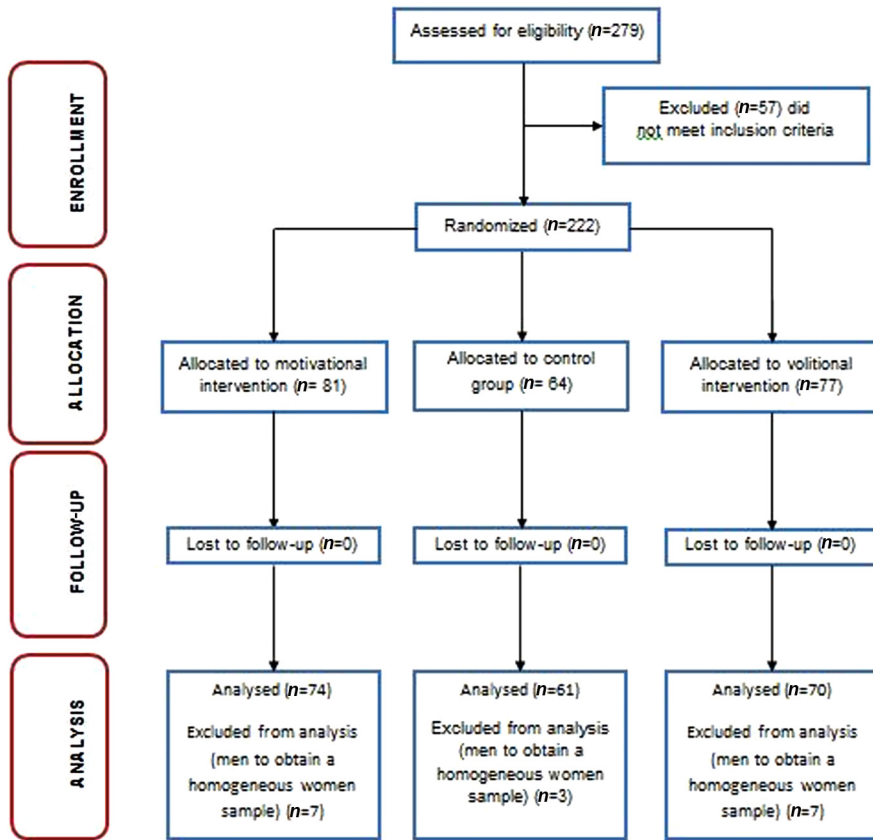


Figure 1. CONSORT flow diagram.

intervention ($n = 70$, formed action and coping plans, coping self-efficacy). There were no between-group differences at baseline for sunscreen use, $F(2, 205) = 1.57, p = .20$.

Measures

Sunscreen use was measured at T1, T2 and T3 by asking whether they had applied sunscreen with a sun protection factor (SPF 15+) before going out on sunny days. Responses ranged from *strongly disagree* (1) to *strongly agree* (4). Based on recommendations from the Healthy People 2010 skin cancer prevention goals (Saraiya et al., 2004) and the World Health Organization (WHO, 2010), we have focused on sunscreen use with a SPF of 15+.

Action planning was measured with one item at T2, asking people to evaluate to which extent they agree with the affirmation that they had already made a concrete plan on when, where and how to use sunscreen. Responses ranged from *strongly disagree* (1) to *strongly agree* (4).

Coping planning was measured with a three-item scale at T2 ($\alpha = .88$). Three types of barriers were chosen, based on a pilot focus group study on sun protection: barriers that hinder behaviour adoption; obstacles that hinder behaviour maintenance; and barriers that make it hard for people to resume their behaviour after a relapse. Thus, participants were asked to rate to what extent they had made a concrete plan about what to do if they forgot their sunscreen at home, if they feel awkward to use

Table 1. Means (and standard deviations in parentheses) for sunscreen use, action planning, coping planning and coping self-efficacy.

| Measures | Control (n = 61) | Motivational intervention (n = 74) | Volitional (planning) intervention (n = 70) |
|-------------------------|---------------------|---------------------------------------|--|
| Action planning T2 | 2.10 (0.95) | 2.30 (0.87) | 2.46 (0.79) |
| Coping planning T2 | 2.12 (0.76) | 2.31 (0.81) | 2.51 (0.77) |
| Coping self-efficacy T2 | 3.02 (0.52) | 3.16 (0.43) | 3.14 (0.49) |
| Sunscreen use T1 | 1.69 (0.80) | 1.68 (0.86) | 1.60 (0.76) |
| Sunscreen use T2 | 1.70 (0.86) | 1.78 (0.84) | 1.77 (0.74) |
| Sunscreen use T3 | 1.75 (0.80) | 1.77 (0.75) | 2.00 (0.91) |

Note: T1 = Time 1, T2 = Time 2, T3 = Time 3.

sunscreen because nobody else does and if they forgot to apply sunscreen when they were in the sun. Answers ranged on a Likert scale from 1 (*strongly disagree*) to 4 (*strongly agree*).

Coping self-efficacy was measured at T2 with a four-item measure ($\alpha = .80$). The items were introduced by a short text that stated that some people find it difficult to maintain their behaviour despite obstacles. Four specific situations were described, such as friends not using sunscreen or believing that by applying sunscreen one does not get tanned, and participants had to rate on a scale from 1 (*strongly disagree*) to 4 (*strongly agree*) to what extent they agreed with each situation.

Means and standard deviations for sunscreen use, action and coping planning and coping self-efficacy can be found in Table 1.

Interventions

The *motivational intervention* combined risk and resource communication. Participants first received a message about the risk of unprotected sun exposure, highlighting negative consequences, such as premature ageing of the skin and skin cancer. This was followed by a short description of the positive outcome expectancies concerning the use of sunscreen with a SPF 15+ and a self-efficacy message in which a role model explained how easy it is to use sunscreen and emphasized its advantages (e.g. the sunscreen can substitute a normal skin

moisturizer, the smell of sunscreen reminds one of a holiday) and gave tips on how not to forget sunscreen use (e.g. always apply sunscreen like a moisturizer before leaving the house when you go out in the sun). The motivational intervention took around five minutes to complete.

In the *volitional intervention*, participants were asked to generate an action and a coping plan. Moreover, their coping self-efficacy was addressed. First, they were given an example of a person who makes an action plan for sunscreen use. Then, they had the opportunity to create their own personalized plan on when, where and how they will apply sunscreen by filling in boxes within the online intervention template. After formulating their plan, they received feedback on what their exact plan looked like. They had the possibility to adjust the wording if they considered that something was missing or incorrect. A message about the utility of coping plans and a short example of coping planning for sunscreen use followed. Participants were asked to think about three obstacles that would interfere with using sunscreen and then come up with three strategies that would help them overcome these barriers. Using the information the participants provided, the computer program generated three coping plans. The opportunity was given to correct these coping plans if the respondents were not satisfied with the way they had formulated them. Second, verbal persuasion and modelling

were used to enhance their coping self-efficacy towards sunscreen use.

In the *control group*, people only received a brief feedback on their skin type as a result of completing the questionnaire.

Analytic procedure

The data were first analysed with repeated measures analyses of variance using the intervention as a factor (three groups), and sunscreen use as the dependent variable at three points in time. Second, it was tested whether action planning, coping planning or coping self-efficacy would mediate between the intervention and sunscreen use, employing the multiple mediation algorithms by Preacher and Hayes (2008).

Results

Sunscreen use was analysed using a repeated measures ANOVA with intervention group (three levels) as between-subjects factor. There was a significant main effect for time, $F(2, 205) = 7.44, p < .001, \eta^2 = 0.03$, indicating that overall, sunscreen use had increased, and a significant time \times group interaction, $F(3, 205) = 2.70, p < .05, \eta^2 = 0.02$. The highest means for sunscreen use at T3 emerged for individuals who had received the volitional intervention, as can be seen in Fig. 2. There was no significant difference between the control group and the motivational intervention group. Post-hoc tests revealed differences between the groups at Time 3. The volitional group (mean = 1.94) obtained a higher mean than the motivational group (mean = 1.73), $t(139) = 1.35, p < .09, d = .23$ than the control group (mean = 1.73), $t(156) = 1.45, p = .07, d = .23$. Thus, a treatment effect emerged only within the volitional intervention group.

A multiple mediational analysis was conducted to examine whether planning and self-efficacy mediated between the intervention and sunscreen use (T3). A treatment contrast was created that compared the volitional treatment (1) with the combined motivational treatment

and control groups (0) because there was no difference between the latter two. Baseline sunscreen use (T1) was specified as a covariate in all mediation models.

It turned out that neither action planning (T2) nor self-efficacy (T2) operated as mediators in these analyses, neither in the multiple mediator model, nor in separate single mediator models. Thus, the only fitting one was a single mediator model in which coping planning (T2) mediated between the treatment alternative and sunscreen use (T3), controlling for sunscreen use (T1). Coefficients were $a = .26 (p = .01)$, $b = .29 (p < .01)$, baseline = $.50 (p < .01)$, indirect effect = $.08$, and $R^2 = .41$.

Discussion

The present randomized controlled trial has contrasted the effects of a volitional and a motivational intervention on sunscreen use in women who took part in a sun protection study. Moreover, it aimed to identify the active ingredient of the intervention effectiveness by testing planning and self-efficacy as potential mediators. Previous studies have shown motivational interventions to be more effective for intention formation, whereas the combination of motivational and volitional interventions was more effective in triggering behaviour change (Milne et al., 2002). Thus, in the present study, we expected that the volitional intervention will be better for improving sunscreen use in comparison to the motivational intervention. Present findings were consistent with our hypotheses as, at one month after the intervention, individuals in the volitional group reported to use more sunscreen than those in the motivational and control groups. The motivational treatment had no effect at all. Thus, only the subgroup of women who generated action and coping plans about using sunscreen did so later on when being exposed to sunshine.

These data lend support to previous findings concerning health behaviour change, where behaviour improved following a planning

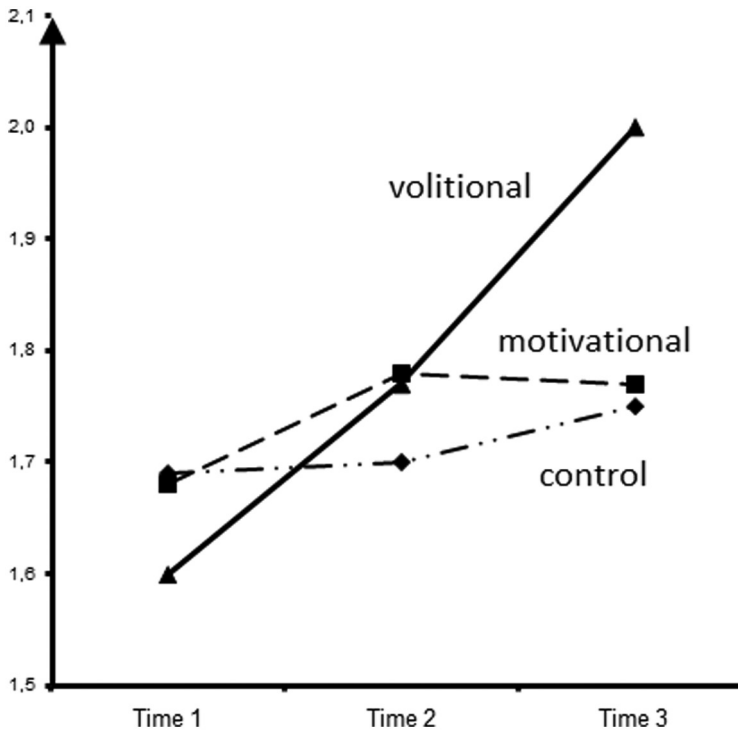


Figure 2. Changes in sunscreen use.

intervention (Chapman et al., 2009; Luszczynska, 2006; Van Osch et al., 2008a; Wiedemann et al., 2011).

Coping planning seems to have been the most active ingredient in the volitional intervention, compared to action planning and coping self-efficacy that did not significantly mediate between the intervention and behaviour adoption. Results support previous findings on the effectiveness of coping planning interventions for long-term smoking relapse (Van Osch et al., 2008a). Data are also in line with a physical activity study on the superior effectiveness of a combined action and coping planning intervention in comparison to a mere planning group (Sniehotta et al., 2006) and with studies that have shown a synergistic effect of action planning and coping planning (Araujo-Soares et al., 2009). One possible explanation for the fact that coping plans are effective at one month follow-up is that they take longer to be

formulated following the intervention. People need time to be confronted with obstacles towards behaviour adoption and refine their coping strategies, whereas action plans are easier to be formulated, requiring only to specify when, where and how a certain behaviour will be implemented. Moreover, previous research has shown that action plans were effective for behaviour initiation, whereas coping plans proved useful for behavioural maintenance (Scholz et al., 2008). Therefore, future studies should look at the effectiveness of volitional and motivational sun protection interventions for people finding themselves at different stages of behaviour change. Based on the present results and previous findings for other behaviours (Lippke et al., 2010), we would expect that action planning interventions would be more helpful for intenders, whereas coping planning interventions would help actors maintain their skin protection habits.

The effectiveness of the combined planning intervention could be due to the fact that people are required to devise their own plans. Also, becoming an expert in planning can increase behaviour by enhancing self-efficacy or through acting as a positive reinforcement for the use of planning as a self-regulatory strategy (Luszczynska et al., 2010; Sniehotta, 2009). Future research should look further into the mechanisms of how planning functions as a behaviour change strategy when combined with other self-regulatory strategies, such as action control in the context of sun protection.

Limitations need to be addressed. First, the intervention was limited to women. Although women are an important target group for sun protection intervention, different processes may account for sun protection in men (Jackson and Aiken, 2000). Also, because men were shown to use sunscreen less often (Baum and Cohen, 1998), they constitute a vulnerable group for developing skin cancer. Therefore, further research should look into testing the effectiveness of the volitional intervention in changing sunscreen use in a male sample. Second, although the validity of self-reports for sun protection methods has been proven to be satisfactory (O'Riordan et al., 2006), additional studies applying objective measures of sunscreen use should replicate the results of this study. Third, testing the effectiveness of the intervention would benefit from the use of a full factorial design, where a control group would be tested against a motivational, a volitional and an all-inclusive intervention.

Overall, the findings from the present study suggest that using a simple volitional intervention mainly based on planning can help increase sunscreen use in women. These findings have implications for health promotion, in terms of designing parsimonious but comprehensive theory- and evidence-based interventions for skin cancer prevention.

Competing Interests

None declared.

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