

Freie Universität Berlin

Fachbereich Erziehungswissenschaft und Psychologie

**Motivational and volitional processes in sunscreen use: A  
longitudinal online experiment**

Dissertation zur Erlangung des akademischen Grades

Doktor der Philosophie (Dr. phil.)

vorgelegt von

Dipl.-Psych. Catrinel Craciun

---

Erstgutachter: Prof. Dr. Ralf Schwarzer

Zweitgutachterin: PD Dr. Nina Knoll

Tag der Disputation: 13 December 2010

---

## Table of Content

Acknowledgments	
Abstract	I
Zusammenfassung	IV
Chapter 1: Introduction	1
Chapter 2: A Mediator Model of Sunscreen Use: A Longitudinal Analysis of Social-Cognitive Predictors and Mediators	28
Chapter 3: Translating Intentions into Sunscreen Use: An Interaction of Self-Efficacy and Appearance Norms	47
Chapter 4: Risk Perception Moderates How Intentions Are Translated Into Sunscreen Use	63
Chapter 5: Stage-Matched Interventions to Enhance Planning for Sunscreen Use	83
Chapter 6: Facilitating Sunscreen Use in Women by a Theory-Based Online Intervention: The Roles of Planning and Self-Efficacy	107
Chapter 7: General Discussion	128
Curriculum Vitae	159
List of Publications	160
Erklärung	164

## Acknowledgments

The writing of this dissertation was made possible with the funding of the Elsa-Neumann-Stipend, for which I express my sincere gratitude.

First and foremost, I would like to express my deep gratefulness to Professor Dr. Ralf Schwarzer, my advisor for this dissertation. Thank you for believing in me, guiding and inspiring me in this journey of scientific discovery, offering encouragement at the right time and challenging me to constantly develop and improve my work.

I would especially like to thank Dr. Sonia Lippke for her useful, stimulating comments and feedback on this thesis and for always being a model to look up to.

I am also very grateful to PD Dr. Nina Knoll for being my second advisor for this thesis and providing her help and feedback.

I would like to express my deep appreciation to my wonderful colleague Natalie Schüz, who has given me her constant support and friendship throughout this dissertation project. I would need to dedicate at least a chapter to thank you for all your patience and wise advise. A big thank you also goes to Benjamin Schüz for competent feedback at times when it was greatly needed.

Great many thanks to Professor Dr. Adriana Baban, who was the first to see the health psychologist in me and never stopped encouraging me in what I do.

A special thank you goes to my colleague and friend Diana, health psychology would not be the same without you! I am grateful to my colleagues: Lavinia, Mara, Luminita, Florina, Lucia, Alina-we have a fabulous team! And the list would not be complete without Ami, Alina C., Maria. A special thanks to Oana Mereuta for her stimulating dedication and readiness to help. I also want to thank Aurora, for her support and encouragement over the years.

I wish to thank Dr. Jochen Ziegelmann for his inspiring seminars that made me discover new paths in health psychology.

I would like to express my gratitude to Prof. Dr. Britta Renner, for her wise counsel and comments on parts of this dissertation.

I am very grateful to my German colleagues: Dr, Amelie Wiedemann, Dr. Tabea Reuter, Lena Fleig, Lisa Warner, Jana Richert, Milena Koring for their help

## Acknowledgments

---

and the whole health psychology group for making me feel welcome over these years. I especially want to thank Mary Wegner for her help on refining the fine details of the chapters included in this thesis. I also thank Dr. Silke Bukert for her wise advice and help.

My endless gratitude goes to my *Mother*, who taught me the most important things in life and most of all, to meet my challenges. A fabulous thanks goes to *Elena Doina*, for her solar presence in my life. I owe you around 5000 coffees. I am grateful to *Anca Gogaltan* for providing help when greatly needed. Thank you to my wonderful aunt *Ioana*, to you I owe my first interest in health. Also thank you Richard, Paul and Cami, Georgiana, Ilinca and Ion for giving me a sense of family.

A very special thanks to *Anca (Lolek)*, who has been a great friend in good and bad times over the years. You know how to appreciate a good challenge and make it feel like fun! A great thank you to *Cipriana*, my role model for positive energy and fighting spirit. I express my gratitude to my dear friends: *Andrea, Nana and Yuki* for their inspiring energy and friendship and 1001 great moments we shared. I want to thank *Ofelia and Gabi* who made Berlin feel like home. Thank you, *Christian* for never ceasing to listen and to inspire me! I want to express my special gratitude to *Arne*, for his endless support, encouragement and understanding during the last three years. Thank you *Mihai*, for your stimulating intellectual energy and critical spirit. Thank you *Saharou* for showing me the power of being thankful, having trust and enjoying patience. My thanks go also to *Herr Kube*, who appreciates the benefits of this work for the target population. This thesis would not be possible without *Eliana, Lucie, Alberto, Daphne* who were there when it all started and without *Ben*, who taught me to believe in myself and follow my dreams.

Berlin, October 2010

Catrinel Craciun

---

## Abstract

Changing health behaviour involves both motivational and volitional factors and processes. The present thesis aimed to explore behaviour change in the context of sunscreen use, using the Health Action Process Approach as a theoretical backdrop (HAPA; Schwarzer, 2008). The five chapters convey knowledge on the motivational and volitional predictors of sunscreen use, mediators and moderators of the intention-behaviour link, planning intervention effects for people who reside at different stages of change, compared effectiveness of motivational and volitional interventions in promoting sunscreen use and reveal active ingredients of the volitional intervention success, specifically coping planning and coping self-efficacy. The studies (three longitudinal designs and two randomized controlled trials) were conducted online during the summer of 2009 and 2010. The sun protection questionnaire and intervention were available in four languages (English, German, Portuguese, Romanian) and were advertised on several university web pages, discussion forums and blogs.

Three main research questions were addressed and potential answers are formulated within the five empirical chapters in this thesis. (1) What are the best predictors of sunscreen use intention and behaviour change? The study depicted in Chapter 2 is the first to identify both motivational and volitional predictors of sunscreen use, with the help of a structured equation model applied to longitudinal data. It is also the first research in the domain of sunscreen use to show risk perception to be a less important predictor of intention in comparison to positive

---

outcome expectancies and self-efficacy. Implications for designing sun protection interventions using both motivational and volitional factors are outlined.

(2) Do specific motivational and volitional predictors play a role as mediators or moderators of the behaviour change process in the context of sunscreen use? Studies in Chapters 3 and 4 bring their theoretical contribution to enhancing the evidence base in sunscreen use, by illustrating that action planning and self-efficacy represent mediators of the intention-behaviour link. Moreover, these represent initial attempts to apply moderated mediation analysis on longitudinal data in the context of the gap between intentions and sunscreen use. Chapter 3 adds knowledge to existing evidence by showing appearance norms to be a moderator of the link between intentions-self-efficacy and sunscreen use. Chapter 4 offers new insight by specifying risk perception as a moderator of the intention-planning-behaviour relation. Data from both studies bring their input to designing interventions, especially for changing postintentional factors that influence behaviour adoption.

(3) Are motivational and volitional interventions effective in promoting sunscreen use and if so, which are the active ingredients responsible for changing behaviour? The study in Chapter 5 is the first to compare the effectiveness of a one-size fits all intervention to an intensive planning intervention and to demonstrate stage-specific effects for sunscreen use. The parsimonious planning intervention, including action and coping plans, proved effective just for the intenders group. This lends support to previous research on other behaviours (Lippke, Ziegelmann, & Schwarzer, 2004) and has important implications for designing tailored interventions. Results from Chapter 6 bring a new input by proving that volitional interventions are more effective than motivational and control group ones in changing sunscreen use. Also, these are the

---

first data to attest that coping planning and self-efficacy are active ingredients of the volitional intervention success in promoting sunscreen use adoption.

All in all, the thesis aims to bring its contribution to theory development as well as design and evaluation of theory- and evidence-based interventions in the domain of sunscreen use for skin cancer prevention.



---

## Zusammenfassung

Die Veränderung gesundheitsrelevanter Verhaltensweisen ist ein Prozess, in dem motivationale und volitionale Faktoren zusammenwirken. Die vorliegende Arbeit untersucht den Prozess der Veränderung von Sonnenschutzverhaltensweisen und verwendet den Health Action Process Approach (HAPA; Schwarzer, 2008) als theoretischen Bezugsrahmen. Insbesondere werden die präintentionalen und die postintentionalen Faktoren untersucht. Die präintentionalen Faktoren spielen eine wichtige Rolle beim Motivierungsprozess, während postintentionale Faktoren dabei helfen, konkrete Absichten in Verhalten umzusetzen. Das Hauptziel der Arbeit ist eine Grundlage für die Entwicklung und Evaluation von theorie- und evidenzbasierten Interventionen für Sonnenschutzverhalten und Hautkrebsprävention zu schaffen. Die fünf empirischen Kapitel in der vorliegenden Arbeit liefern neue Erkenntnisse über motivationale und volitionale Prädiktoren von Sonnenschutzverhalten, die Mediatoren und Moderatoren der Beziehung zwischen Intention und Verhalten, die Effekte von Planungsinterventionen in verschiedenen Phasen der Verhaltensänderung, und die Effekte einer motivationalen im Vergleich mit einer volitionalen Intervention für Sonnencremebenutzung sowie die wirksamen Komponenten die für den Interventionserfolg verantwortlich sind. Die fünf Studien (drei mit einem langsschnittlichen Design und zwei randomisiert kontrollierte Studien) sind im Sommer 2009 und 2010 online durchgeführt worden. Der Sonnenschutzfragebogen stand in vier Sprachen zur Verfügung (Englisch, Deutsch, Portugiesisch, Rumänisch) und wurde auf universitären Webseiten, Diskussionsforen und Blogs beworben.

Der Schwerpunkt der vorliegenden Arbeit liegt auf drei Hauptforschungsfragen die in den fünf empirischen Kapiteln untersucht werden. (1) Was sind die

---

geeignetsten Prädiktoren für die Intention zur Sonnencremebenutzung und wie lässt sich die Verhaltensänderung in diesem Bereich vorhersagen? Die Studie in Kapitel 2 ist die erste die motivationale und volitionale Prädiktoren von Sonnencremebenutzung auf Basis eines längsschnittlichen Strukturgleichungsmodells beschreibt. Diese Erkenntnisse bieten eine unerlässliche Grundlage für die Entwicklung effektiver Sonnenschutzinterventionen und Hautkrebspräventionsprogramme.

(2) Welche Rolle spielen spezifische motivationale und volitionale Mediatoren und Moderatoren beim Verhaltensänderungsprozess im Kontext von Sonnencremebenutzung? Die Studien in Kapitel 3 und 4 liefern einen wichtigen Beitrag zur vorliegenden Evidenzbasis für Sonnenschutzcremebenutzung, da sie auf die Rolle von Handlungsplanung und Selbstwirksamkeitserwartungen als Mediatoren der Intentions-Verhaltens-Beziehung eingehen. Darüber hinaus sind dies die ersten Studien, die mittels längsschnittlicher moderierter Mediationsanalysen versuchen, die Intentions-Verhaltens-Lücke im Kontext von Sonnenschutzverhalten zu schließen. Kapitel 3 liefert neue Erkenntnisse durch die Untersuchung von Normen bezüglich des Aussehens als Moderator der Beziehung zwischen Selbstwirksamkeitserwartungen und Sonnencremebenutzung. Das vierte Kapitel bringt einen neuen Einblick indem es Risikowahrnehmung als Moderator der Intentions-Planungs-Verhaltens-Beziehung untersucht. Die Daten aus beiden Studien helfen bei der Entwicklung von Interventionen, beziehungsweise bei der theoretischen Ergänzung von postintentionalen Faktoren die einen starken Einfluss auf Verhalten haben.

(3) Sind motivationale oder volitionale Prädiktoren effektiver zur Förderung von Sonnenschutzverhalten, und was sind die wirksamen Komponenten die für die Verhaltensänderung verantwortlich sind? Die im fünften Kapitel beschriebene Studie

---

ist die erste, die die Effektivität einer Standardintervention mit einer intensiven Planungsintervention vergleicht und stadienspezifische Effekte für Sonnencremebenutzung findet. Die Planungsintervention, die Handlungs- und Bewältigungspläne beinhaltet, war nur wirksam für die Gruppe der Absichtsvollen. Dies entspricht vorheriger Forschung zu anderen Verhaltensweisen (Lippke, Ziegelmann, & Schwarzer, 2004) und hat wichtige Folgen für die Praxis. Die Ergebnisse aus Kapitel 6 liefern neue Erkenntnisse indem gezeigt wird, dass volitionale Interventionen effektiver sind als motivationale in der Änderung von Sonnenschutzverhalten. Darüber hinaus, zeigt das Kapitel, dass Bewältigungsplanung und Selbstwirksamkeit als wirksame Komponenten verantwortlich sind für den Erfolg volitionaler Interventionen zur Steigerung der Sonnencremebenutzung.

Das abschließende siebte Kapitel diskutiert die Ergebnisse zusammenfassend, zeigt zukünftige Forschungsfragen auf und liefert Vorschläge für die Entwicklung und Verbesserung weiterer Interventionen.

Insgesamt hat die vorliegende Dissertation das Ziel, einen wichtigen Beitrag zur Theorieentwicklung und der Entwicklung und Evaluation von theorie- und evidenzbasierten Interventionen in der Domäne von Sonnenschutzverhalten und Hautkrebsprävention zu liefern.

---

# Chapter 1

## Introduction

---

## Introduction

Sun exposure is associated with many leisure time activities such as relaxing in the nature, going to the beach, practicing outdoor sports or a “*healthy tanned look*”. However, nowadays due to ozone depletion and changes in ultraviolet (UV) rays quality, unprotected sun exposure has been shown to lead to skin cancer and premature aging of the skin. Therefore, dermatologists have developed sun protection guidelines that comprise simple actions that people should follow in order to take care of their skin while enjoying the sun such as: using sunscreen with a sun protection factor (SPF) of 15 or higher, wearing protective clothing and seeking shade. Even though these are all effortless behaviours, evidence shows that only around 29-50% individuals adhere to adequate protection guidelines (Kasparian, McLoone & Meiser, 2009). Thus, it is important to discover the factors that motivate people to use sun protection and help them adopt and maintain protective behaviours. Based on these identified factors, health psychologists can start out to develop and evaluate effective theory- and evidence-based interventions for skin cancer prevention. Although much is known about distinct social-cognitive variables that constitute predictors of sunscreen use (Arthey & Clarke, 1995; Kasparian et al., 2009), only around one third of the studies state a theoretical background that guided the intervention elaboration and even fewer measure mediators of intervention success (Adams, Norman, Hovell, Sallis, & Patrick, 2009) or investigate effectiveness of volitional interventions (Pagoto, McChargue, & Fuqua, 2003). Moreover, little attention has been given to volitional factors like action planning (Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Van Osch, Reubsaet, Lechner, Candel, Mercken, & De Vries, 2007) and none to coping planning or postintentional self-efficacy in the context of sunscreen use. Based on

---

existing reviews (Kasparian et al., 2009; Saraya et al., 2004; Baum & Cohen, 1998), several questions remain unanswered, such as: can we apply a parsimonious model that would comprise both motivational and volitional predictors of sunscreen use? What factors mediate and moderate the intention-behaviour gap in the context of sunscreen use adoption? Are planning interventions effective in changing sunscreen use? And if so, for which target group are they most effective (preintenders, intenders or actors) and what are the active ingredients responsible for the intervention success?

The present chapter describes why it is important to investigate the predictors of behaviour change relating to skin cancer prevention and argue for the relevance of testing the theoretical assumptions of the Health Action Process Approach Model (HAPA; Schwarzer, 2008) in the context of sunscreen use. The main research questions and aims will be outlined and linked to an overview of the five empirical chapters included in this thesis.

### **Skin cancer prevention and sunscreen use**

Skin cancer has become one of the most prevalent forms of cancer among the white population around the world (Diepgen & Mahler, 2002). While the highest incidence of skin cancer was registered in Australia (Arthey & Clarke, 1995) and the USA (American Cancer Society, 2009), there is proof of a rising trend also in Europe, especially in the central (Lasithiotakis et al., 2006) and northern regions due to global warming, popularity of tanning salons and extensive tourism to sunny places (Bränström, Ullen, & Brandberg, 2004; Grunfeld, 2004). The rising incidence of skin cancer at the European level (Lens & Dawes, 2004), as well as the ease of preventing its occurrence make it an important target for illness prevention campaigns.

There is strong epidemiologic evidence that attests for the relationship between unprotected ultraviolet (UV) exposure and skin cancer (Abdulla, Feldman,

---

Williford, Krowchuck, & Kaur, 2005). Besides being a determinant of both melanoma and non-melanoma skin cancer, prolonged exposure to UV radiation has been associated with premature skin aging, photodermatoses, actinic keratoses and eye cataracts (WHO, 2010). However, sun exposure has also been proven important for vitamin D production and fixation. This is vital for bone health, since vitamin D deficiency determines osteoporosis and osteomalacia in adults. Moreover, a drastic reduction in global UV exposure was estimated to contribute with an annual disease burden of 3.3 million disability adjusted life years (DALYs) (Lucas, Michael, Armstrong, & Smith, 2008). Thus, sun exposure should not be totally avoided, but protected exposure should be adopted instead in order to prevent the risk of skin cancer and premature skin aging.

Sun protection methods comprise sunscreen use, wearing protective clothing and seeking shade. While the latter two indicate that the person reduces sun exposure altogether, the use of sunscreen allows the person to enjoy the healthy properties of the sun and outdoor activities while being protected. Sunscreen use has been proven to be an efficient prevention method (Gonzalez et al., 2008). However, it is important to apply it correctly in order that it is effective (Saraya et al., 2004) and pay attention not to exaggerate sun exposure while under the positive illusion that one is protected.

Guidelines on effective sun protection prescribe using sunscreen with a SPF of 15 or higher and remembering to apply it before going out and taking care to reapply it every two hours while spending time in the sun (Skin Cancer Foundation, 2010). Despite the apparent effortlessness of adopting these behaviors, evidence shows that only 29-50% individuals exhibit adequate sun protection in accordance to guidelines (Kasparian et al., 2009). Thus, several questions arise: why do people not apply

---

sunscreen? What makes individuals develop intentions to use sunscreen and what helps them to actually use sunscreen when they go out in the sun?

A series of studies have tried to answer these questions by applying several models to sunscreen use. Prior research has shown factors from the Health Belief Model (Carmel, Shani, & Rosenberg, 1994), the Protection Motivation Theory (Grunfeld, 2004), the Theory of Planned Behavior (Myers & Horswill, 2006), the Transtheoretical Model (Kristjansson, Bränström, Ullen, & Helgason, 2003) to be predictors of sunscreen use. Other studies have focused on examining single social-cognitive variables in the context of applying sunscreen use. Main findings point to the importance of appearance norms, defined as beliefs about being more attractive when tanned, as both effective sunscreen use predictors (Jackson & Aiken, 2000) and efficient components of sunscreen use interventions (Jackson & Aiken, 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008).

All in all, previous research has found mainly factors that lead to forming an intention such as attitudes towards sunbathing, appearance norms, risk perception or self-efficacy (Kasparian et al., 2009; Arthey & Clarke, 1995). However, research in health psychology has established the existence of an intention-behavior gap that needs to be explored in order to understand postintentional process (Sheeran, 2002). In the context of sunscreen use, action planning has been found to help people translate their intentions into action (Jones et al., 2001; Van Osch et al., 2007). Nevertheless, there are few studies that use one single theoretical background to investigate both motivational and volitional determinants of sunscreen use. Identifying such a parsimonious model would improve the design and evaluation of theory and evidence-based interventions for sunscreen promotion. Moreover, additional postintentional predictors such as coping planning and coping self-efficacy



---

need to be examined in order to inform volitional interventions for sunscreen use adoption.

Prior research has looked at mediators of the intention-behavior link, but did not focus on moderators of this relation. Mediation analyses provides information on how behavior change takes place, while moderators inform on for whom a specific change mechanism works (McKinnon & Luecken, 2008). For instance, studies on other behaviors have found intention strength to moderate the intention-planning-behavior link (Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2009). The present thesis aims to examine moderators that have previously proven their relevant role as predictors of sunscreen use, such as risk perception and appearance norms. Thus, the dissertation sets off to investigate factors that contribute to developing an intention to use sunscreen as well as the factors that help individuals act upon their good intentions when they spend time in the sun (*Chapter 2*) and to identify significant mediators and moderators in this context (*Chapters 3 and 4*).

The evidence base on effectiveness of interventions to improve sunscreen use comprises a series of successful programs like the “Slip!Slop!Slap!” (Rassaby, Larcombe, Hill, & Wake, 1983), the SunSmart campaign (Borland, Hill, & Noy, 1990; Hill, Marks, White & Borland, 1993), the Under Cover Skin Cancer Prevention Project (Boutwell, 1995), the Skin Safe Program (Girgis, Sanson-Fisher, Tripodi, & Golding, 1993). However, these do not inform on the active ingredients that contribute to the effectiveness of the intervention and do not have a parsimonious theoretical background. Therefore, the present thesis sets out to develop and test an intervention based on the HAPA model and identify the components responsible for the intervention success in changing sunscreen use. Earlier studies based on the HAPA framework have shown that certain aspects of the intervention are successful

---

for different groups depending on the stage of behaviour change of the individual (Lippke, Ziegelmann, & Schwarzer, 2004). Motivational factors are more relevant for preintenders, whereas volitional aspects proved more effective for intenders. Thus, the present thesis aims to see whether such staging effects occur also in the case of a HAPA based sunscreen use promotion intervention (*Chapter 5*). Earlier research on health behaviours has shown that volitional interventions are more effective in changing behaviour (Milne, Orbell, & Sheeran, 2002). Nevertheless, there are no studies to compare motivational and volitional interventions in the domain of sunscreen use. Thus, the present thesis attempts to test and contrast a volitional versus a motivational and control group intervention and also identify ingredients of intervention success (*Chapter 6*).

### **Explaining and predicting health behavior change**

Just as when searching our way into unknown territory we need a good map in order not to get lost, while trying to identify the best predictors of behavior change, we need a good theory to guide our investigation efforts. Health behavior theories help us explain, predict and develop interventions to change risk behavior and promote healthier alternatives. Theories in the domain of health psychology have been described either as being continuum or stage models.

Continuum models are built on the assumption that individuals find themselves on a range that reflects the probability of taking action and that their behavior is the direct result of forming an intention. Examples of such models comprise the Protection Motivation Theory (PMT; Maddux & Rogers, 1983) or the Theory of Planned Behavior (TPB; Ajzen 1985) (for an overview and critical discussion of these models see Lippke & Ziegelmann, 2008 or Armitage & Conner, 2000). Among the major criticisms brought to these models is the fact that they expect

---

behavior change to happen in a linear fashion and ignore qualitative changes such as relapses, transition processes and changing mindsets. Moreover, they assume that once a person has developed an intention to change, behavior modification will follow. However, sometimes people are full of good intentions to change their behavior, but never come around to taking concrete action. Research has attested the existence of an “intention-behavior gap” (Sniehotta, 2009; Sheeran, 2002) that needs further exploration and explaining so as to understand the working of volitional processes.

In order to make up for the limitations of continuum models, stage theories have been elaborated. These start off from the assumption that behavior change implies a temporal succession and require an individual to pass through a number of qualitative distinct stages. In order to be successful, interventions that aim at changing behavior should be tailored to the needs of the individual who finds himself at one particular stage. Several stage models have been proposed, among the most popular being the Transtheoretical Model of Behavior Change (Prochaska, & DiClemente, 1983) and the Precaution Adoption Process Approach (Weinstein, 1988) and the Health Action Process Approach model (Schwarzer, 1992, 2008).

#### *The Health Action Process Approach*

The theoretical background chosen for the present thesis is represented by the Health Action Process Approach (HAPA; Schwarzer, 2008) which can be used both as a continuum model to investigate social-cognitive predictors of behavior change, but also a stage model that comprises different mindsets leading to behavioral adoption and maintenance. During the motivational phase individuals develop an intention to act as a result of perceiving a risk to their health (“*I am at risk for developing skin cancer due to unprotected sun exposure*”), holding positive outcome

expectancies (“*If I use sunscreen I will get a healthy tan*”) and having high self-efficacy (“*I am confident I can use sunscreen even if I have to make an effort to apply it on a regular basis*”). Perceived self-efficacy together with positive outcome expectancies play a more important role in intention formation as compared to perceived risk perception (Schwarzer, 2008).

Intentions are translated into action within the volitional phase as a result of planning and coping self-efficacy and maintained with the aid of self-regulatory skills and recovery self-efficacy (see Figure 1.).

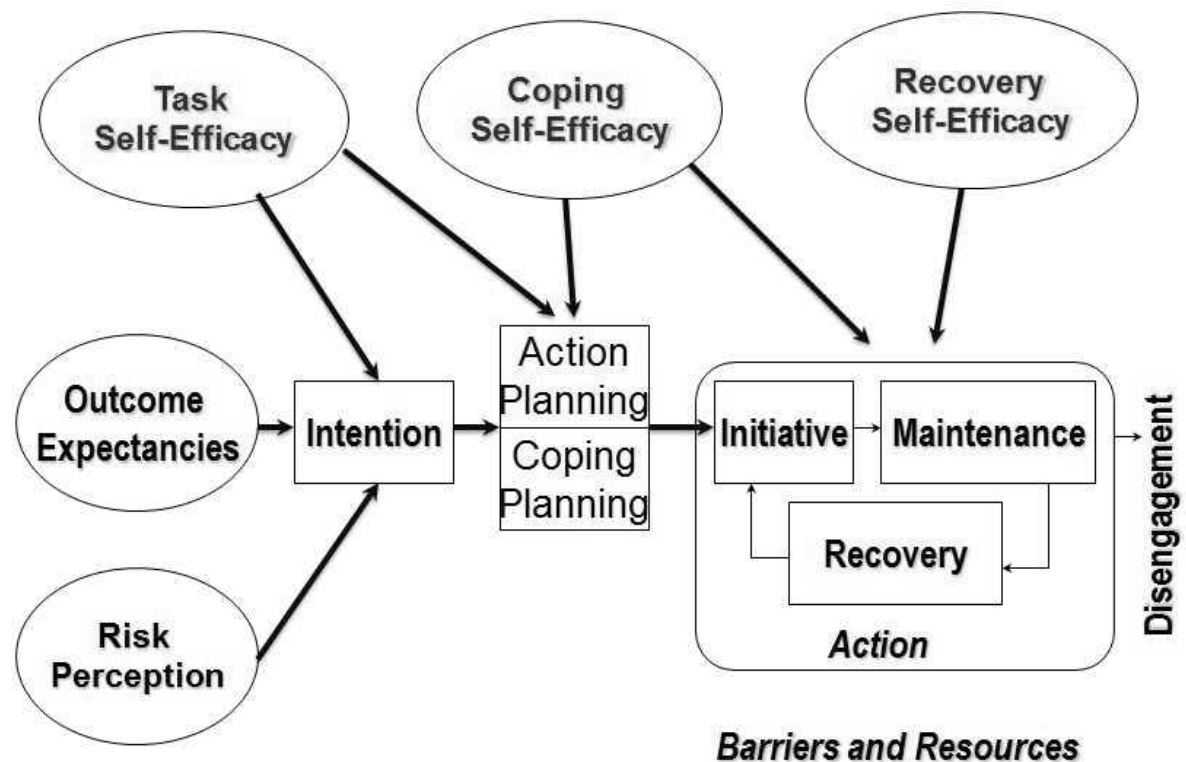


Figure 1. Action Phases and determinants of intention and behaviour according to the Health Action Process Approach (taken from R.Schwarzer, 2008)

The inclusion of planning and self-efficacy as volitional mediators allows one to perceive HAPA as an implicit stage theory because it implies the existence of at

---

least two phases: a motivational and a volitional one. Other social-cognitive models do not explicitly include postintentional factors (Luszczynska & Schwarzer, 2005). For instance, self-efficacy is supposed to be highly relevant for behaviour change (Bandura, 1997), but the HAPA takes one step further by distinguishing between types of self-efficacy which are important at different stages of the behavioural adoption process. The distinction between action, coping and relapse self-efficacy implies that different tasks need to be mastered and therefore, also different self-efficacy beliefs are needed for successful health behaviour adoption and maintenance (Schwarzer, 2008).

Planning processes are also thoroughly depicted within the HAPA model. These represent self-regulatory strategies that prepare one for future action when good opportunities arise. Within the HAPA framework there are two types of such self-regulatory processes, namely action and coping planning (Sniehotta, Schwarzer Scholz, & Schüz, 2005). Action plans refer to stating exactly when, where and how one will adopt a certain behaviour. The working mechanism is represented by forming a mental link between a desired behaviour (use sunscreen) and situational cues such as timing (on weekends), place (when I am at the beach) and method (apply sunscreen with SPF 15+ before going to the beach). When the specified cues are detected, the intended behavioural response is supposed to be activated automatically since the control of the behaviour performance is partly transferred to the environment (Gollwitzer, 1999, 2006). Still, unexpected internal (one values a tan) or external (one forgets sunscreen) barriers can emerge and interfere with behavioural adoption in spite of detailed action plans. For this reason, coping plans need to be formed by identifying possible obstacles and planning on strategies to overcome them (Sniehotta et al., 2005). Thus, action and coping planning serve different purposes. Action plans

---

facilitate behaviour initiation, while coping plans are dependent on experience with behaviour adoption and interfering variables and are more important for behaviour maintenance (Sniehotta et al., 2005; Ziegelmann, Lippke, & Schwarzer, 2006).

The HAPA model has proven successful in predicting several behaviours from eating patterns (Schwarzer & Renner, 2000), breast self-examination (Luszczynska & Schwarzer, 2003), physical activity (Scholz, Sniehotta, & Schwarzer, 2005; Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, 2008), smoking (Schwarzer & Luszczynska, 2008) to dental flossing (Schüz, Sniehotta, & Schwarzer, 2007) and for revealing the causal mechanism of behaviour change. The present thesis aimed to apply the HAPA in the context of sun protection and identify the best predictors of intention and behavioural adoption in the case of sunscreen use (*Chapters 2, 3 and 4*).

Postintentional factors have been little investigated in the context of sunscreen use. Thus, the HAPA model provides a sensible theoretical background for the exploration of such volitional aspects like planning or postintentional self-efficacy for sunscreen use adoption. For instance, it is known that self-efficacy influences the goals people set for themselves, the actions they choose to pursue, the effort they invest in translating their intentions into actions and how long they persevere when they face obstacles (Luszczynska & Schwarzer, 2003). Also, previous studies in the domain of sun protection have shown self-efficacy to be a good predictor of intention and sunscreen use adoption (Mahler, Fitzpatrick, Parker, & Lapin, 1997; Myers & Horswill, 2006). However, we do not know exactly if self-efficacy helps individuals put their intentions into practice and apply more sunscreen while spending time in the sun. Therefore, it is important to examine whether self-efficacy constitutes a mediator of the intention-behaviour relation and if this is moderated by other factors such as valuing a tan. Appearance norms, defined as the belief that a tan makes one more

---

attractive, represent one of the best predictors of sun exposure (Hillhouse & Turrisi, 2002) and sun protection (Arthey & Clarke, 1995) and have been proven to be an important ingredient of sunscreen use adoption interventions (Jackson & Aiken, 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008). Thus, investigating their role as moderator of the intention-behaviour gap in the context of sun protection can improve understanding of the behaviour change process and lend support to existing literature on effectiveness of appearance based interventions in the context of sunscreen use (Cox, Copper, Vess, Arndt, Goldenberg, & Rutledge, 2009; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008; Jackson & Aiken, 2006).

Getting skin cancer or premature wrinkles due to unprotected sun exposure can represent a scary outlook. But often people underestimate their risk of developing illness and they do not take protective actions (Renner & Schupp, in press).

Underestimating one's health risk has been conceptualized as the "optimistic bias" (Weinstein, 1982, 2000). In this case, low risk perception can be understood as a form of unrealistic optimism, defined as the tendency to perceive oneself as being less vulnerable or invulnerable to negative life events (Weinstein, 1982, 2000) or health threats (Radcliffe & Klein, 2002). This biased perception of a health risk can be interpreted as either "defensive" or "functional" optimism (Schwarzer, 1994), depending on how it relates to engaging in healthy actions. In the context of sun protection, risk perception has been shown to be an important predictor of both applying sunscreen (de Vries, Lezwijn, Hol, & Honing, 2005) or failing to do so (Calder & Aiken, 2008). Thus, the role of risk perception as a postintentional predictor of sunscreen use needs to be further explored and clarified. The question is whether risk perception continues to be relevant after people are motivated to act and

---

if it actually helps individuals to transform their intentions into behaviour, for instance, by forming plans to act.

Mediators and moderators need to be investigated in order to fully understand the behaviour change process. The HAPA model allows for the flexible investigation of both mediators and moderators either within a continuum or a stage model framework. Stage as a moderator implies that a prediction model works for the motivational mindset but not for the volitional one. Moreover, it means that a certain set of social-cognitive variables can help move people from being preintenders to becoming intenders and another set can assist people to move from being intenders to becoming actors (Schwarzer, 2008). For example, action planning has been found to mediate between intentions and behaviour (Gollwitzer & Sheeran, 2006), but others did not come across such a relation (Norman & Conner, 2005), suggesting that the link between the three constructs may depend on other factors that come into play. Previous studies have found age (Renner, Spivak, Kwon, & Schwarzer, 2007), temporal stability of intention (Conner, 2008) and levels of intention (Wiedemann et al., 2009) to moderate the intention-behaviour relation that is mediated by planning. In the domain of sunscreen use, earlier research has identified planning to be a mediator (Van Osch et al., 2007) or both a mediator and moderator (Jones et al., 2001) of the intention-behaviour link. However, these studies have explored this relation with cross-sectional data and this has to be replicated in the context of behaviour change over time. Moreover, in order to bring a contribution to the existing evidence base, known sunscreen predictors such as appearance norms (Jackson & Aiken, 2000), self-efficacy (Myers & Horswill, 2006) or risk perception (Arthey & Clarke, 1995; Kasparian et al., 2009) need to be further investigated in order to see if they play a role as mediators or moderators of the intention-behaviour relation. The present thesis



---

aims to explore possible mediators such as planning or self-efficacy and moderators like appearance norms and risk perception in the context of sunscreen use adoption (*Chapters 3 and 4*). Once identified, mediators and moderators can be used as active ingredients in intervention elaboration and tested for effectiveness in this context.

### **Motivational and volitional interventions**

When planning to design health behaviour change interventions, HAPA can be regarded as an explicit stage model. The process implies the identification of the individuals who find themselves within the motivational or volitional stage and tailor the treatment to the specific need of each of these groups. In this context, the concept of stage is defined as a mindset, comprised by a series of social-cognitive factors, that an individual has to go through as part of the cycle of behaviour change. These stages or mindsets are divided in terms of intention and behaviour, rather than time (Lippke, Ziegelmann, Schwarzer, & Velicer, 2009). Thus, preintenders are people who have not yet developed an intention to act, intenders are those who are motivated to adopt behaviour but have not yet acted upon their intentions and actors are those who have already adopted the desired behaviour.

Interventions are supposed to be most effective when matched to the specific needs of people at different behaviour change stages. (Lippke, Schwarzer, Ziegelmann, Scholz, & Schüz, 2010). For preintenders, risk communication (i.e. transmitting the message that not using sunscreen puts one at risk for skin cancer, premature skin aging and cataracts) as well as developing positive outcome expectancies (i.e. people need to be told that if they use sunscreen they will get a nice and healthy tan) and self-efficacy (i.e. individuals believe they can use sunscreen even if it is difficult to remember to apply it regularly) are considered to be most effective. Intenders should not benefit from risk communication and forming positive outcome expectancies

---

since they have already developed a motivation to act. This group would need a planning intervention that would help them translate their behaviour change intentions into action (i.e. specify plans on when, where and how to use sunscreen). Actors are supposed to benefit most from relapse prevention treatments that help them maintain behaviour change in spite of obstacles and temptations (Schwarzer, 2008).

Reviews show that most sun protection interventions augment knowledge on sun protection, sunbathing and risk of cancer, as well as attempt to change attitudes about tanning and intentions to reduce sunbathing or take protective measures (Kasparian et al., 2009), but only few manage to actually reduce sun exposure or increase sun protection behavior (Morris & Elwood, 1996; Jackson & Aiken, 2006; Mahler et al., 2008). Moreover, awareness of skin cancer risk and knowledge about protective measures do not necessarily lead to behavior initiation and maintenance (Sjöberg, 2003). Therefore, it is important to identify postintentional strategies that help change sun protection behavior. In the context of sun protection, most interventions target motivational aspects and assume that intention is the best proximal determinant of behavior. Nevertheless, this may not always be the case as many individuals fail to translate their good intentions into practice (Orbell & Sheeran, 1998; Sheeran, 2002). Once people are motivated to act, they need volitional interventions that comprise post-intentional strategies such as action plans or coping plans to help them act upon their intentions.

Previous research has reported on the success of planning interventions in changing exercise behavior (Prestwich, Lawton, & Conner, 2003; Arbour & Martin Ginis, 2009), fruit intake (Armitage, 2007) or breast self-examination (Prestwich, Conner, Lawton, Bailey, Litman & Molyneaux, 2005) and the effectiveness of forming action and coping plans for changing physical exercise (Sniehotta, Scholz, &

---

Schwarzer, 2006; Scholz, Schuez, Ziegelmann, Lippke, & Schwarzer, 2008).

Although there is evidence for the importance of addressing both motivational and volitional aspects in interventions (Armitage & Arden, 2008), there are few randomized controlled trials that report on the effectiveness of combined motivational-volitional interventions. For instance for physical exercise (Milne et al., 2002) and medication intake (Sheeran & Orbell, 1999). Moreover, stage-matched interventions to promote sunscreen use, based on the Transtheoretical Model (TTM; Prochaska, & DiClemente, 1983; Prochaska et al., 2004) do not focus on post-intentional processes such as increasing action and coping planning to change behavior. However, action planning has been shown to mediate and moderate the intention-sunscreen use link (Jones et al., 2001; Van Osch et al., 2007). Thus, research is needed in order to test interventions aiming to change sunscreen use by encouraging the development of action and coping planning. Moreover, despite the body of evidence on successful interventions in sun protection (Jackson & Aiken, 2006; Weinstock, Rossi, Redding, & Maddock, 2002; Pagoto et al., 2003; Prentice-Dunn, McMath, & Cramer, 2009), there are no studies up to date that examine the comparative effectiveness of motivational and volitional interventions in changing sunscreen use and look at volitional ingredients of intervention success. Therefore, research on developing and testing of volitional interventions against motivational ones and identifying active components responsible for behavior change is needed in the domain of sunscreen use (*see Chapter 6*).

---

## **Aims and research questions of the Present Thesis**

Summarizing all the above, the present thesis sets out to explore the factors that facilitate behaviour change in the context of sunscreen use. In particular, it aims to investigate preintentional factors that determine people to become motivated to change their behaviour as well as postintentional processes that help people translate their intentions to use sunscreen into practice. The superordinate goal is to supply the informative background for developing and evaluating theory- and evidence-based interventions in the domain of sun protection.

Several research questions are addressed within five studies (3 longitudinal designs and 2 randomized controlled trials) conducted online during the summer of 2009 and 2010. The sun protection questionnaire and intervention were available in four languages (English, German, Portuguese, Romanian) and were advertised on several university web pages, discussion forums and blogs. More details about the specific objectives, hypotheses, study design, inclusion criteria and proceedings are included in the following five empirical chapters (*Chapters 2-6*). The next paragraphs describe the main research questions and relate them to the content of the empirical chapters.

### ***1. What are the best predictors of sunscreen use intention and behaviour change?***

In order to answer this question, the applicability of the HAPA model is being explored in the context of sunscreen use. Both motivational and volitional predictors were identified with the help of a structural equation model and implications for designing skin cancer prevention interventions are outlined (*Chapter 2*).

---

**2. Which specific motivational and volitional predictors constitute mediators or moderators of the behaviour change process in the context of sunscreen use?**

*What role do appearance norms play in sunscreen use change and how do these relate to self-efficacy? Does an intention-self-efficacy-behaviour chain exist and how is it influenced by levels of appearance norms?*

Chapter 3 attempts to provide answers to this question by looking into the role played by intentions, self-efficacy and appearance norms in the context of sunscreen use. The change in sunscreen use over time is explored and it is tested whether self-efficacy represents a mediator between intention and behaviour. Moreover, it is examined if appearance norms operate in conjunction with self-efficacy as reflected by an interaction of the two constructs and moderate the link between intentions, self-efficacy and sunscreen use.

*Is there an intention-planning-sunscreen use relation and is this moderated by levels of risk perception?*

In order to formulate an answer, the role of planning and risk perception is explored in the context of sunscreen use change over time (Chapter 4). It is examined whether planning mediates the relation between intention and behaviour and if risk perception operates in conjunction with intention as reflected by an interaction between the two constructs. In this context, it is explored how the intention-planning-behaviour link works for different levels of risk perception.

**3. Are motivational and volitional interventions effective in promoting sunscreen use and if so, which are the active ingredients responsible for changing behaviour?**

*Is a planning intervention more effective in changing sunscreen use as compared to a comprehensive, one-size fits all intervention? Do individuals who*

---

*find themselves at different stages of change benefit differently from the planning and comprehensive interventions?*

In order to answer these questions, a one-size fits all intervention was compared with an intensive planning intervention in changing sunscreen use. It is explored whether differential intervention effects emerge for preintenders, intenders and actors (*Chapter 5*).

*Is a volitional intervention better than a motivational intervention in changing sunscreen use? If so, what are the ingredients that help make the intervention effective?*

A randomized controlled trial was conducted in order to contrast a volitional intervention to a motivational and control group and identify the one that is most effective in changing sunscreen use. Active ingredients of the intervention effect in changing behaviour were explored (*Chapter 6*).

The five empirical chapters were written for publication in journals and can be each read as stand-alone chapters and in any desired order. *Chapter 7* includes a summary and discussion of the main findings depicted in the empirical chapters and highlights conclusions for sunscreen use change theory, intervention development and effectiveness testing.

---

### References

- Abdulla, F.R., Feldman, S.R., Williford, P.M., Krowchuck, D., & Kaur, M. (2005). Tanning and skin cancer. *Pediatric Dermatology*, *22*, 501-512.
- Adams, M.A., Norman, G.J., Hovell, M.F., Sallis, J.F., & Patrick, K. (2009). Reconceptualizing decisional balance in an Adolescent Sun Protection intervention: mediating effects and theoretical interpretations. *Health Psychology*, *28*, 217-225.
- Ajzen, I. (1985). From intentions to actions: A theory of planned behaviour. In J.Kuhl & J. Beckmann (Eds.), *Action control: from cognition to behaviour* (pp.11-40). Berlin, Germany: Springer.
- American Cancer Society (2009). *Cancer Facts & Figures*. Atlanta: American Cancer Society.
- Arbour, K.P., & Martin Ginis K.A. (2009). A randomized controlled trial of the effects of implementation intentions on women's walking behaviour. *Psychology and Health*, *24*, 49-65.
- Armitage, C., & Arden, M.A. (2008). How useful are the stages of change for targeting interventions? Randomized test of a brief intervention to reduce smoking. *Health Psychology*, *27*, 789-798.
- Armitage, C. (2007). Effects of an implementation intention-based intervention on fruit consumption, *Psychology and Health*, *22*, 917-928.
- Armitage, C. J., & Conner, M. (2000). Social cognition models and health behavior. *Psychology & Health*, *15*, 173-189.
- Arthey, S., & Clarke, V.A. (1995). Suntanning and sun protection: A review of the psychological literature. *Social Science Medicine*, *40*, 265-274.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Baum, A., & Cohen, L. (1998). Successful behavioural interventions to prevent cancer: the example of skin cancer. *Annual Review of Public Health*, *19*, 319-333.
- Borland, R., Hill, D., & Noy, S. (1990). Being SunSmart: changes in community awareness and reported behavior following a primary prevention programme for skin cancer control. *Behavior Change*, *7*, 126-135.
- Boutwell, W.B. (1995). The under cover skin cancer prevention project: a community based programme in four Texas cities. *Cancer*, *75*, 657-60.

- 
- Brändström, R., Ullen, H., Brandberg, Y. (2004). Attitudes, subjective norms and perception of behavioural control as predictors of sun-related behaviour in Swedish adults. *Preventive Medicine*, 39, 992-999.
- Calder N., & Aitken, R. (2008). An exploratory study of the influences that compromise the sun protection of young adults. *International Journal of Consumer Behavior*, 32, 579-587.
- Carmel, S., Shani, E., & Rosenberg, L. (1994). The role of age and an expanded Health Belief Model in predicting skin cancer protective behaviour. *Health Education Research*, 9, 433-447.
- Conner, M. (2008). Initiation and maintenance of health behaviours. *Applied Psychology: An International Review*, 57, 42-50.
- Cox, C.R., Copper, D.P., Vess, M., Arndt, J., Goldenberg, J.L., & Rutledge, C. (2009). bronze is beautiful but pale can be pretty: the effects of appearance standards and mortality salience on sun-tanning outcomes. *Health Psychology*, 28, 746-752.
- de Vries, H., Lezwijn, J., Hol V., & Honing C. (2005). Skin cancer prevention: behavior and motives of Dutch adolescents. *European Journal of Cancer Prevention*, 14, 39-50.
- Diepgen, T.L., & Mahler, V. (2002). The epidemiology of skin cancer. *British Journal of Dermatology*, 146 (Suppl. 61), 1-6.
- Girgis, A., Sanson-Fisher, R. W., Tripodi, D. A., & Golding, T. (1993). Evaluation of interventions to improve solar protection in primary schools. *Health Education Quarterly*, 20, 275-287.
- Gollwitzer, P. M. (2006). Open questions in implementation intention research. *Social Psychological Review*, 8, 14-18.
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119.
- Gollwitzer, P. M. (1999). Implementation intentions: Strong effects on simple plans. *American Psychologist*, 54, 493-503.
- Gonzalez, S., Fernandez-Lorente, M., Gilaberte-Calzada, Y. (2008). The latest on skin photoprotection. *Clinics in Dermatology*, 26, 614-626.
- Grunfeld, E.A., (2004). What influences university students intentions to practice safe sun exposure behaviours?. *Journal of Adolescent Health*, 35, 486-492.



- 
- Hill, D., White, V., Marks, R., & Borland, R. (1993). Changes in sun-related attitudes and behaviors, and reduced sunburn prevalence in a population at high risk of melanoma. *European Journal of Cancer Prevention*, 2, 447-456.
- Hillhouse, J.J., & Turrisi, H. (2002). Examination of the efficacy of an appearance-focused intervention to reduce UV exposure. *Journal of Behavioural Medicine*, 25, 395-409.
- Jackson, K. M., & Aiken, L. S. (2000). A psychological model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology*, 19:469–478.
- Jackson, K.M, & Aiken, L.S., (2006). Evaluation of a multicomponent appearance based sun protective intervention for young women, uncovering the mechanisms of programme efficacy, *Health Psychology*, 25, 34-46.
- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). From knowledge to action regulation: modeling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology & Health*, 16, 191-206.
- Kasparian, N. A, McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine*, 32, 406–428.
- Lasithiotakis K.G., Leiter, U., Gorkiewicz, R., Eigentler, T., Breuninger, H., Metzler, G., Strobel, W., Garbe, C. (2006). The Incidence and Mortality of Cutaneous Melanoma in Southern Germany Trends by Anatomic Site and Pathologic Characteristics, 1976 to 2003. *Cancer*, 107, 1331-1339.
- Lens, M.B., & Dawes, M. (2004). Global perspectives of contemporary epidemiological trends of cutaneous malignant melanoma. *British Journal of Dermatology*, 150, 179–185.
- Lippke, S., Schwarzer, R., Ziegelmann, J. P., Scholz, U., & Schüz, B. (2010). Testing stage-specific effects of a stage-matched intervention: a randomized controlled trial targeting physical exercise and its predictors. *Health Education & Behavior*, 37(4), 533-546. - DOI: 10.1177/1090198109359386.
- Lippke, S., Ziegelmann, J. P., Schwarzer, R., & Velicer, W. F. (2009). Validity of stage assessment in the adoption and maintenance of physical activity and fruit and vegetable consumption. *Health Psychology*, 28, 183-193.

- Lippke, S., & Ziegelmann, J. P. (2008). Theory-based health behaviour change: Developing, testing and applying theories for evidence-based interventions. *Applied Psychology: International Review*, *57*, 698-716.
- Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine*, *12*, 221–240.
- Lucas, R.M., McMichael, A.J., Armstrong B.K., & Smith, W.T. (2008). Estimating the global disease burden due to ultraviolet radiation exposure. *International Journal of Epidemiology*, *37*, 654–667.
- Luszczynska, A., & Schwarzer, R. (2003). Planning and self-efficacy in the adoption and maintenance of breast self-examination: A longitudinal study on self-regulatory cognitions. *Psychology and Health*, *18*, 93–108.
- Luszczynska, A., & Schwarzer, R. (2005). Social cognitive theory. In M. Conner & P. Norman (Eds.), *Predicting health behaviour* (2nd ed. rev., pp. 127-169). Buckingham, England: Open University Press.
- Maddux, J.E., & Rogers, R.W. (1983). Protection motivation and self-efficacy: A revised theory of fear appeals and attitude change. *Journal of experimental Social Psychology*, *19*, 469-479.
- Mahler, H.I.M., Kulik, J.A., Butler, H.A., Gerrard, M., & Gibbons, F. (2008). Social norms information enhances the efficacy of an appearance based sun protection intervention. *Social Science and Medicine*, *67*, 321-329, doi:10.1016/j.socscimed.2008.03.037.
- Mahler, H. I. M., Fitzpatrick, B., Parker, P., & Lapin, A. (1997). The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion*, *11*: 426-429.
- MacKinnon, D. P., & Luecken, L. J. (2008). How and for whom? Mediation and moderation in health psychology. *Health Psychology. Suppl. Issue: Mediation and Moderation* *27*, S99-S100.
- Milne, S., Orbell, S., & Sheeran P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions, *British Journal of Health Psychology*, *7*, 163-184.

- 
- Morris, J., & Elwood M. (1996). Sun exposure modification programmes and their evaluation: a review of the literature. *Health Promotion International*, 4, 321-332.
- Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine*, 32, 57-63.
- Norman, P., & Conner, M. (2005). The Theory of Planned Behavior and exercise: Evidence for the mediating and moderating roles of planning and intention-behavior relationships. *Journal of Sport and Exercise Psychology*, 27, 488-504.
- Orbell, S. & Sheeran, P. (1998). "Inclined abstainers": A problem for predicting health-related behaviour, *British Journal of Social Psychology*, 37, 151-165.
- Pagoto, S., McChargue, D., & Fuqua, R.W. (2003). Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology*, 22, 429-433.
- Prentice-Dunn, S., McMath, B.F., & Cramer, R.J. (2009). Protection motivation theory and stages of change in sun protective behaviour. *Journal of Health Psychology*, 14, 297-305.
- Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour, *Psychology and Health*, 18, 707-721.
- Prestwich, A., Conner, M., Lawton, R., Bailey, W., Litman, J., & Molyneaux, V. (2005). Individual and collaborative implementation intentions and the promotion of breast self-examination, *Psychology and Health*, 20, 743-760.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395.
- Prochaska, J. O., Velicer, W. F., Rossi, J. S., Redding, C. A., Greene, G. W., Rossi, S. R., et al. (2004). Multiple risk expert system interventions: Impact of simultaneous stage-matched expert system interventions for smoking, high-fat diet, and sun exposure in a population of parents. *Health Psychology*, 25, 503-516.
- Radcliffe, N. M., & Klein, W. M. P. (2002). Dispositional, unrealistic, and comparative optimism: Differential relations with knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin*, 28, 836-846.

- 
- Rassaby, J., Larcombe, I., Hill, D. & Wake, F. R. (1983). Slip Slop Slap: health education about skin cancer. *Cancer Forum*, 7,63-69.
- Renner, B., & Schupp, H.T. (in press). The perception of health risk. In H. Friedman (ed), *Oxford Handbook of Health Psychology*. New York, N.Y.: Oxford University Press.
- Renner, B., Spivak, Y., Kwon, S., & Schwarzer, R. (2007). Does age make a difference? Predicting physical activity of South Koreans. *Psychology and Aging*, 22, 482-493.
- Saraya et al. (2004). Interventions to prevent skin cancer by reducing exposure to ultraviolet radiation, a systematic review. *American Journal of Preventive Medicine*, 25, 422-466.
- Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology*, 12, 1–36.
- Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behaviour: augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology*, 29, 349-369.
- Sjöberg, L. (2003). Neglecting the Risks: The Irrationality of Health Behavior and the Quest for La Dolce Vita. *European Psychologist*, 8(4), 266-278.
- Scholz, U., Schüz, B., Ziegelmann, J. P., Lippke, S., & Schwarzer, R. (2008). Beyond behavioral intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology*, 13, 479-494.
- Scholz, U., Sniehotta, F. F., & Schwarzer, R. (2005). Predicting physical exercise in cardiac rehabilitation: The role of phase-specific self-efficacy beliefs. *Journal of Sport & Exercise Psychology*, 27, 135–151.
- Schüz, B., Sniehotta, F. F., & Schwarzer, R. (2007). Stage-specific effects of an action control intervention on dental flossing. *Health Education Research*, 22, 332–341.
- Schwarzer, R. (1992). Self-efficacy in the adoption and maintenance of health behaviors: Theoretical approaches and a new model. In R. Schwarzer (Ed.), *Self-efficacy: Thought control of action* (pp. 217-243). Washington, DC: Hemisphere.
- Schwarzer, R. (1994). Optimism, vulnerability, and self-beliefs as health-related cognitions: A systematic overview. *Psychology and Health*, 9, 161–180.
- Schwarzer, R., & Renner, B. (2000). Social-cognitive predictors of health

- behavior: Action self-efficacy and coping self-efficacy. *Health Psychology*, *19*, 487–495.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*, *57*, 1-29.
- Schwarzer, R., & Luszczynska, A. (2008). How to overcome health-compromising behaviours: The health action process approach. *European Psychologist*, *2*, 141-151.
- Schwarzer, Luszczynska, Ziegelmann, Scholz, & Lippke, S. (2008). Social-cognitive predictors of physical exercise adherence: three longitudinal studies in rehabilitation. *Health Psychology*, *27*, S54-S63.
- Sniehotta, F. (2009). Towards a theory of intentional behaviour change: Plans, planning and self-regulation. *British Journal of Health Psychology*, *14*, 261-273.
- Sniehotta, F. F., Schwarzer R, Scholz U, & Schüz B. (2005). Action planning and coping planning for long-term lifestyle change: Theory and assessment. *European Journal of Social Psychology*, *35*, 565-576.
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2006). Action plans and coping plans for physical exercise: A longitudinal intervention study in cardiac rehabilitation. *British Journal of Health Psychology*, *11*, 23-37.
- Skin Cancer Foundation, retrieved 14.09.2010 from <http://www.skincancer.org/Guidelines/>.
- Van Osch, L., Reubsæet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2007). Predicting parental sunscreen use: Disentangling the role of action planning in the intention-behavior relationship. *Psychology and Health*, 1-19. DOI: 10.1080/08870440701596577.
- Weinstein, N. D. (1982). Unrealistic optimism about susceptibility to health problems. *Journal of Behavioral Medicine*, *5*: 441-460.
- Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology*, *7*, 355-386.
- Weinstein, N. D. (2000). Perceived probability, perceived severity and health-protective behavior. *Health Psychology*, *19*, 135-140.
- Weinstock, M.A., Rossi, J.S., Redding, C.A., & Maddock, J.E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched

---

intervention to increase sun protection among beach goers. *Preventive Medicine*, 35, 584-592.

Wiedemann, A. U., Schüz, B., Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2009). Disentangling the relation between intentions, planning, and behaviour: A moderated mediation analysis. *Psychology & Health*, 24, 67-79.

WHO, Health effects of UV radiation, retrieved 13.08.2010 from <http://www.who.int/uv/health/en/>.

Ziegelmann, J. P., Lippke, S., & Schwarzer, R. (2006). Adoption and maintenance of physical activity: Planning interventions in young, middle-aged, and older adults. *Psychology & Health*, 21, 145-163.

---

# Chapter 2

**A Mediator Model of Sunscreen Use:**

**A Longitudinal Analysis of Social-Cognitive Predictors and Mediators**

---

Abstract

**Purpose.** Sun safety behaviors to prevent skin cancer, such as sunscreen use, are difficult to adopt and maintain. Most social-cognitive theories assume that the intention to change is the best predictor of actual change. But unforeseen barriers emerge, or people give in to temptations, such as getting a tan despite their initial good intentions. A social-cognitive model with predictors and mediators of sunscreen use is examined to explore the self-regulatory mechanisms of sun safety behaviors.

**Method.** An international longitudinal survey was conducted with 524 individuals. Intentions, positive outcome expectancies, distal self-efficacy, and risk perception were assessed at Time 1, whereas intention, planning, and proximal self-efficacy were measured two weeks later at Time 2. Sunscreen use was reported at three-month follow-up (Time 3).

**Results.** A structural equation model fit the data well. Positive outcome expectancies, risk perception, and self-efficacy predicted the behavioral intention. Self-efficacy and planning predicted sunscreen use, and planning mediated the relation between intended and performed sunscreen use.

**Conclusions.** The findings contribute to the understanding of psychological mechanisms in health behavior change. They also point to the particular role of mediator variables in the context of sun protection behaviors, which may have implications for designing skin cancer preventive interventions.

Keywords: sunscreen use, self-efficacy, planning, intention, skin cancer, sun safety



---

**A Mediator Model of Sunscreen Use:  
A Longitudinal Analysis of Social-Cognitive Predictors and Mediators**

Skin cancer is caused by health-compromising behaviors such as unprotected sun exposure (Abdulla, Feldman, Williford, Krowchuck, & Kaur, 2005), but fortunately it can be prevented by taking simple protection measures, such as using sunscreen (Gonzales, Fernandez-Lorente, & Gilaberte-Calzada, 2008). Although individuals have, in principle, control over their conduct, many fail at successfully controlling their risk behaviors. Such problems can be overcome by self-regulatory efforts, and preventive measures can be adopted, such as using sunscreen, wearing protective clothing, or seeking shade.

Health behavior change refers to motivational as well as volitional processes, such as adopting and maintaining health-enhancing behaviors. It also encompasses a variety of social, emotional, and cognitive factors that sometimes are assumed to operate in concert. Therefore, researchers have aimed at identifying the optimal set of factors that allow for the best prediction or explanation of health behavior change. Factors and their interplay are modeled in social-cognitive theories. Such models or theories are subject to debate in health psychology (cf. Lippke & Ziegelmann, 2008).

***The Health Action Process Approach***

Intention to change behavior stands at the core of most health behavior models, representing the best proximal predictor of behavior. However, although people sometimes have the best intentions to quit bad habits and adopt healthy alternatives, they do not manage to translate their intentions into action. Intentions have been shown to have limited predictive value when it comes to behavior change.

---

Following this line of thought, authors have identified the intention-behavior gap and attempted to tackle the postintentional factors that help people act upon their good intentions (Abraham & Sheeran, 2000).

A model that explicitly includes postintentional mediators to overcome the intention-behavior gap is the Health Action Process Approach (HAPA; Schwarzer; 2008). This approach suggests a distinction between (a) preintentional motivation processes that lead to a behavioral intention, and (b) postintentional volition processes that lead to the actual health behavior. Within the two phases, different patterns of social-cognitive predictors may emerge. In the initial motivation phase, a person develops an intention to act. Within this first phase, risk perception is seen as a distal antecedent (e.g., *“I am at risk for developing skin cancer”*). Risk perception alone is insufficient to form an intention. Rather, it may set the stage for further elaboration of thoughts about consequences and competencies. Similarly, positive outcome expectancies (e.g., *“If I use sunscreen, I will reduce my risk for skin cancer”*) are seen as being important in the motivation phase, when a person balances the pros and cons of certain behavioral outcomes. Further, one needs to believe in one's capability to perform the goal behavior (perceived self-efficacy, e.g., *“I am capable of using sunscreen even if it feels sticky”*). Perceived self-efficacy operates in concert with positive outcome expectancies, both of which contribute substantially to forming an intention.

After a person develops a motivation towards adopting a particular health behavior, 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 postintentional 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 plan the concrete goal attainment and how to overcome barriers. Planning mediates between intention and behavior (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008). Meta-analyses have summarized the findings on the effects of planning (or “implementation intentions”) on health behaviors (for an overview, see Gollwitzer & Sheeran, 2006). Planning is an alterable variable. It can be easily communicated to individuals with self-regulatory deficits. Randomized controlled trials have documented the evidence in favor of such planning interventions to improve the adoption and maintenance of health behaviors (Chapman, Armitage, & Norman, 2009; Luszczynska, 2006).

The HAPA allows for a prediction of behavior as well as an understanding of the causal mechanisms involved in behavior change. Thus, a great deal of empirical evidence has been accumulated to support the assumptions of the model for diverse behavior like healthy diet, performing physical exercise, dental flossing, breast cancer screening, smoking, or seat belt use (Gutiérrez-Doña, Lippke, Renner, Kwon, & Schwarzer, 2009; Luszczynska, et al., 2010; Renner et al., 2008; Schwarzer, 2008; Ziegelmann & Lippke, 2007.). However, no studies up till now have explored the applicability of the HAPA model within the context of sunscreen use.

### ***Predictors of Sunscreen Use***

Previous research in the domain of sun protection has tried to identify the best predictors of protective behavior adoption. Perceived threat of developing skin cancer, costs and benefits of adopting a sun protection method, social norms, and knowledge

---

about skin cancer were found among the most frequent predictors of sun protection (Kasparian, McLoone, & Meiser, 2009). Risk perception concerning perceived susceptibility to skin cancer and premature aging due to unprotected sun exposure has been shown to predict intention and sunscreen use (Brandström, Ullen, & Brandberg, 2004). Self-efficacy, defined as the belief that one can adopt a certain behavior despite existing barriers, was identified as one of the best predictors of both sun protection intention and behavior (Mahler, Fitzpatrick, Parker, & Lapin, 1997; Myers & Horswill, 2006). Several barriers were described for using sunscreen, such as beliefs that sunscreen was greasy and sticky, the fact that sunscreen has to be applied repeatedly, and for men the belief that applying sunscreen represents “a not very manly” thing to do (Eid, 2001). While positive and negative expectancies associated with tanning were thoroughly explored as predictors of sun protection (Paul, Tzelepis, Parffit, & Giris, 2008), the role of positive outcome expectancies regarding the results of using sunscreen has been not explored in previous studies.

In what concerns postintentional factors, planning has been shown to mediate and moderate between intention and sunscreen use (Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Van Osch et al., 2007). However, these studies did not explore planning as part of a behavior change model, but investigated its role as a component added to other models of sun protection.

Earlier studies have tested and shown the effectiveness of the Health Belief Model in predicting sun protection practice in different age groups (Carmel, Shani, & Rosenberg, 1994), the effectiveness of Protection Motivation Theory (Grunfeld, 2004; McClendon & Prentice-Dunn, 2001), the Theory of Planned Behavior (Myers & Horswill, 2006), and the Transtheoretical Model (Kristjansson, Bränström, Ullen, & Helgason, 2003) in predicting sun protection. However, there is a scarcity of theory-

---

based studies investigating the applicability of both preintentional factors, such as positive outcome expectancies, risk perception and self-efficacy, and postintentional factors like planning in changing sunscreen use.

### *Aims of the Present Study*

Much evidence has emerged that underscores the theoretical contribution of the HAPA in the context of various health behaviors. The present research represents an application of this model to sunscreen use. So far, no study was found testing the application of the HAPA to sun safety behavior. Moreover, little attention has been given to preintentional factors, such as positive outcome expectancies or postintentional mediators of sunscreen use such as planning. The question is whether the HAPA can be replicated in the context of sunscreen use.

## **Method**

### *Participants and Procedure*

Participants were recruited through announcements placed on university websites and discussion forums from June to September, 2009. The online questionnaire was available in four languages: English, German, Portuguese and Romanian. The study was performed in accordance with both the Helsinki Declaration and the Proposals for Safeguarding Good Scientific Practice by the German Research Foundation. It was also approved by the review board of participating universities. Individuals ( $N = 524$ ) who were interested in the study gave informed consent for participation, completed the questionnaire at Time 1 (T1), and filled in their e-mail address, at which they received the follow-up questionnaires after

---

two weeks (Time 2, T2) and again after three months (Time 3, T3). The T2 questionnaires were completed by 515 participants, whereas the questions at T3 were answered by 154 individuals, 11 (7.1%) of whom were men and 143 (92.9%) were women, with a mean age of 21.46 years ( $SD = 4.47$ ), ranging from 18 to 48 years.

Those who made themselves available for follow-up assessments by providing their e-mail address were more likely to be female, were significantly younger, perceived less risk, and had lower intentions to use sunscreen in comparison to those persons who did not provide their email address.

### ***Measures***

Risk perception, positive outcome expectancies, self-efficacy, and intention were measured at T1, intention, self-efficacy and planning were assessed at T2, and sunscreen use was reported at T3.

*Intention to use sunscreen* was measured at T1 and T2 with one item asking participants about their intentions during the next months: "I intend to use sunscreen with a SPF 15+ when I am in the sun." Responses ranged from *strongly disagree* (1) to *strongly agree* (4).

*Planning to use sunscreen* was measured at T2 with four items that asked participants to state to which extent they had made a concrete plan on when, where, and how they would use sunscreen. Responses were made on four-point scales ranging from *not at all true* (1) to *exactly true* (4). Cronbach's  $\alpha$  was .86 for the planning items.

*Risk perception* was assessed at T1 by four items that targeted perceived vulnerability to develop premature wrinkles and skin spots due to unprotected sun exposure and perceived vulnerability to develop skin cancer. For two of the items,

---

respondents had to estimate their risk for developing cancer and for premature skin aging by choosing an answer from *very unlikely* (1) to *very likely* (5). The other two items asked people to compare their chances of developing premature wrinkles and skin cancer to an average person of their own sex and age. Chances were rated from *much below average* (1) to *much above average* (5). Cronbach's  $\alpha$  was .88 for the risk perception items.

*Self-efficacy* was measured at T1 (distal) and T2 (proximal) with four items that asked about people's confidence that they can apply sunscreen even if they face different barriers, such as desiring a tan or forgetting the sunscreen. Responses ranged from *not at all true* (1) to *exactly true* (4). For distal self-efficacy, Cronbach's  $\alpha$  was .82, whereas for proximal self-efficacy  $\alpha$  was .84.

*Positive outcome expectancies* were assessed at T1 with four items that asked people to say to what extent they consider several positive outcomes to be true in the case of applying sunscreen, such as having healthy skin or preventing wrinkles. Response options were from *not at all true* (1) to *exactly true* (4). Cronbach's  $\alpha$  was .83 for these four items.

*Sunscreen use* was measured at T3 by asking people whether they applied sunscreen with a sun protection factor (SPF) 15+ on sunny days when they were outside. Responses ranged from *strongly disagree* (1) to *strongly agree* (4).

Table 1 displays the item examples for all measures used in the study, means, standard deviations, reliability coefficients, and factor loadings obtained in structural equation analyses.

Table 1. *Overview of Variables and Psychometric Data (SD = Standard Deviations)*

Construct	Items	Response scale	Number of items	$\alpha$	$M$	$SD$	<i>Factor loadings</i>
Risk perception	How likely is it that you will develop...: ...wrinkles and skin spots due to unprotected sun exposure?	1 (very unlikely) -5 (very likely)	4	.88	2.47	0.84	.63
	...skin cancer due to unprotected sun exposure?						.75
	Compared to an average person of your sex and age, your chances for premature aging are	1-(much below average)- 5 (much above average)					.79
	Compared to an average person of your sex and age, your chances of developing skin cancer are						.86
Positive Outcome Expectancies	If I use sunscreen with SPF 15+ I avoid getting sunburned.	1 - 4	4	.83	3.07	0.60	.68
	If I use sunscreen with SPF 15+ I avoid getting wrinkles and age spots.						.84
	If I use sunscreen with SPF 15+ I reduce my chances of developing skin cancer.						.71
	If I apply sunscreen when I am in the sun I keep my skin looking young and healthy.						.74
Distal self-efficacy	I believe I can use sunscreen even if I think I will not get a tan.	1 - 4	4	.82	3.13	0.59	.63
							.77
							.80
							.74



Intention 1	I intend to use sunscreen with a SPF 15+ when I am in the sun (T1).	1 - 4	1	-	3.18	0.85	.82
Intention 2	I intend to use sunscreen with a SPF 15+ when I am in the sun (T2).	1 - 4	1	-	3.21	0.78	.82
Proximal self- efficacy	I believe I can use sunscreen even if I think I will not get a tan.	1 - 4	4	.84	3.13	0.57	.66
	I believe I can use sunscreen even if my friends do not apply sunscreen when they are in the sun.						.73
	I believe I can use sunscreen even if I have to invest time and money to buy it.						.83
	I believe I can use sunscreen even if I have to remember to carry it with me and apply it regularly.						.82
Planning	I have already made concrete plans on how, when and where to use sunscreen.	1 - 4	4	.86	2.32	0.79	.86
	I have already made concrete plans about what to do if I don't have sunscreen with me.						.83
	I have already made concrete plans about what to do if I feel awkward when applying sunscreen.						.64
	I have already made concrete plans about what to do if I forget to apply sunscreen.						.86
Behaviour	I applied sunscreen with a sun protection factor (SPF) of at least 15+ when I was in the sun.	1-4	1	-	2.31	0.91	1

---

**Data Analysis**

Structural equation modeling with AMOS 18 was used to examine the longitudinal model. Multiple indicators were specified for each construct except for intention and behavior. Self-efficacy was measured repeatedly at T1 and T2 with four items each. In terms of their distance to the final outcome, we labeled them distal self-efficacy and proximal self-efficacy. Autocorrelated residuals among these two constructs were set free to covary. Positive outcome expectancies as well as risk perception were measured at T1 with four items each. Intention was a single item measure at T1 as well as at T2. To define the temporal distance between antecedents (self-efficacy, outcome expectancies, and risk perception) and outcomes (planning and sunscreen use), we specified intention in between as a stable construct indicated by these two items. Planning at T2 was measured with four items. For the final behavioral outcome at T3 only one item on sunscreen use was available. Missing data were imputed using Full Information Maximum Likelihood (FIML), as recommended by Graham (2009).

**Results**

A longitudinal structural equation model with multiple indicators was examined. The model fit the data well,  $\chi^2 = 660$ ,  $df = 217$ ,  $p < .01$ ,  $\chi^2 / df = 3.0$ , CFI = .93, TLI = .91, RMSEA = .06. The standardized solution is depicted in Figure 1.

The factor loadings (lambdas) were very high, indicating a good measurement model (see Table 1). The retest reliability of self-efficacy was high (.82), reflecting the stability of this construct over time. The latent correlation between distal self-efficacy and outcome expectancies was .35, between outcome expectancies and risk perception was .09, and between self-efficacy and risk perception .17. Most conspicuous are the paths from distal self-efficacy to intention (.63), from intention to planning (.64), and from planning to behavior (.44). Moreover, one has to consider the indirect and total effects. Via this pathway

and the one via proximal self-efficacy, distal self-efficacy exerts a total effect of .39 on sunscreen use, and a total effect on planning of .41. In comparison, the total effects of outcome expectancies (.06) and risk perception (.03) on behavior are negligible. The model explains 35% of behavior variance, 41% of the variance in planning was explained by intention, and 57% of the intention variance by the social-cognitive predictors.

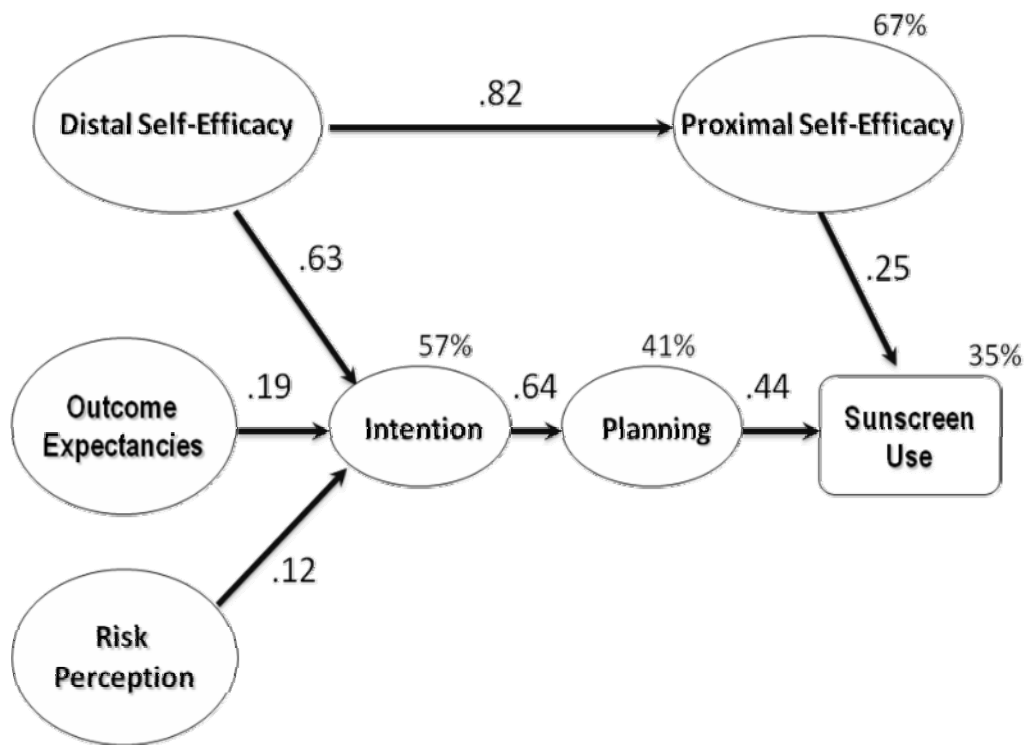


Figure 1. Longitudinal structural model for social-cognitive determinants of sunscreen use with standardized coefficients. (Multiple indicators and residuals omitted in the figure for ease of communication.) All coefficients  $p < .01$ .

## Discussion

The present data attest to the applicability of the HAPA in the context of sunscreen use, adding to the evidence on its usefulness as documented for other behaviors, such as healthy diet, performing physical exercise, dental flossing, breast cancer screening, smoking, or seat belt use (Gutiérrez-Doña et al., 2009; Luszczynska et al., 2010; Renner et al., 2008; Schwarzer, 2008; Ziegelmann & Lippke, 2007).

---

Nevertheless, some of the present results require further discussion, for example, the role of health risk awareness in sunscreen use adoption. In some of the previous studies on sun protection predictors, risk perception was shown to predict sunscreen use (Brändström et al., 2004; Grunfeld, 2004). But previous research shows that risk perception may be less important than outcome expectancies and self-efficacy in predicting intentions (Schwarzer, 2008). The present study adds to this evidence base by showing that risk perception makes only a minor contribution within the intention formation process, especially in comparison to positive outcome expectancies and self-efficacy towards sunscreen use. One possible explanation might be that other factors, such as valuing a tan (Jackson & Aiken, 2000) might come into play and weaken the effect of risk perception on intention. Future studies should explore the importance of adding appearance norms in the motivational and volitional stages of the HAPA in predicting intention and adoption of sun protection measures.

The present findings also attest to the important role played by positive outcome expectancies in conjunction with self-efficacy in developing a motivation for sunscreen use. This has implications for intervention suggesting to focus on both factors when trying to change intentions to use sunscreen.

The main addition of the HAPA in comparison to previous social-cognitive models lies in the inclusion of volitional factors such as proximal self-efficacy (e.g., coping self-efficacy, recovery self-efficacy) and strategic planning that come into play after people have formed an intention to change their health-compromising behaviors. Strategic planning mediates between intention and behavior, showing that intenders who are motivated and who also develop a plan on when, where, and how to use sunscreen, are more likely to translate their intentions into behavior. The present results add to the evidence that emphasize the need to regard postintentional variables in sun protection interventions (Jones et al. 2001; Van Osch et al., 2007). Earlier interventions based on the Transtheoretical Model have proven to

---

be effective in promoting sun protection intention and behavior. Although tailored to behavior change stages, these do not explicitly address planning and do not respect the principle of parsimony in designing theory-based interventions (Pagoto, McChargue, & Fuqua, 2003; Weinstock, Rossi, Redding, & Maddock, 2002), or the transition from preparation to action and maintenance is not clearly stated (Prentice-Dunn, McMath, & Cramer, 2009).

Some limitations of the present study also need to be addressed. A general problem when trying to assess behavioral outcomes lies in the self-report measures that are often the only ones available. However, self-reports have been shown to be valid in the context of sunscreen use (Dwyer, Blizzard, Gies, Ashbolt, & Roy, 1996). Another issue is that behavior and intention assessment relied on single item measures that may be less reliable than multi-item scales. Moreover, in structural equation modeling, by specifying latent variables with only one single manifest item, one assumes perfect measurement, which does not reflect reality. Future studies should apply multiple behavioral measurements, also including wearing protective clothing or avoiding sun exposure.

We can also not generalize to the entire population, since the persons who took part in the online study were mainly university students. However, this is a relevant population to target in sun protection interventions because sun exposure during adolescence and young adulthood represents a higher risk for the development of skin cancer later on, and this also represents a period when tanning and protection habits are shaped (Shoveller, Lovato, Young, & Moffat, 2003).

Although the present findings have added to the evidence that attests to the universality and applicability of the HAPA, they do not necessarily prove that the model chosen is the only one that fits. The question is whether this model appears to be superior to alternative models. To test the validity of a model in comparison to other theories of health

---

behavior change, experimental studies are required. A further question is whether we should judge the quality and usefulness of a model only in terms of explained behavioral variance (cf. Lippke & Ziegelmann, 2008). Gaining insight into mediating processes upgrades the importance of such mediators as secondary outcomes. The mediators are relevant criteria by themselves. Even if we cannot immediately attain the goal behavior, we might move a crucial step further by changing one of the proximal mediators into the right direction, for instance helping people form more plans to use sunscreen. Thus, elucidating the mechanisms of change is not only of purely scientific interest, but also may have significant implications for health promotion by guiding the development of theory-based interventions. In this context, the present results inform both research and practice. The HAPA is a parsimonious model to apply to sunscreen use, it targets both pre- and postintentional factors and offers solutions for interventions. For example, information on the negative consequences of sun exposure can be used to induce risk perception, decisional balance can be discussed to form positive outcome expectancies, and modelling can be applied to enhance self-efficacy. Finally, for people in the volitional phase, planning strategies can be included to encourage behavior adoption.

---

### References

- Abdulla, F. R., Feldman, S. R., Williford, P. M., Krowchuck, D., & Kaur, M. (2005). Tanning and skin cancer, *Pediatric Dermatology*, *22*, 501-512.
- Abraham, C., & Sheeran, P. (2000). Understanding and changing health behavior: From health beliefs to self-regulation. In P. Norman, C. Abraham, & M. Conner (Eds.), *Understanding and changing health behavior* (pp. 3-24). Amsterdam: Harwood.
- Bränström, R., Ullen, H., & Brandberg, Y. (2004). Attitudes, subjective norms and perception of behavioral control as predictors of sun related behavior in Swedish adults, *Preventive Medicine*, *39*, 992-999.
- Calder, N., & Aitken, R. (2008). An exploratory study of the influences that compromise the sun protection of young adults, *International Journal of Consumer Studies*, *39*, 579-587.
- Carmel, S., Shani, E., & Rosenberg, L. (1994). The role of age and an expended Health Belief Model in predicting skin cancer protective behaviour. *Health Education Research*, *9*, 433-447.
- Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology & Health*, *24*, 317 - 332.
- Dwyer, T., Blizzard, L., Gies, P. H., Ashbolt, R., & Roy, C. (1996). Assessment of habitual sun exposure in adolescents via questionnaire- a comparison with objective measurement using polysulphone badges, *Melanoma Research*, *6*, 231-239.
- Eid, M. (2001). Sun exposure and skin cancer prevention. In N. J. Smelser & P. B. Baltes (Eds.), *International encyclopedia of the social & behavioral sciences* (Vol. 22, pp. 15278-15281). Amsterdam: Elsevier.
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, *38*, 69-119.
- Gonzales, S., Fernandez-Lorente, M., & Gilaberte-Calzada, Y. (2008). The latest on skin protection. *Clinics in Dermatology*, *26*, 614-626.
- Graham J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology*, *60*, 549-576.
- Grunfeld, E. A., (2004). What influences university students intentions to practice safe sun exposure behaviors? *Journal of Adolescent Health*, *35*, 486-492.

- 
- Gutiérrez-Doña, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). How self-efficacy and planning predict dietary behaviors in Costa Rican and South Korean women: A moderated mediation analysis. *Applied Psychology: Health & Well-Being, 1*, 91–104.
- Jackson, K. M., & Aiken, L. S. (2000). A psychological model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self efficacy for sun protection. *Health Psychology, 19*, 469–478.
- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). Modeling the cognitive prerequisites of sunscreen use in Australian and UK samples, *Psychology and Health, 16*, 191-206.
- Kasparian, N. A., McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: a review of the literature. *Journal of Behavioral Medicine, 32*, 406–428.
- Kristjansson, S., Bränström, R., Ullen, H., & Helgason, A. R. (2003). Transtheoretical Model: The investigation of adolescents' sunbathing behavior. *European Journal of Cancer Prevention, 12*, 501-508.
- Lippke, S., & Ziegelmann, J. P. (2008). Theory-based health behavior change: Developing, testing and applying theories for evidence-based interventions. *Applied Psychology: International Review, 57*, 698-716.
- Luszczynska, A. (2006). Effects of an implementation intention intervention on physical activity after MI are mediated by cognitive processes, change in forming action plans. *Social Science and Medicine, 62*, 900-908.
- Luszczynska, A., Cao, D. S., Mallach, N., Pietron, K., Mazurkiewicz, M., & Schwarzer, R. (2010). Intentions, planning, and self-efficacy predict physical activity in Chinese and Polish adolescents: Two moderated mediation analyses. *International Journal of Clinical and Health Psychology, 10*, 265-278.
- Mahler, H. I. M., Fitzpatrick, B., Parker, P., & Lapin, A. (1997). The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion, 11*, 426-429.
- Mcclendon, B. T., & Prentice-Dunn, S. (2001). Reducing skin cancer risk: An intervention based on Protection Motivation Theory. *Journal of Health Psychology, 6*, 321-328.
- Myers, L. B., & Horswill M. S. (2006). Social cognitive predictors of sun protection intention and behavior, *Behavioral Medicine, 32*, 57-63.



- 
- Pagoto, S., McChargue, D., & Fuqua, R. W. (2003). Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology, 22*, 429-433.
- Paul, C., Tzelepis, F., Parffit, N., & Girgis, A. (2008). How to improve adolescents' sun protection behaviour? Age and gender issues. *American Journal of Health Behavior, 32*, 387-398.
- Prentice-Dunn, S., McMath, B. F., & Cramer, R. J. (2009). Protection motivation theory and stages of change in sun protection behavior. *Journal of Health Psychology, 14*, 297-305.
- Renner, B., Kwon, S., Yang, B.-H., Paik, K.-C., Kim, S. H., Roh, S., Song, J., & Schwarzer, R. (2008). Social-cognitive predictors of dietary behaviors in South Korean men and women. *International Journal of Behavioral Medicine, 15*, 4-13.
- Scholz, U., Schüz, B., Ziegelmann, J. P., Lippke, S., & Schwarzer, R. (2008). Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology, 13*, 479-494.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review, 57*, 1-29.
- Shoveller, J. A., Lovato, C. Y., Young, R. A. & Moffat, B. (2003). Exploring the development of sun-tanning behavior: A grounded theory study of adolescents' decision-making experiences with becoming a sun tanner. *International Journal of Behavioral Medicine, 10*, 299-314.
- Van Osch, L., Reubsaet, A., Lechner, L., Candel, M., Mercken, L., & deVries, H. (2007). Predicting parental sunscreen use: Disentangling the role of action planning in the behavior-intention relationship, *Psychology and Health, 1-19*.
- Weinstock, M. A., Rossi, J. S., Redding, C. A., & Maddock, J. E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched intervention to increase sun protection among beach goers. *Preventive Medicine, 35*, 584-592.
- Ziegelmann, J. P., & Lippke, S. (2007). Planning and strategy use in health behavior change: A life span view. *International Journal of Behavioral Medicine, 14*, 30-39.

---

# Chapter 3

**Translating Intentions into Sunscreen Use: An Interaction of Self-Efficacy and Appearance Norms**

**Abstract**

The study examines whether self-efficacy mediates between intention and behavior and whether appearance norms and self-efficacy are additive or synergistic predictors of sunscreen use. At two measurement points in time, 14 weeks apart, 154 individuals responded to an online questionnaire. Moderated mediation was tested by hierarchical regression analyses. Self-efficacy mediated the intention-behavior relationship, whereas appearance norms emerged as a moderator of the self-efficacy – sunscreen use relationship. The model accounted for 22% of the behavior variance at Time 2 (T2). For individuals who think they would look more attractive with a tan, self-efficacy did not have a strong effect on behavior. Thus, for skin-protection motivation to become effective, self-efficacy is needed in conjunction with less positive appearance norms.

*Key words:* sunscreen use, self-efficacy, appearance norms, intention, moderated mediation

---

## **Translating Intentions into Sunscreen Use: An Interaction of Self-Efficacy and Appearance Norms**

The intention to change health behaviors and one's confidence in being able to do so are critical components in the behavior change process. In the context of skin protection, appearance norms also play an important role, but the mechanisms of how intention, self-efficacy, appearance norms, and sun safety behavior operate are not yet well understood. In the following introduction, we will first describe the theoretical constructs of self-efficacy and appearance norms and will then address the mechanisms of behavior change.

### *Perceived Self-Efficacy*

Perceived self-efficacy is one's confidence in the ability to execute a difficult or novel action (Bandura, 1997). Such optimistic self-beliefs influence the goals people set for themselves, the course of action they choose to pursue, the effort they invest, and the perseverance in the face of obstacles. Self-efficacy operates in concert with risk perception and outcome expectancies in predicting motivation to change health behaviors. Thus, it is influential in the motivational phase (preintentional) as well as in the volitional phase (postintentional) of health behavior change. Perceived self-efficacy can mediate the intention-behavior relation (Schwarzer, 2008). For people with higher self-efficacy, it seems to be easier to translate their intentions into health-enhancing behaviors. In contrast, those who harbor self-doubts are less likely to act upon their intentions (Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009). Self-efficacy was also identified as one of the best predictors of both sun protection intention and behavior (Mahler, Fitzpatrick, Parker, & Lapin, 1997; Myers & Horswill, 2006) and has been shown to influence intentions and behaviors

---

(Jones, Abraham, Harris, Schulz, & Chrispin, 2001). In a multicomponent appearance-based intervention, self-efficacy mediated the intervention effect on intention to protect oneself from the sun (Jackson & Aiken, 2006). Studies have explored the relation between self-efficacy and appearance norms for tanning and showed that even if people have self-efficacy for sun protection they are unwilling to give up a tan due to the belief that this would make them more attractive (Turrisi, Hillhouse, & Gebert, 1998).

### *Appearance Norms*

Appearance norms about tanning are the belief that a tan makes one more attractive. They constitute one of the best predictors of sun exposure in youth (Hillhouse & Turrisi, 2002). The belief that a tanned look is healthy and attractive strongly influences tanning intentions. The degree to which people engage in excessive tanning is more related to their belief that “*a tan makes someone more attractive*” than to the expected health risks of sun exposure (Leary & Jones, 1993). Sometimes, even if people are aware of the risks of unprotected sun exposure, this does not reduce the perceived attractiveness of tanning (Dennis, Lowe, & Snetselaar, 2009).

Appearance norms are negative predictors of sun protection in all age groups. However, Carmel, Shani, and Rosenberg (1994) showed that appearance reasons for tanning were more important in younger age groups, whereas for older participants the value of health prevailed. In the opinion of a majority of teenagers, a tan stands for emotional and physical good health, attractiveness, activity, and a risk-taking, cool personality (Calder & Aitken, 2008). Gender differences also emerged. For example, men who consider a tan to be attractive tend to use less sun protection methods and perceive fewer risks associated with unprotected sun exposure (Broadstock, Borland, & Gason, 1992; Maddock, Redding, Rossi, & Weinstock, 2005; Miller, Ashton, McHoakey, & Gimbel, 1990). On the other hand,

---

women tend to use more sun protection methods (Baum & Cohen, 1998), although they also report feeling more attractive, healthy and confident when they are tanned (Broadstock et al., 1992; Cody & Lee, 1990).

People are often less interested in health itself as they are concerned with the “*appearance of health*” that a suntan seems to suggest, demonstrating a preference for appearance over skin health. Even when knowledge about skin cancer and about the risk of unprotected sun exposure is high, many believe that the benefits of a tan outweigh the costs, and they refrain from skin-protective behavior. On the other hand, when the desire for a tan decreases, people tend to adopt more sun protection behaviors (Arthey & Clarke, 1995).

Concerns about the damage to one’s appearance by wrinkles and skin spots is associated with more sun protection practices than concerns about one’s health with regard to skin cancer (Jones, Harris, & Chrispin, 2000). Thus, appearance norms can be used to promote sun protection when one emphasizes the short-term damages that unprotected sun exposure causes to the skin, such as uneven pigmentation and premature wrinkles. However, factors that operate in concert with appearance norms and influence sun protection need to be identified in order to develop effective behavior change interventions.

### ***Mechanisms of Health Behavior Change: Mediators and Moderators***

To study *how* behavior change takes place, we need to apply mediation analyses. In order to study *for whom* a particular change mechanism is valid, we need to study the moderators of these mechanisms (MacKinnon, 2008). *Mediation* describes how an effect occurs, that is, how an independent variable affects a dependent variable via a third variable that constitutes the mediator. A mediator might emerge in one group (e.g., people with strong appearance norms), but not in another (e.g., individuals with weak appearance norms). In such a case, appearance norms operate as a *moderator* of the mediating relationship. Self-efficacy has been shown to be a mediator of the intention-behavior relation for breast self-

---

examination, (Luszczynska & Schwarzer, 2003), but also being a moderator of the intention-planning-behavior relation for physical activity in adolescents (Luszczynska et al., 2010). But does self-efficacy help individuals to act upon their intentions in the context of sunscreen use? Do individuals who are motivated apply more sunscreen if they are confident that they can use it despite barriers, such as valuing the attractiveness of a tan?

### *Aims of the Study*

This study examines the role of intentions, self-efficacy, and appearance norms in the domain of sunscreen use. It is expected that self-efficacy mediates the intention – behavior relationship. Moreover, appearance norms as a putative moderator influencing this relation will be explored. It is examined whether appearance norms operate in conjunction with self-efficacy as reflected by an interaction between self-efficacy and appearance norms. Such a moderator effect could shed light upon the mechanisms that operate when people adopt or maintain sun safety behaviors. The main question is whether an intention – self-efficacy – behavior chain exists and whether this chain is moderated by levels of appearance norms.

## **Method**

### *Participants and Procedure*

Participants were recruited in university seminars and were invited to take part in an online study, for which they received course credits. The study was performed in accordance with both the Helsinki Declaration and the Proposals for Safeguarding Good Scientific Practice by the German Research Foundation. It was also approved by the review board of Babes-Bolyai University, Cluj, Romania. Individuals ( $N = 181$ ) who were interested in the study gave informed consent for participation and provided their e-mail address, agreeing to receive the follow-up questionnaire. Baseline assessment took place at the beginning of

---

summer, invitations for the completion of the follow-up questionnaire were sent out at the end of summer (about 14 weeks later). The final sample that completed the questionnaires at both points in time consisted of 154 individuals, of which 11 (7.1%) were men and 143 (92.9%) were women, with a mean age of 21.46 years ( $SD = 4.47$ ), ranging from 18 to 48 years. Those who completed the questionnaires at both measurement points in time did not differ in any of the variables under study, nor did they differ in age.

### **Measures**

*Measures.* Means, standard deviations, and intercorrelations are displayed in Table 1. All scales were tested in prior studies with respect to psychometric properties (see Schwarzer, 2008).

*Intention to use sunscreen* was measured at Time 1 (T1), with one item asking participants about their intentions during the next months: "I intend to use sunscreen with a sun protection factor (SPF) 15+ when I am in the sun for a long time." Responses ranged from *strongly disagree* (1) to *strongly agree* (4).

*Self-efficacy towards using sunscreen* was measured at T1, with four items that asked about people's confidence that they can apply sunscreen even if they face different barriers such as desiring a tan. The item content pertained to the volitional phase of health behavior change ("coping self-efficacy"). Responses were made on four-point scales ranging from *not at all true* (1) to *exactly true* (4). Cronbach's  $\alpha$  was .83 for these four items.

*Appearance norms* were assessed at T1 by one item stating "The tanner I am, the more attractive I feel." Participants were asked to rate on a scale from 1 (*strongly disagree*) to 4 (*strongly agree*) how much they agreed with this statement.



*Sunscreen use* was measured at T2 with one item asking people if they applied sunscreen with a SPF 15+ repeatedly during the sunny days when they were outside.

Responses ranged from *strongly disagree* (1) to *strongly agree* (4).

Table 1. Means (M), Standard Deviations (SD) and Intercorrelations for Time 1 (T1) Intentions, Self-Efficacy and Appearance Norms, and Time 2 (T2) Sunscreen Use

	Intention (T1)	Self-efficacy (T1)	Appearance Norms (T1)	Sunscreen use (T2)
<i>M</i>	3.21	3.13	2.55	2.31
<i>SD</i>	0.78	0.57	0.87	0.91
Self-efficacy (T1)	.61**	-		
Appearance Norms (T1)	-.02	-.13**	-	
Sunscreen use (T2)	.39**	.41**	-.05	-

Note. \*\*  $p < .01$ .

### **Analytical Procedure**

The analyses were based on procedures recommended by Preacher, Rucker and Hayes (2007). A moderated mediator model was tested, where appearance norms were chosen as a moderator of the intention-behavior relationship, using the MODMED macro (Version 1.1; Model 2) by Preacher et al. (2007). To test the interactions, variables were centered (Aiken & West, 1991). In the same model, the mediation of the intention – behavior relation by self-efficacy was tested. Sunscreen use at T2 was considered as the dependent variable, intention

---

at T1 as the independent variable, self-efficacy (T1) as the mediator, whereas appearance norms (T1) were considered as a moderator. Moderated mediation is expressed by an interaction between self-efficacy and appearance norms on sunscreen use and by the mediation of the intention – behavior relation by self-efficacy.

### Results

Figure 1 shows the path model of the moderated mediation analysis. The direct effect of intention on sunscreen use is completely mediated by self-efficacy. Furthermore, there is an interaction effect of appearance norms and self-efficacy on behavior, whereas appearance norms do not yield a direct effect on sunscreen use.

The moderated mediation hypothesis was tested by two regression analyses. First, self-efficacy was predicted by intention ( $\beta = 0.61, p < .01$ ). Sunscreen use was predicted by intention ( $\beta = 0.38, p < .01$ ), self-efficacy ( $\beta = 0.28, p < .01$ ), and the interaction of Appearance Norms \* Self-Efficacy ( $\beta = -0.15, p < .05$ ) with 20% of the behavior variance explained. The Appearance Norms \* Self-Efficacy interaction added 2% to the explained sunscreen use variance.

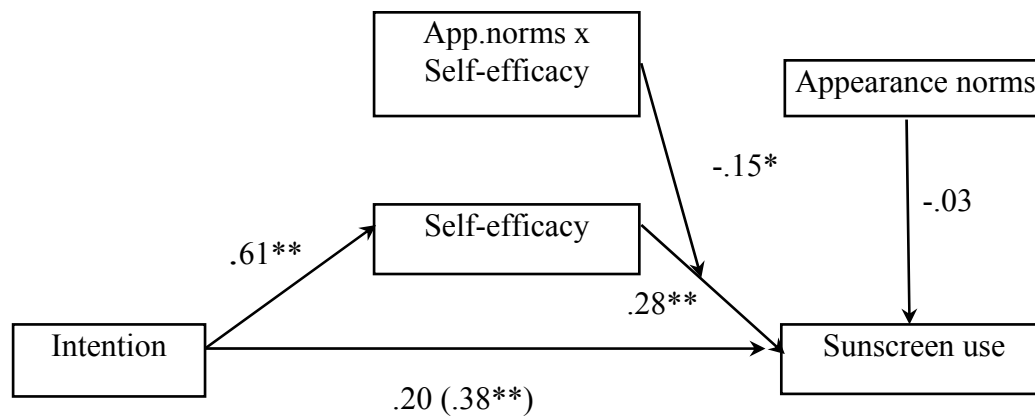


Figure 1. Standardized regression coefficients for the moderated mediation model with self-efficacy as the mediator and appearance norms as the moderator. The standardized regression coefficient between intention and sunscreen use before controlling for self-efficacy (.38) is in parentheses.

For a closer look at the interaction effect, a simple slopes analysis was performed, as recommended by Aiken and West (1991). Figure 2 illustrates the joint effects of self-efficacy and appearance norms on sunscreen use, based on a hierarchical regression analysis with centered predictors and their product term. In this figure, the simple slopes are depicted for three selected values of the moderator variable: 1. the mean of the moderator variable, 2. the mean plus one standard deviation, 3. the mean minus one standard deviation. It indicates that for individuals with lower appearance norms, the relation between self-efficacy and sunscreen use is much higher than for those with high appearance norms.

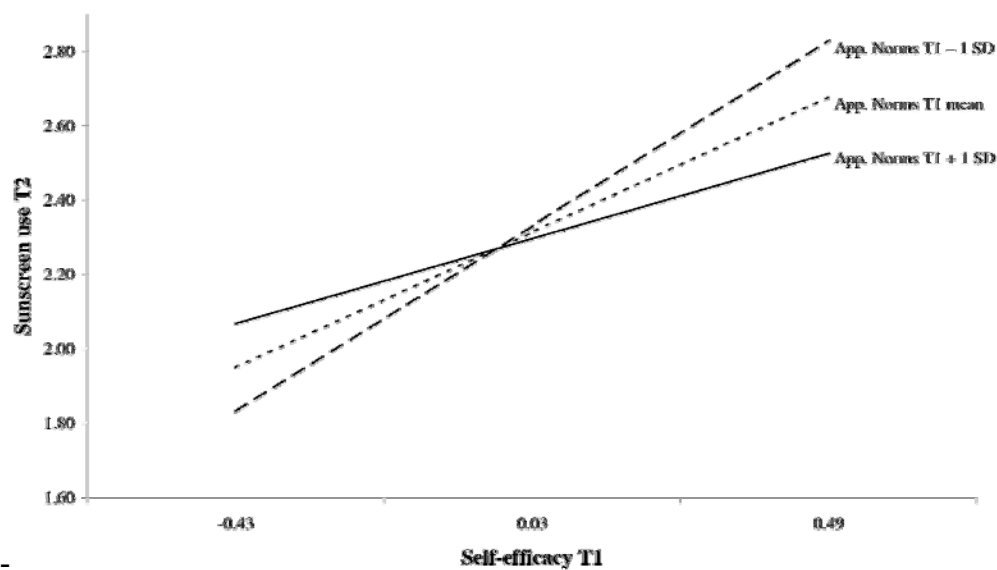


Figure 2. Regression of sunscreen use (Time 2) on self-efficacy (Time 1) at specific values of appearance norms.

## Discussion

The present study explored the intention-self-efficacy-behavior relation in the context of sun protection. We started out from the premise that self-efficacy could constitute a mediator of the relation between intentions and sunscreen use (Schwarzer, 2008). Moreover, since appearance norms have also been found to be important for sun protection intentions and behavior, it was assumed that they might play a role in influencing the intention-self-efficacy-behavior relationship. Self-efficacy indeed mediated between intentions to use sunscreen and behavior, whereas appearance norms moderated this relation.

The Appearance Norms \* Self-Efficacy interaction added 2% to the explained sunscreen use variance. Although this might seem a small addition in comparison to what adding another predictor might have determined, this is in accordance with earlier studies stating that interaction effects in psychological field studies usually account for no more than 1-3% of variance (Champoux & Peters, 1987).

---

Sunscreen use appears to be facilitated by a high level of self-efficacy for individuals who do not hold high appearance norms. However, if these individuals have strong appearance norms (i.e., strongly believing that they appear more attractive to others with a tan), then self-efficacy does not help translating intentions into sunscreen use. Thus, in order to change sun protection behavior, it is not enough to increase individuals' self-efficacy. It is also important to ensure sufficiently low beliefs that having a tan makes one more attractive. This is in accordance with research that shows that sun protection decisions are affect laden because they depend on beliefs about tan attractiveness. Even if women had high self-efficacy for sun protection, they did not give up sunbathing if they considered a tan to be attractive (Turrisi et al, 1998).

Self-efficacy emerged as a facilitator of health behavior change, moderated by appearance norms. Consequently, when designing interventions for sunscreen use promotion, both increasing self-efficacy and decreasing appearance norms that favor a tanned look should constitute change objectives. For example, self-efficacy could be enhanced through verbal persuasion by creating messages that promote the idea that using sunscreen is easy and can be done just like using a body cream moisturizer. Another method to increase self-efficacy could be modeling. Models with the characteristics of the target population can be used to demonstrate how sunscreen is applied and emphasize the importance of its use. This adds up to research on interventions that included a self-efficacy enhancement component and proved this to be effective in intention change (Jackson & Aiken, 2006).

Appearance norms concerning a suntan should also be addressed directly, as was done in the study by Jackson and Aiken (2006), where female models and media figures were chosen to promote a pale look. Moreover, in addition to changing the belief that a tanned look is more attractive, the idea that a pale look is unhealthy should also be addressed. Media messages sometimes paint a paradoxical picture, in which sun protection messages contradict

---

the promotion of tanned models, who implicitly endorse the idea that a suntan is attractive (Dixon, Dobbinson, Wakefield, Jansen, & McLeod, 2007). Thus, future sun protection campaigns could include self-efficacy messages for sunscreen use presented by models who also emphasize the attractiveness of a pale look.

A limit of the present study is constituted by the fact that analyses were conducted only on a rather small sample. Future studies should further replicate these findings elsewhere in larger, more heterogeneous samples. The one-item measures for behavior and appearance norms also constitute limitations. Further studies should attempt to use more objective measures for sunscreen use and make use of multiple-item measures for behavior and appearance norms.

All in all, the present study adds to the previous knowledge about the role of self-efficacy and appearance norms in the context of sun protection. Self-efficacy can play an important role in helping people to translate their sunscreen use intentions into practice and underscores the importance of addressing appearance norms concerning the attractiveness of tan.

---

### References

- Aiken, L. S., & West, S. G. (1991). *Multiple regression: testing and interpreting interactions*. Newbury Park, CA: Sage.
- Arthey, S., & Clark, V. A. (1995). Suntanning and sun protection: A review of the psychological literature. *Social Science and Medicine*, *40*, 265-274.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Baum, A. & Cohen, L. (1998). Successful behavioral interventions to prevent cancer: The example of skin cancer. *Annual Review of Public Health*, *19*, 319-333.
- Broadstock, M., Borland, R., & Gason, R. (1992). Effects of suntan on judgement of healthiness and attractiveness by adolescents. *Journal of Applied Social Psychology*, *22*, 157-172.
- Calder, N., & Aitken, R. (2008). An exploratory study of the influences that compromise the sun protection of young adults. *International Journal of Consumer Studies*, *39*, 579-587.
- Carmel, S., Shani, E., & Rosenberg, L. (1994). The role of age and an expanded health belief model in predicting skin cancer protective behaviour. *Health Education Research*, *9*, 433-447.
- Champoux, J. E., & Peters, W. S. (1987). Form, effect size, and power in moderated regression analysis. *Journal of Occupational Psychology*, *60*, 243-255.
- Cody, R., & Lee, C. (1990). Behaviors, beliefs, and intentions in skin cancer prevention. *Journal of Behavioral Medicine*, *13*, 373-389.
- Dennis, L. K., Lowe, J. B., & Snetselaar, L. G. (2009). Tanning behaviour among young frequent tanners is related to attitudes and not lack of knowledge about the dangers. *Health Education Journal*, *68*, 232-243.
- Dixon, H., Dobbinson, S., Wakefield, M., Jansen, K., & McLeod, K. (2007). Portrayal of tanning, clothing fashion and shade use in Australian's women magazines: 1987-2005. *Health Education Research*, *13*, 1-12.
- Hillhouse, J. J., & Turrisi, H. (2002). Examination of the efficacy of an appearance-focused intervention to reduce UV exposure. *Journal of Behavioural Medicine*, *25*, 395-409.  
*Doi: 0160-7715/02/0800-0395/0*

- Jackson, K. M., & Aiken, L. S. (2006). Evaluation of a multicomponent appearance-based sun-protective intervention for young women: uncovering the mechanisms of program efficacy. *Health Psychology, 25*, 34-46. *Doi: 10.1037/0278-6133.25.1.34*
- Jones, F., Harris, P., & Chrispin, C. (2000). Catching the sun: An investigation of skin exposure and sun protective behaviour. *Psychology, Health & Medicine, 50*, 131-141.
- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). Modeling the cognitive prerequisites of sunscreen use in Australian and UK samples. *Psychology & Health, 16*, 191-206.
- Leary, M. R., & Jones, J. L. (1993). The social psychology of tanning and sunscreen use: Self-presentation motives as a predictor of health risk. *Journal of Applied Social Psychology, 23*, 390-406.
- Lippke, S., Wiedemann, A. U., Ziegelmann, J. P., Reuter, T., & Schwarzer, R. (2009). Self-efficacy moderates the mediation of intentions into behavior via plans. *American Journal of Health Behavior, 33*, 521-529.
- Luszczynska, A., & Schwarzer, R. (2003). Planning and self-efficacy in the adoption and maintenance of breast-self-examination: A longitudinal study on self-regulatory cognitions. *Psychology & Health, 18*, 93-108. *Doi: 10.1080/0887044021000019358*
- Luszczynska, A., Cao, D. S., Mallach, N., Pietron, K., Mazurkiewicz, M., & Schwarzer, R. (2010). Intentions, planning and self-efficacy predict physical activity in Chinese and Polish adolescents: Two moderated mediation analyses. *International Journal of Clinical and Health Psychology, 10*, 265-278.
- MacKinnon, D. P. (2008). *Introduction to Statistical Mediation Analysis*. New York: LEA.
- Maddock, J. E., Redding, C. A., Rossi, J. S., Weinstock, M. A. (2005). Development and validation of an appearance motivation attitudes scale for sun protection. *Psychology & Health, 20*, 775-788.
- Mahler, H. I. M., Fitzpatrick, B., Parker, P., & Lapin, A. (1997). The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion, 11*, 426-429.
- Miller, A. G., Ashton, W. A., McHoskey, J. W., & Gimbel, J. (1990). What price attractiveness? Stereotype and risk factors in suntanning behavior. *Journal of Applied Social Psychology, 20*, 1272-1300.
- Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine, 32*, 57-63.



---

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: theory, methods, and prescriptions. *Multivariate Behavioral Research*, *42*, 185-227.

Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*, *57*, 1-29.

Turrisi, R., Hillhouse, J., & Gebert, C. (1998). Examination of cognitive variables relevant to sunbathing. *Journal of Behavioral Medicine*, *21*, 299-313.

---

# Chapter 4

**Risk Perception Moderates How Intentions Are Translated Into  
Sunscreen Use**

### **Abstract**

**Purpose.** Planning is supposed to mediate between intention and behavior. The study examines whether such a mediation also exists in the context of sunscreen use. Moreover, the question is raised whether health risk perception might moderate such a mechanism.

**Method.** A longitudinal online study was conducted with three measurement points in time. Sunscreen use, intention, planning, and risk perception were assessed. A sample of 154 individuals was analyzed by hierarchical regression procedures in terms of moderated mediation.

**Results.** Planning partially mediated the intention-behavior relationship, and risk perception operated as a moderator. The moderator effect was negative, implying that low risk perception in conjunction with high intention was a prerequisite for planning, and, thus, for the mediation by planning.

**Conclusions.** Low risk perception reflects health-specific optimism which can be a facilitator of health behavior change, in this case the change of sunscreen use from Time 1 to Time 3.

**Key words:** planning, intention, risk perception, sunscreen use, health-related optimism

### **Risk Perception Moderates How Intentions Are Translated Into Sunscreen Use**

People are supposed to become motivated to adopt health behaviors if they associate a risk with continuing to perform their health-compromising behaviors. Several theories acknowledge the role played by health risk perception. For instance, the Health Belief Model (HBM; Becker, 1974), the Protection Motivation Theory (PMT; Rogers, 1975), the Precaution Adoption Process Model (PAPM; Weinstein, 1988) and the Health Action Process Approach (HAPA; Schwarzer, 2008) consider risk appraisal to be one of the prerequisites for forming an intention to act. However, the relevance of risk perception may also differ as a function of the targeted health behavior. In a meta-analysis (Brewer et al., 2007) it is argued that risk perception is more important for behaviors that contribute to the reduction of a health threat, are less prone to external influences, and are easier to perform (e.g., sun screen use) than for complex behaviors such as exercise and healthy eating habits.

#### ***Sun protection motivation***

Unprotected sun exposure puts an individual at risk for developing skin cancer (Abdulla, et al., 2005), a highly prevalent form of cancer within the Caucasian population (Diepgen & Mahler, 2002). Reducing sun exposure or adopting simple protective measures such as applying sunscreen with a sun protection factor (SPF) 15+ on a regular basis could help prevent four out of five cases of skin cancer (Baum & Cohen, 1998; Myers & Horswill, 2006). However, only 29–50% of individuals exhibit ‘adequate’ levels of sun protection based on country-specific sun protection guidelines (Kasparian, McLoone, & Meiser, 2009). Thus it is imperative to figure out how people become motivated to engage in these behaviors. Risk perception has been shown to be a significant predictor of both intention and behavior in the context of sun protection (Arthey & Clarke, 1995; Cody & Lee, 1990; Kasparian et al., 2009, Keesling & Friedman, 1987). A study based on PMT found that threat appraisal constitutes a

better predictor of sun protection intention in comparison to coping appraisal, whereas previous performance of similar behavior emerged as the strongest predictor of intention followed by perceived vulnerability to developing skin cancer (Grunfeld, 2004). Moreover, risk perception has been shown to predict behavior such as sunscreen use and seeking shade in a sample of Dutch adolescents (deVries et al., 2005). Further research has shown that people are more prone to protect themselves from the sun when perceiving a higher risk, when their appearance would suffer due to unprotected sun exposure as well as when knowing someone diagnosed with skin cancer (Jones, Harris, & Chrispin, 2000).

On the other hand, being aware of short term risks of sun exposure together with valuing a tan, and unrealistic optimism influence the decision not to take sun protection measures (Calder & Aitken, 2008). Based on the results of their qualitative study on young people from New Zealand, the authors argue that even if people are informed about the risks of skin cancer, have high self-efficacy, but lack perceived threat they will not act because they are not motivated to do so. Recommendations are made to address the imbalance between threat appraisal and outcome expectancies, emphasizing the short term negative consequences of unprotected sun exposure in order to promote preventive behavior.

But how can we best develop motivation for sun protection and help motivated people to act upon their intentions? A study on the usefulness of stages of change in developing sun protection motivation showed that threat appraisal information facilitated the transition from precontemplation to contemplation, whereas in order to make the leap from contemplation to preparation, people needed high threat and high coping information (Prentice-Dunn, McMath & Cramer, 2009). Another study found that the decisional balance, defined as the competing evaluation of the pros of sun exposure and pros of sun protection, represents a mediator of an intervention to increase sun protection in adolescents (Adams et al., 2009). The effectiveness of tailored personalized risk feedback on increasing sun protection practices has also been demonstrated for those people with high risk of developing skin cancer (Glanz, Schoenfeld, &

Steffen, 2010). Moreover, results of studies that investigated the mechanisms that accounted for the success of sun protection intervention in changing behavior found that knowledge about sun exposure risk and protection methods, sunscreen use barriers and self-efficacy acted as mediators of a sun protection intervention for middle school children (Reynolds et al., 2006). Further research showed that knowledge, social norms, perceived risk, self-efficacy, and perceived negative consequences of sun exposure accounted for 44% of the variance in intention to use sunscreen, whereas planning and intention predict sunscreen use. Moreover, there is support for a mediating and moderating influence of planning on intention to use sunscreen, arguing for the inclusion of post-intentional factors in a model explaining sun protection (Jones, et al., 2001; Van Osch, et al., 2007). Thus, most theories consider risk perception a predictor of intention, and there is evidence that risk perception facilitates the development of a sun protection intention. However, does risk perception continue to play a role even after people are motivated to act, and does it help them to translate intentions into actions by planning? And if so, what is the mechanism through which it influences planning and behavior adoption?

### ***Risk perception***

People often underestimate their risk of developing illness. A sense of vulnerability is lacking, and therefore they might not take precautions (Renner & Schupp, in press). Risk perception can be subdivided into *absolute* and *comparative risk perception*. Absolute risk perception refers to one's subjective likelihood of adversity such as "I am at risk for skin cancer" whereas comparative risk perception reflects the difference between the perceived risk for oneself as opposed to that for others (e.g., "I am more prone to skin cancer than other people of my age and gender"). Underestimating one's health risk either way has been conceptualized as the "optimistic bias" (Weinstein, 1982, 2000). Thus, the construct of risk perception can be considered part of the family of optimism constructs.

Unrealistic optimism refers to the tendency to perceive oneself as being invulnerable or less vulnerable than others to negative life events (Weinstein, 1982, 2000) or health threats and is associated with taking less action to change behaviors (Radcliffe & Klein, 2002). This biased perception of health risks (unrealistic optimism, positive illusion) has been interpreted as “defensive” optimism as opposed to “functional” optimism (Schwarzer, 1994; Taylor & Brown, 1994).

Functional optimism is based on beliefs about one’s resources, including ability and effort to deal with adversity. One example is the dispositional optimism construct, embedded in the self-regulation theory of Carver and Scheier (1998). It is based on generalized outcome expectancies (e.g., “There is always a silver lining”) and includes an effort to attain valued goals (e.g., “If I take precautions I will stay healthy”). Dispositional optimists are people who expect positive outcomes in various life domains including health. They are confident about the future and, therefore, invest effort when facing hardship. The other example of functional optimism is perceived self-efficacy (Bandura, 1997) that is based on one’s belief in being capable to cope with adversity (e.g., “I am certain that I can control my health even when being challenged by illness”).

The relationship between risk perception and optimism becomes more complicated when also considering levels of generality and specificity. Health risk perception is a domain-specific construct, and the corresponding functional optimism is coined “health-related optimism”. A study by Luo and Isaacowitz (2007) examining how optimists process skin cancer information, found that dispositional and health-related optimism predict health-cognitions and behavior in distinct ways. People low in dispositional optimism, defined as a belief in good future outcomes across life domains, or high in health-related optimism were more attentive to skin cancer information when they were at objective risk of developing skin cancer. Individuals high in dispositional optimism were more likely to engage in health-promoting behaviors. However, health-related optimism better predicted health information

processing and behavior in comparison to dispositional optimism (see also Aspinwall & Brunhart, 1996). Davidson and Prkachin (1997) have confirmed the discriminant validity of unrealistic and health-related optimism while also implicating their joint importance as determinants of health-promoting behaviors.

In the present study, low levels of risk perception pertain to one's optimism towards not developing skin cancer. It needs to be determined whether such kind of optimism is dysfunctional or functional for using sun screen when being exposed to the sun.

### ***Mechanisms of Health Behavior Change: Mediators and Moderators***

To study *how* behavior change takes place, we need to apply mediation analyses, and to study *for whom* a particular change mechanism is valid, we need to study moderation (MacKinnon & Luecken, 2008). *Mediation* describes how an effect occurs, that is, how an independent variable affects a dependent variable via a third variable that constitutes the mediator. A mediator might emerge in one group (e.g., people perceiving high risk), but not in another (e.g., people perceiving low risk). In such a case, risk operates as a *moderator* of the mediating relationship.

Good intentions are more likely to be translated into action when people plan when, where, and how to perform the desired behavior. Intentions foster planning, which in turn facilitates behavior change. Planning had been found to mediate the intention-behavior relation but some studies failed to find such mediation effects (Norman & Conner, 2005). This suggests that the relationships between intentions, planning, and behavior might also depend on other factors such as risk perception. This represents a case of moderated mediation.



### *Aims of the Study*

Previous studies have shown planning to be a mediator between intention and sunscreen use (Jones et al., 2001; Van Osch et al., 2007). The present study examines the role of planning and risk perception in the domain of sunscreen use. It is expected that planning mediates the intention – behavior relationship. Moreover, it explores which role risk perception might play. In particular, it is examined whether risk perception operates in conjunction with intentions as reflected by an interaction between intention and risk perception. Such a moderator effect could shed light upon the mechanisms that operate in the motivational or volitional phases when people adopt or maintain sun safety behaviors. The study aims at the change of sunscreen use over time and explores the underlying social-cognitive variables that may be responsible for behavior change. The main question is whether an intention – planning – behavior chain exists and whether this chain is moderated by levels of risk perception.

## **Method**

### *Participants and Procedure*

People were invited to take part in an international online study on sun protection through announcements placed on university websites and discussion forums in Germany, Portugal and Romania from June to September, 2009. The online questionnaire was available in four languages: English, German, Portuguese and Romanian. Individuals ( $N=524$ ) who were interested in the study gave informed consent for participation and filled in their e-mail address to which they agreed receiving the follow-up questionnaires after two weeks (T2) and again after three months (T3). The final sample that completed the questionnaires at the three points in time, consisted of 154 individuals, out of which 11 (7.1%) were men and 143 (92.9%) were women, with a mean age of 21.46 years ( $SD= 4.47$ ) ranging from 18 to 48 years. Those who made themselves available for follow-up assessments were more likely to be

women, were significantly younger, perceived less risk, and had lower intentions to use sunscreen.

### ***Measures***

*Measures.* Means, standard deviations, and intercorrelations are displayed in Table 1. All scales were tested in several prior studies with respect to psychometric properties (see Schwarzer, 2008).

*Intention to use sunscreen* was measured at Time 1 with one item asking people about their intentions during the next months: "I intend to use sunscreen with a SPF 15+ when I am in the sun for a long time". Responses ranged from strongly disagree (1) to strongly agree (4).

*Action plans to use sunscreen* were measured at Time 2 with one item that asked participants to state to what extent they had made a concrete plan on when, where and how they would use sunscreen. Responses were made on 4-point scales ranging from *not at all true* (1) to *exactly true* (4).

*Risk perception* was assessed at Time 2 by four items that targeted *perceived vulnerability to develop premature wrinkles and skin spots* due to unprotected sun exposure and *perceived vulnerability to develop skin cancer*. Two items addressed these outcomes directly (absolute risk perception). Respondents had to estimate their risk by choosing an answer from very unlikely (1) to very likely (5). Two other items asked people to compare their chances of developing premature wrinkles and skin cancer due to unprotected sun exposure to an average person of their own sex and age (comparative risk perception). Chances were rated from much below average (1) to much above average (5). Cronbach's  $\alpha$  was .88 for these four items, and, therefore, absolute and comparative risk perception were collapsed to one scale.

*Sunscreen use* was measured both at Time 1 and Time 3 with one item asking people if they applied sunscreen with a SPF 15+ repeatedly during the sunny days when they were outside. Responses ranged from strongly disagree (1) to strongly agree (4).

***Analytical procedure.***

The analyses were based on procedures recommended by Preacher et al. (2007). A moderated mediator model was tested, where risk perception was chosen as a moderator of the intention-planning relationship, using the MODMED macro (Version 1.1; Model 2) by Preacher et al. (2007). To test the interactions, variables were centered (Aiken & West, 1991). Moderated mediation is expressed by an interaction between risk perception and intention on planning (MacKinnon & Luecken, 2008). To account for baseline behavior, Time 1 sunscreen use was included as a covariate.

## Results

Table 1 provides the descriptive statistics for Time 1 intentions and sunscreen use, Time 2 planning and risk perception, and Time 3 sunscreen use.

Table 1.

Means (M), Standard Deviations (SD) and intercorrelations for Time 1 intentions and sunscreen use, Time 2 planning and risk perception, and Time 3 sunscreen use

	Sunscreen use (T1)	Intention (T1)	Risk perception (T2)	Planning (T2)	Sunscreen use (T3)
<i>M</i>	2.23	3.05	2.15	2.38	2.33
<i>SD</i>	0.90	0.76	0.82	0.84	0.90
Sunscreen use (T1)	-				
Intention (T1)	.41**	-			
Risk perception (T2)	.11**	.16**	-		
Planning (T2)	.37**	.49**	.06	-	
Sunscreen use (T3)	.53**	.43**	-.09	.49**	-

Note \*\*  $p < 0.01$

The correlation between intention and sun screen use was  $r = .53$ . This substantial association was partially mediated by planning. Moreover, an interaction between intention and risk perception became significant, further qualifying the effect of intention on behavior. After adding sunscreen use at baseline as a covariate to the equation, 40% of the behavior variance was accounted for, whereas 28% of the variance of planning was explained. In this model, the direct effect of intention on sunscreen use was reduced to .18 which is still significant but much lower than the initial effect of  $r = .53$  (see Figure 1). Planning (.31,  $p < .01$ ) and Time 1 sunscreen use (.35,  $p < .01$ ) were of equal importance. While intention had a strong

effect (.44,  $p < .01$ ) on planning, the most remarkable negative effect on planning was made by risk perception as a moderator (-.19,  $p < .05$ ), operationalized as the product term of intention and risk perception. Thus, when people have high intentions in conjunction with low risk perception, they are more likely to plan, and if they do so, they are more likely to use sunscreen more adequately at Time 3 than at Time 1.

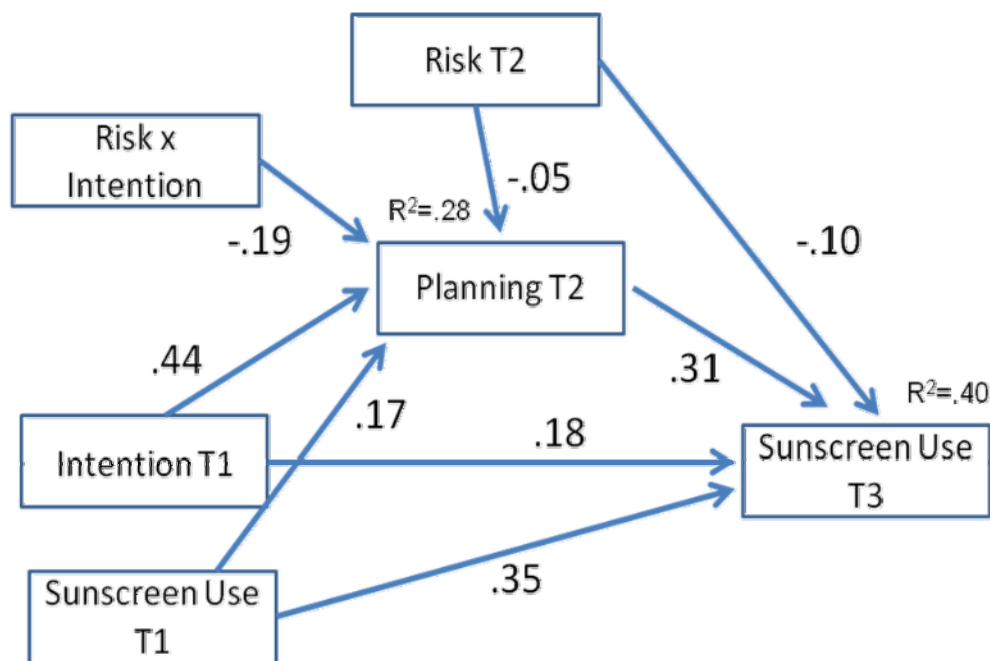


Figure 1.  
Moderated mediation model with planning as the mediator and risk perception as the moderator.

A further analysis was performed to look at the interaction effect in more detail. Figure 2 illustrates the joint effects of intention and risk perception on planning, based on a hierarchical regression analysis with centered predictors and their product term. People with higher intentions were more likely to plan and they did so especially when they also harbored low risk perception.

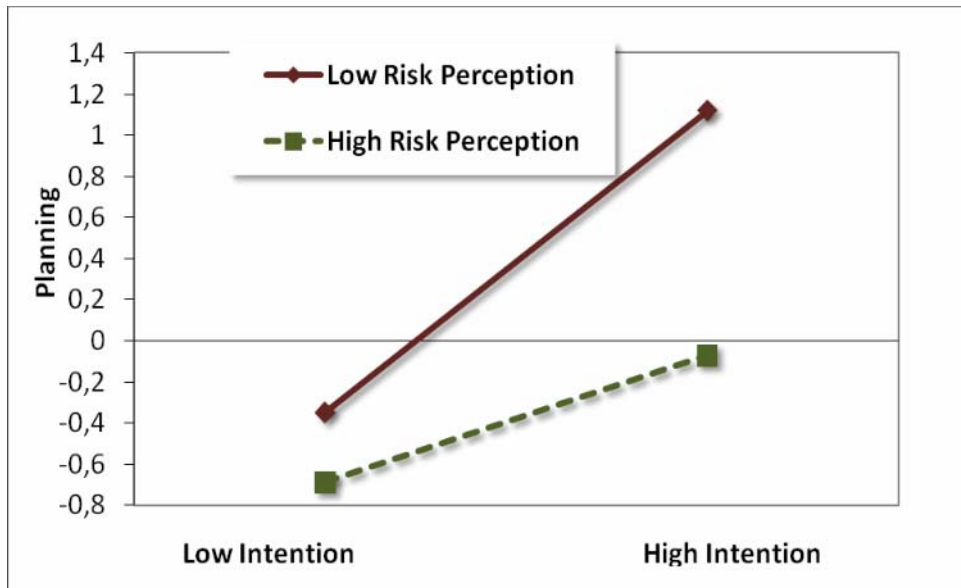


Figure 2. Effects of intention and risk perception on planning (standardized values).

Figure 3 demonstrates the continuous relationship between the moderator (risk perception) and the size of the intention effect on planning. When risk perception is lowest, the effect of intention on planning is maximal ( $b=.76, p<.01$ ). When risk perception is highest, the effect is nil ( $b=0$ ). The upper and lower curves indicate the 95% confidence interval.

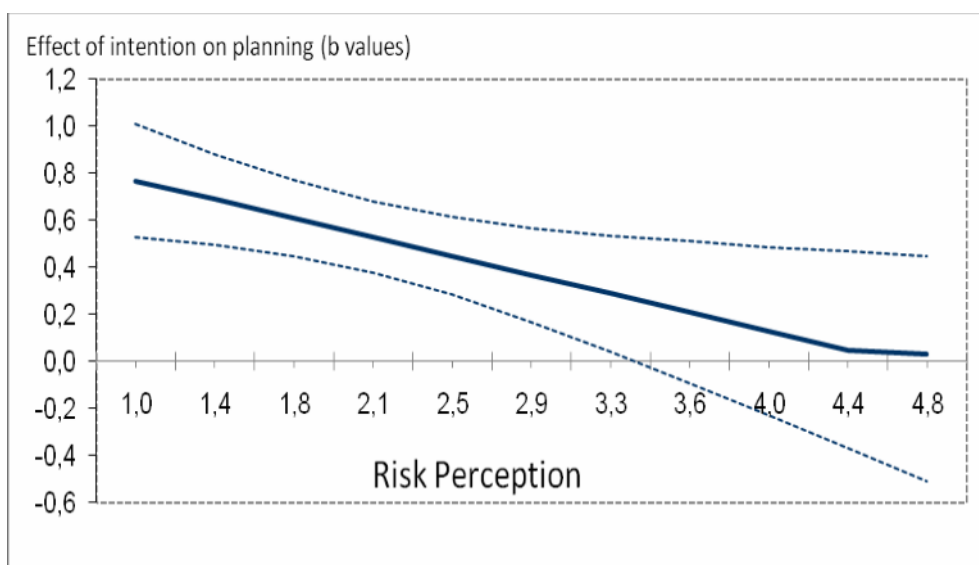


Figure 3. Relationship between the moderator (risk perception) and the size of the intention effect on planning.

## Discussion

The present study has examined the interrelationships between intention, planning, and risk perception in the context of sunscreen use over an extended period of time. Starting point for the analysis has been the well-known intention – planning – behavior chain that has been found in many previous studies in different behavioral domains (e.g., Gollwitzer & Sheeran, 2006; Norman & Conner, 2005; Schwarzer, 2008; Sniehotta, 2009). As expected, it was found that planning partially mediates the effect of intention at Time 1 on sunscreen use at Time 3.

Previous studies on dietary behaviors as well as physical activity have found that the intention-planning-behavior mediation can be moderated by self-efficacy (e.g., Gutierrez-Dona et al., 2009; Lippke et al., 2009). Since the possible development of skin cancer after sun exposure constitutes a scary outlook, we had hypothesized that risk perception might constitute a moderator in this case. This indeed materialized in the present data. Risk perception moderated the intention – planning – behavior relationship. In other words, the size of the conditional indirect effect varied along levels of the moderator. However, the moderator effect was negative, reflecting a better mediation when people did not feel vulnerable. As the figures illustrate, there is no effect of intentions on planning when risk perception is very high, and thus, there can be no mediation. In contrast, when risk perception is very low, there is a strong effect of intentions on planning, allowing for the mediation process.

How can this be explained? Health risk perception can be regarded as the opposite of health-specific optimism, be it realistic or unrealistic optimism (Weinstein, 1982, 2000). When people feel agentic and are optimistic about their control over a health threat they are more likely to consider health actions and perform them (Bandura, 1997). This means that optimistic individuals may well translate their intentions into plans. Health-specific optimism, which means low health risk perception, thus, can be a facilitator of health behaviors.

There is a large body of literature that provides ample evidence that optimism is associated with well-being, health, and health behaviors, although the size of these associations is very inconsistent (Davidson, & Prkachin, 1997; Luo, & Isaacowitz, 2007; Radcliffe, & Klein, 2002; Taylor & Brown, 1994; Weinstein, 1982, 2000). Although “defensive” unrealistic optimism and “functional” optimistic beliefs belong to the same family of optimism constructs, they are clearly distinct and must be separated conceptually and empirically. One reason for such inconsistencies lies in the conceptual diversity of the optimism construct and corresponding psychometric measures.

In the present study, perceived risk provide a proxy measure of health optimism, and an empirical distinction between the different kinds of optimism was not made. This turned out to be a limitation. Future studies should include health-specific defensive optimism as well as functional optimism (Schwarzer, 1994). Defensive optimism pertains to the neglect of a threat for an immediate self-serving purpose (Weinstein, 1982, 2000) whereas functional optimism relates to the belief in one’s competence (Bandura, 1997) or effort (Carver & Scheier, 1998) to cope successfully with a threat. One would expect that only the latter type of optimism would assist in translating intentions into planning for sunscreen use.

Another limitation is the small sample size which does not allow for generalizing the results to a larger population. Future studies are needed in order to explore the role of planning and risk perception in sun protection with larger samples that are representative for a defined population. For a full account of the determinants of sun protection behaviors, more social-cognitive variables need to be included in a causal model. Measures of the value participants placed on appearance and tanning, and their skin type would also have been of interest. Moreover, results of theory-based interventions such as message framing need to be considered (Orbell, & Kyriakaki, 2008).

Nevertheless, this represents the first study to address the role played by risk perception in influencing the mediating relation between intention – planning - sunscreen use.



Results point to the importance of low risk perception or health-specific optimism in the elaboration of plans and behavior adoption. They also have implications for prevention practice as they highlight the relevance of providing planning interventions in conjunction with enhancing optimism to help people transform their sunscreen use intentions into action.

## References

- Abdulla, F. R., Feldman, S. R., Willieford, P. M., Krowchuck, D., & Kaur, M. (2005). Tanning and skin cancer. *Pediatric Dermatology*, *22*, 501-512.
- Adams, M.A., Norman, G.J., Hovell, M.F., Sallis, J.F., & Patrick, K. (2009). Reconceptualizing decisional balance in an Adolescent Sun Protection intervention: mediating effects and theoretical interpretations. *Health Psychology*, *28*, 217-225.
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Arthey, S., & Clarke, V. A. (1995). Sun tanning and sun protection: A review of the psychological literature. *Social Science Medicine*, *40*, 265-274.
- Aspinwall, L. G., & Brunhart, S. M. (1996). Distinguishing optimism from denial: Optimistic beliefs predict attention to health threats. *Personality & Social Psychology Bulletin*, *22*, 993-1003.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Baum A., & Cohen, L. (1998). Successful behavioral interventions to prevent cancer: the example of skin cancer. *Annual Review of Public Health*, *19*, 319-333.
- Becker, M. H. (1974). The health belief model and sick role behavior. *Health Education Monographs*, *2*, 401-419.
- Brewer, N. T., Chapman, G. B., Gibbons, F. X., Gerrard, M., McCaul K. D., & Weinstein, N. D. (2007). Meta-analysis on the relationship between risk perception and health behavior: The example of vaccination. *Health Psychology*, *26*, 136-145.
- Calder N., & Aitken, R. (2008). An exploratory study of the influences that compromise the sun protection of young adults. *International Journal of Consumer Behavior*, *32*, 579-587.
- Carver, C. S., & Scheier, M. F. (1998). *On the self regulation of behavior*. New York: Cambridge University Press.
- Cody, R., & Lee, C. (1990). Behaviors, beliefs and intentions in skin cancer prevention, *Journal of Behavioral Medicine*, *13*, 373-389.
- Davidson, K., & Prkachin, K. (1997). Optimism and unrealistic optimism have an interacting impact on health-promoting behavior and knowledge changes. *Personality and Social Psychology Bulletin*, *23*, 617-625.
- de Vries, H., Lezwijn, J., Hol V., & Honing C. (2005). Skin cancer prevention: behavior and motives of Dutch adolescents. *European Journal of Cancer Prevention*, *14*, 39-50.

- Diepgen, T. L., & Mahler, V. (2002). The epidemiology of skin cancer. *British Journal of Dermatology, 146*, 1-6.
- Duke, J., Leventhal, H., Brownlee, S., & Leventhal, E. A. (2002). Giving up and replacing activities in response to illness. *Journal of Gerontology: Psychological Sciences, 57B*, 367-376.
- Glanz, K., Schoenfeld, E.R., & Steffen, A. (2010). A randomized trial of tailored skin cancer prevention messages for adults: project SCAPE. *American Journal of Public Health, 100*, 735-741, doi:10.2105/AJPH.2008.155705
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology, 38*, 69-119.
- Grunfeld, E. (2004). What influences university students intentions to practice safe sun exposure behaviors? *Journal of Adolescent Health, 35*, 486-492.
- Gutierrez-Dona, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). Self-Efficacy and planning predict dietary behaviors in Costa Rican and South Korean women: Two moderated mediation analyses, *Applied Psychology: Health and Well Being, 1*, 91-104.
- Jones, F., Harris, P., & Chrispin, C. (2000). Catching the sun: an investigation of sun exposure and skin protective behavior. *Psychology, Health & Medicine, 5*, 131-141.
- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). From knowledge to action regulation: modeling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology & Health, 16*, 191-206.
- Kasparian, N. A, McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine, 32*, 406-428.
- Keesling, B., & Friedman, H.S. (1987). Psychosocial factors in sunbathing and sunscreen use, *Health Psychology, 6*, 477-493.
- Lippke, S., Wiedemann, A. U., Ziegelmann, J. P., Reuter, T., & Schwarzer, R. (2009). Self-efficacy moderates the mediation of intentions into behavior via plans. *American Journal of Health Behavior, 33*, 521-529.
- Luo, J., & Isaacowitz, D. M. (2007). How optimists face skin cancer information: Risk assessment, attention, memory and behavior. *Psychology and Health, 22*, 963-984.
- MacKinnon, D. P., & Luecken, L. J. (2008). How and for whom? Mediation and moderation in health psychology. *Health Psychology. Suppl. Issue: Mediation and Moderation 27*, S99-S100.

- Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine, 32*(2), 57-63.
- Norman, P., & Conner, M. (2005). The Theory of Planned Behavior and exercise: Evidence for the mediating and moderating roles of planning and intention-behavior relationships. *Journal of Sport and Exercise Psychology, 27*, 488-504.
- Orbell, S. & Kyriakaki, M. (2008) Temporal framing and persuasion to adopt preventive health behavior: Moderating effects of individual differences in consideration of future consequences on sunscreen use. *Health Psychology, 27*, 770-779.
- Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods and prescriptions. *Multivariate Behavioral Research, 42*, 185-227.
- Prentice-Dunn, S., McMath, B. F., & Cramer, R. (2009). Protection Motivation Theory and Stages of Change in sun protection behavior. *Journal of Health Psychology, 14*, 297-305.
- Radcliffe, N. M., & Klein, W. M. P. (2002). Dispositional, unrealistic, and comparative optimism: Differential relations with knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin, 28*, 836-846.
- Renner, B., & Schupp, H.T. (in press). The perception of health risk. In H. Friedman (ed), *Oxford Handbook of Health Psychology*. New York, N.Y.: Oxford University Press.
- Reynolds, K.D., Buller, D.B., Yaroch, A.L., Maloy, J.A., & Cutter, G.R. (2006). Mediation of a middle school skin cancer prevention program. *Health Psychology, 25*, 616-625.
- Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. *Journal of Psychology, 91*, 93-114.
- Schwarzer, R. (1994). Optimism, vulnerability, and self-beliefs as health-related cognitions: A systematic overview. *Psychology and Health, 9*, 161-180.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review, 57*, 1-29.
- Sniehotta, F. F. (2009). Towards a theory of intentional behavior change: Plans, planning, and self-regulation. *British Journal of Health Psychology, 14*, 261-273.
- Taylor, S.E., & Brown, J.D. (1994). Positive illusions and well-being revisited: Separating fact from fiction. *Psychological Bulletin, 116*, 21-27.

- Van Osch, L., Reubsaet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2008). Predicting parental sunscreen use: Disentangling the role of action planning in the intention-behavior relationship. *Psychology & Health, 23*, 829-847.
- Weinstein, N. D. (1982). Unrealistic optimism about susceptibility to health problems. *Journal of Behavioral Medicine, 5*: 441-460.
- Weinstein, N. D. (1988). The precaution adoption process. *Health Psychology, 7*, 355-386.
- Weinstein, N. D. (2000). Perceived probability, perceived severity and health-protective behavior. *Health Psychology, 19*, 135-140.

---

# **Chapter 5**

**Stage-Matched Interventions to Enhance Planning for Sunscreen**

**Use**

### Abstract

**Purpose.** Targeting particular subgroups of persons by matching the intervention to their stage of change can be more effective in enhancing health behavior than addressing a broad audience. The present study examines to which degree individuals make plans for sun protection as a means to avoid skin damage and skin cancer. We compared a comprehensive (one-size-fits-all) intervention with an intense, parsimonious planning intervention and predicted that differential effects would emerge for the investigated stages of change.

**Methods.** A world-wide online-study on sun safety was launched in English, Romanian, Portuguese, and German. It was designed as a randomized controlled trial (RCT) with two intervention groups and one control group and two assessment points in time, before intervention (Time 1) and two weeks after the intervention (Time 2). To explore stage-matched intervention effects, participants ( $N=292$ ) were grouped according to their stages of change, resulting in 51 preintenders (no intention to use sunscreen), 102 intenders (high intention but no regular use of sunscreen), and 139 actors (already use sunscreen on a regular basis when being exposed to sunshine).

**Results.** No overall treatment effects emerged but interactions between time and intervention within stages occurred for action planning and coping planning. The comprehensive intervention was more effective for preintenders, whereas the parsimonious planning intervention proved more effective for intenders.

**Conclusions.** Results confirm that a parsimonious planning treatment can be beneficial if matched to intentional stage, highlighting the importance of designing tailored interventions in the context of sunscreen use.

**Key words:** stages of change, planning intervention, motivation, sun protection

### **Stage-Matched Interventions to Enhance Planning for Sunscreen Use**

Skin cancer has become one of the most prevalent forms of cancer among the white population around the world (Diepgen & Mahler, 2002). More than one million cases are diagnosed annually in the USA, making it the most common form of cancer according to US-American Cancer Society (2009). The highest incidence of skin cancer in the world was registered in Australia where two out of every three people are expected to develop a form of skin cancer during their lifetime. Moreover, it was estimated that approximately 1,000 Australians die each year due to skin cancer, 85% of these having been diagnosed with melanoma (Arthey & Clarke, 1995). The incidence of skin cancer has also been on the rise in Europe, especially in the northern regions due to global warming, popularity of tanning salons and extensive tourism to sunny places (Branström, Ullen, & Brandberg, 2004; Grunfeld, 2004).

Research shows strong epidemiologic evidence that nonmelanoma skin cancer is linked to unprotected UV exposure (Abdulla, Feldman, Willieford, Krowchuck, & Kaur, 2005). However, four out of five cases of skin cancer could be prevented by introducing behavior changes such as reducing sun exposure or adopting preventive measures such as applying sunscreen, wearing protective clothing and seeking shade (Baum & Cohen, 1998; Myers & Horswill, 2006). Applying sunscreen with a sun protection factor (SPF) of 15+ on a regular basis has been proven to be an effective prevention method, reducing the occurrence of squamous cell carcinoma with 40% in a four and a half year community randomized controlled trial conducted in Australia (Green, Williams, Neale et al., 1999).

Skin cancer prevention has focused on increasing sun protection methods and decreasing unprotected sun exposure by designing policy interventions or educational randomized controlled trials within community, school, tourist and work settings. Several



multicomponent community-based interventions have been implemented and proven successful such as: “Slip!Slop!Slap!” (Rassaby, Larcombe, Hill, & Wake, 1983), the SunSmart campaign (Borland, Hill, & Noy, 1990; Hill, Marks, White & Borland, 1993), the Under Cover Skin Cancer Prevention Project (Boutwell, 1995) or in the school context the Skin Safe programme (Girgis, Sanson-Fisher, Tripodi, & Golding, 1993). Although effective in changing intention and behavior, these studies fail to clarify which specific program ingredients account for its effectiveness.

Reviews show that most sun protection interventions augment knowledge on sun protection, sunbathing and risk of cancer, as well as attempt to change attitudes about tanning and intentions to reduce sunbathing or take protective measures (Kasparian, McLoone, & Meiser, 2009) but only few manage to reduce sun exposure or increase sun protection behavior (Morris & Elwood, 1996; Jackson & Aiken, 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008). Moreover, awareness of skin cancer risk and knowledge about protective measures do not necessarily lead to behavior initiation and maintenance (Sjöberg, 2003). Therefore, it is important to identify postintentional strategies that help change sun protection behavior. Most interventions target motivational aspects and assume that intention is the best proximal determinant of behavior in the context of sun protection. However, this may not always be the case as many individuals fail to translate their intentions into practice (Orbell & Sheeran, 1998; Sheeran, 2002). Once people are motivated to act, they need post-intentional strategies such as action plans or coping plans to help them act upon their intentions.

Previous research has reported on planning interventions in changing exercise behavior (Prestwich, Lawton, & Conner, 2003; Arbour & Martin Ginis, 2009), fruit intake (Armitage, 2007) or breast self-examination (Prestwich, Conner, Lawton, Bailey, Litman & Molyneaux, 2005) and the effectiveness of forming action and coping plans for changing physical exercise (Sniehotta, Scholz, & Schwarzer, 2006; Scholz, Schuez, Ziegelmann, Lippke, & Schwarzer, 2008). Although there is evidence for the importance of addressing

both motivational and volitional aspects in interventions, there are few randomized controlled trials that report on the effectiveness of combined motivational-volitional interventions.

Examples of such successful endeavors were reported in the domains of exercise behavior (Milne, Orbell, & Sheeran, 2002) and medication intake (Sheeran & Orbell, 1999).

Starting from the premise that interventions should be tailored to the stage of change of the target population, several stage-matched sun protection programs were developed. The Transtheoretical Model of Change (TTM; Prochaska, & DiClemente, 1983; Prochaska et al., 2004) has been the most popular theoretical background chosen for elaborating such programs. A stage-matched intervention based on TTM and tailored photoaging information was effective in increasing self-reported sun protection behavior and moving people across stages (Weinstock, Rossi, Redding, & Maddock, 2002). Another TTM based stage-matched intervention was successful in promoting sun protection use and stage progression but not in decreasing sun exposure among beachgoers (Pagoto, McChargue, & Fuchua, 2003). However, these stage-matched interventions did not focus on post-intentional processes such as increasing planning to change behavior.

Action plans have been repeatedly shown to mediate and moderate between intention and sunscreen use (Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Van Osch, Reubsæet, Lechner, Candel, Mercken, & De Vries, 2007). However, we are not aware of any research up to date that tests interventions aiming to change sunscreen use by encouraging the development of action and coping planning, thus reflecting the importance of such studies.

### ***Health Action Process Approach***

The theoretical backdrop of the present study is the Health Action Process Approach (HAPA; Schwarzer, 2008; Schwarzer & Luszczynska, 2008). It suggests dividing the health behavior change process into two phases. First comes the motivation phase in which people develop their intentions. Afterwards, they enter the volition phase. There is a switch of

mindsets when people move from deliberation to action. Persons who are not yet motivated to change are characterized by inaction and low intention. They are in a preintentional stage and are therefore called preintenders. All others are postintentional (i.e., in a volitional phase).

Moreover, it is theoretically meaningful, and has been found to be useful, to subdivide further the volitional group into those who perform as opposed to those who only intend to perform the behavior. In the postintentional preactional stage, individuals are labeled “intenders,” whereas in the action stage they are labeled “actors.” The subdivision of preintenders, intenders, and actors is more parsimonious than a five or seven stage-approach and might be sufficient in many health promotion settings, although there might be some settings for which five stages (TTM; Prochaska & DiClemente, 1983) or even seven stages (PAPM; Weinstein, Lyon, Sandman, & Cuite, 1998) might be more promising. However, the higher the number of stages, the more likely it is that individuals are misclassified because no staging algorithm has perfect validity (Lippke, Ziegelmann, Velicer, & Schwarzer, 2009).

Interventions may be most effective when tailored to these stages. For example, *preintenders* are supposed to benefit from confrontation with outcome expectancies and some level of risk communication. They need to learn that the target behavior (e.g., sunscreen use) has positive outcomes (e.g., less wrinkles, healthier skin) as opposed to the negative outcomes that accompany the risk behavior (e.g., sunburn; Sjöberg, 2003).

In contrast, *intenders* should not benefit so much from such health messages because, after setting a goal, they have already moved beyond this mindset. They want to change, but have not yet taken action. Intenders (who are in the volitional preactional stage) are motivated to change, but they do not act because they might lack the right skills to act upon their intentions. Thus, they should benefit from planning interventions to translate their intentions into action. Planning is a key strategy at this point, serving as a mediator between intentions and behavior (Schwarzer & Luszczynska, 2008).

Finally, *actors* do not need any treatment at all unless one wants to improve their relapse prevention skills. In such a case, they should be prepared for particular high-risk situations in which lapses are imminent.

### ***Action Planning and Coping Planning***

Planning mediates between intentions and behaviors. Action planning refers to the when, where, and how to perform the target behavior. Another way of planning is the anticipation of barriers and the generation of alternative behaviors to overcome them. This has been called coping planning (Sniehotta, Scholz, & Schwarzer, 2006). People are asked to imagine scenarios that would hinder them in performing their intended behavior, and then develop one or more plans to cope with such 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 of action, they go on to imagine possible barriers and generate coping strategies. Thus, coping planning comes on top of action planning (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008). Planning is an alterable variable. It can be easily communicated to individuals with self-regulatory deficits. Quite a few randomized controlled trials have documented the effectiveness of planning interventions for behavior change (e.g., Chapman, Armitage, & Norman, 2009; Luszczynska, 2006; Wiedemann, Lippke, Reuter, Ziegelmann, & Schwarzer, 2009). However, there are no studies testing the effectiveness of action planning and coping planning for sun screen use.

### ***Aims of the Study***

This intervention study examines the efficacy of planning in the domain of sunscreen use. The main question was whether a parsimonious planning intervention is generally beneficial, and whether a comprehensive intervention would boost this effect above and

beyond regular planning. Moreover, the question was whether members of one of the stage groups would benefit in particular from one of the treatments (differential effect).

Two theory-guided interventions were provided to the experimental group: parsimonious planning and a comprehensive intervention (by inclusion of risk and resource communication). The control group participants received only feedback on their skin type in addition to the pre- and post-assessments. Experimental participants received one of the two interventions. Based on their intention and behavior levels, participants were assigned to subgroups of preintenders, intenders, and actors (for the analyses). The assumption was that intenders would especially benefit from planning whereas preintenders in particular would benefit from a comprehensive intervention because the ingredient of risk and resource communication is typically matched to this stage. Thus, this intervention was supposed to be matched to preintenders, whereas the mere planning treatment was supposed to be matched to the intenders. There was no matched treatment for actors. Actors were not supposed to benefit from either type of treatment because their sun prevention levels were already high by stage definition.

## **Method**

### ***Participants and Procedure***

Participants were recruited through world-wide announcements placed on university websites, blogs and discussion forums starting in June 2009. The online intervention was available in four languages: English, German, Portuguese, and Romanian. Individuals ( $N=524$ ) 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), 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: (1) they did not complete the questionnaire at T1, (2) they did not

provide an e-mail address. After logging in, participants were randomly assigned to one of two different sun safety randomized controlled trials, one examining message framing ( $n=212$ ), and the present one examining planning ( $n=307$ ). Of the 307 individuals who were randomized to the planning study, 292 (95%) respondents filled in both T1 and T2 questionnaires. The present article is constrained to the second study, and only those study participants ( $n=292$ ) were included into the following analyses.

By randomization, individuals were assigned to a control group ( $n=96$ ; received feedback on their skin type), a parsimonious planning treatment ( $n=109$ ; formed action and coping plans) or comprehensive intervention ( $n=87$ ; received a resource communication treatment in addition to forming action plans and coping plans). These groups were further subdivided in terms of the stage the individuals were in (based upon self-reported levels of intention and behavior, see below).

Two weeks later at Time 2 (T2) all participants received an e-mail asking them to fill in a follow-up questionnaire. The final sample consisted of 35 (12%) men and 257 (88%) women, with a mean age of 25.33 years ( $SD= 8.42$ ) ranging from 18 to 65 years.

### ***Research Design***

A quasi-experimental 3 x 3 between-factors design with repeated measures was chosen. There were three stages of change (preintenders,  $n=51$ ; intenders,  $n=102$ ; actors,  $n=139$ ) and three intervention groups (planning,  $n=109$ ; comprehensive,  $n=87$ ; control,  $n=96$ ).

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 completing the questionnaire at T1, based on the random number received, participants were assigned to the control group, the parsimonious planning treatment, or the comprehensive intervention. Action planning and coping planning were measured at baseline and follow-up after two weeks, and served as the

dependent variable. In order to explore the effectiveness of the two different treatments for different stages, a staging algorithm (see below) was used to classify people as being preintenders, intenders, or actors.

### **Measures**

**Stage.** In order to assess stages, a sunscreen-use staging algorithm was applied to classify participants based on their intention to use sunscreen and present sunscreen use. Those who had low intentions and low sunscreen use were classified as preintenders, those who had high intentions but were low on sunscreen use were labeled as intenders, and actors were considered those who were high on sunscreen use.

*Intention to use sunscreen* was measured at Time 1 and Time 2 with one item asking people about their intentions during the next months: “I intend to use sunscreen with a SPF 15+ when I am in the sun for a long time”. Responses ranged from strongly disagree (1) to strongly agree (4). Those answering 3 or 4 were labeled intenders, those answering 1 or 2 were labeled preintenders.

Sunscreen use was measured at Time 1 with one item asking people if they applied sunscreen with a SPF 15+ repeatedly during the sunny days when they were outside. Responses ranged from strongly disagree (1) to strongly agree (4). Only those indicating 3 and 4 were actors, all others were labeled intenders.

**Planning to use sunscreen.** *Action planning* was measured with one item that asked participants to state to what extent they had made a concrete plan on when, where and how they would use sunscreen. Answers ranged on a Likert Scale from 1 (strongly disagree) to 4 (strongly agree). *Coping planning* was measured with a three-item scale ( $\alpha=.80$  at T1,  $\alpha=.81$  at T2). Three types of barriers were chosen based on a pilot focus group study on sun protection: barriers that hinder behavior adoption, obstacles that hinder behavior maintenance and barriers that make it hard for people to adopt behavior after a relapse. Thus, participants

were asked to rate to what extent they had made a concrete plan what to do if they forgot their sunscreen at home, if they feel awkward to use sunscreen because nobody else does and if they forgot to apply sunscreen when they are in the sun. Answers ranged on a Likert scale from 1 (strongly disagree) to 4 (strongly agree).

### ***Interventions***

The *comprehensive intervention* (one-size-fits-all) combined planning with risk and resource communication. Participants received a message about the risk of unprotected sun exposure highlighting the negative consequences such as premature aging 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 where 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 gives tips on how not to forget to use sunscreen (e.g., always carry a bottle in your bag during the summer). The comprehensive intervention took around 15 minutes to complete.

The *parsimonious planning intervention* focused on forming action plans and coping plans to initiate, maintain, or resume sun protection behaviors. Participants were asked to complete a plan on where, when and how they will protect themselves from the sun. First, they were given a short example of a plan and were then provided with the opportunity to make their own personalized plan by filling in boxes within the online intervention template. After formulating their plan they had the possibility to adjust the formulation if they considered that something was missing or incorrect. A message about the utility of coping plans and a short example of coping planning in the context of sun protection followed. Participants were then asked to think about three obstacles that would interfere with their sun protection behaviors 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. The planning intervention here is simply an intense version of the comprehensive intervention, designed to examine the most parsimonious way of treating people who are already motivated. The whole planning intervention lasted about 10 minutes.

In the *control group*, people only received a brief feedback on their skin type as a result of completing the questionnaire and a brief message that they should take care of their skin.

### ***Analytic Procedure***

The data were analyzed with repeated measures analyses of variance using SPSS 18. Stage (preintenders, intenders, actors) and treatment (planning, comprehensive, and control groups) were chosen as between-subjects factors. Action planning and coping planning were the dependent variables measured at two points in time, two weeks apart (pre-post measures).

## **Results**

### ***Action Planning***

A repeated measures ANOVA was run with action planning as the dependent variable at two points in time, and stage (3 levels) and treatment groups (3 levels) as between-factors. There was no overall treatment effect ( $F(2, 283) = 0.91, p = .40$ ), but a stage effect ( $F(2, 283) = 39.52, p < .001, \eta^2 = .22$ ) emerged as people at higher stages plan more sun protection. There was no interaction between stage and treatment groups ( $F(4, 283) = 0.36, p = .84$ ).

Within-subject contrasts were as follows: A Time effect ( $F(1,283) = 8.64, p < .001, \eta^2 = .03$ ), a Time x Treatment interaction ( $F(2, 283) = 3.34, p < .05, \eta^2 = .023$ ). Figure 1 displays the patterns of pre-post mean differences in action planning for the three stage groups.

Table 1a.  
*Means (M), Standard Deviations (S.D.), and Sample Sizes (n) for action planning regarding sunscreen use (Time1, Time2), (N=292) divided in terms of Stages (Time1) and Intervention Groups*

	Time 1								Time 2							
	Parsimonious		Comprehensi		Control		total		Parsimonious		Comprehensi		Control		total	
	<i>M (S.D.)</i>		<i>n</i>		<i>M (S.D.)</i>		<i>n</i>		<i>M (S.D.)</i>		<i>n</i>		<i>M (S.D.)</i>		<i>n</i>	
	planning	intervention	ve	intervention	group				planning	intervention	ve	intervention	group			
preintenders	1.29	(0.58)	1.35	(0.49)	1.53	(1.00)	1.39	(0.72)	1.53	(0.71)	1.94	(0.82)	1.53	(0.87)	1.67	(0.81)
	n=17		n=17		n=17		n=51		n=17		n=17		n=17		n=51	
intenders	2.28	(0.94)	2.35	(0.98)	2.26	(0.81)	2.29	(0.90)	2.56	(0.73)	2.42	(0.99)	2.17	(0.92)	2.38	(0.89)
	n=36		n=31		n=35		n=102		n=36		n=31		n=35		n=102	
actors	2.46	(0.83)	2.54	(0.79)	2.52	(0.95)	2.50	(0.85)	2.63	(0.64)	2.79	(0.61)	2.50	(1.00)	2.63	(0.77)
	n=56		n=39		n=44		n=139		n=56		n=39		n=44		n=139	
total	2.22	(0.92)	2.24	(0.92)	2.25	(0.97)	2.24	(0.93)	2.43	(0.78)	2.49	(0.86)	2.21	(1.00)	2.38	(0.89)
	n=109		n=87		n=96		N=292		n=109		n=87		n=96		N=292	

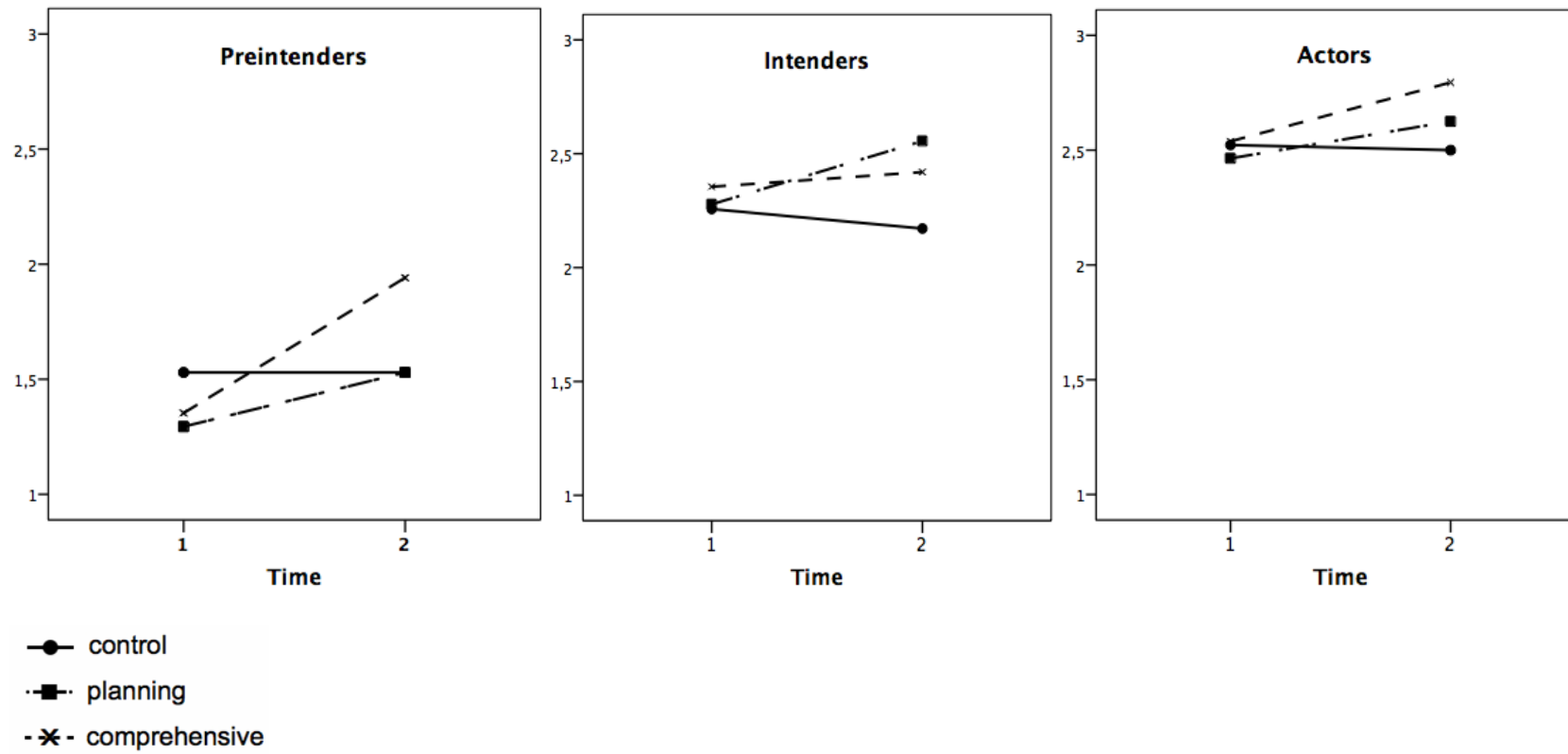


Figure 1:

Changes in levels of action planning in different groups (control, planning, comprehensive) and at different stages (Preintenders [Panel A], Intenders [Panel B], Actors [Panel C])

### ***Coping Planning***

A repeated measures ANOVA was run with coping planning as the dependent variable at two points in time, and stage (3 levels) and treatment groups (3 levels) as between-factors. There was no overall treatment effect ( $F(2, 282) = 0.6, p = .55$ ), but a stage effect ( $F(2, 282) = 43.23, p < .001, \eta^2 = .23$ ) as people at higher stages plan more sun protection. There was no interaction between stage and treatment groups ( $F(4, 282) = 1.12, p = .35$ ).

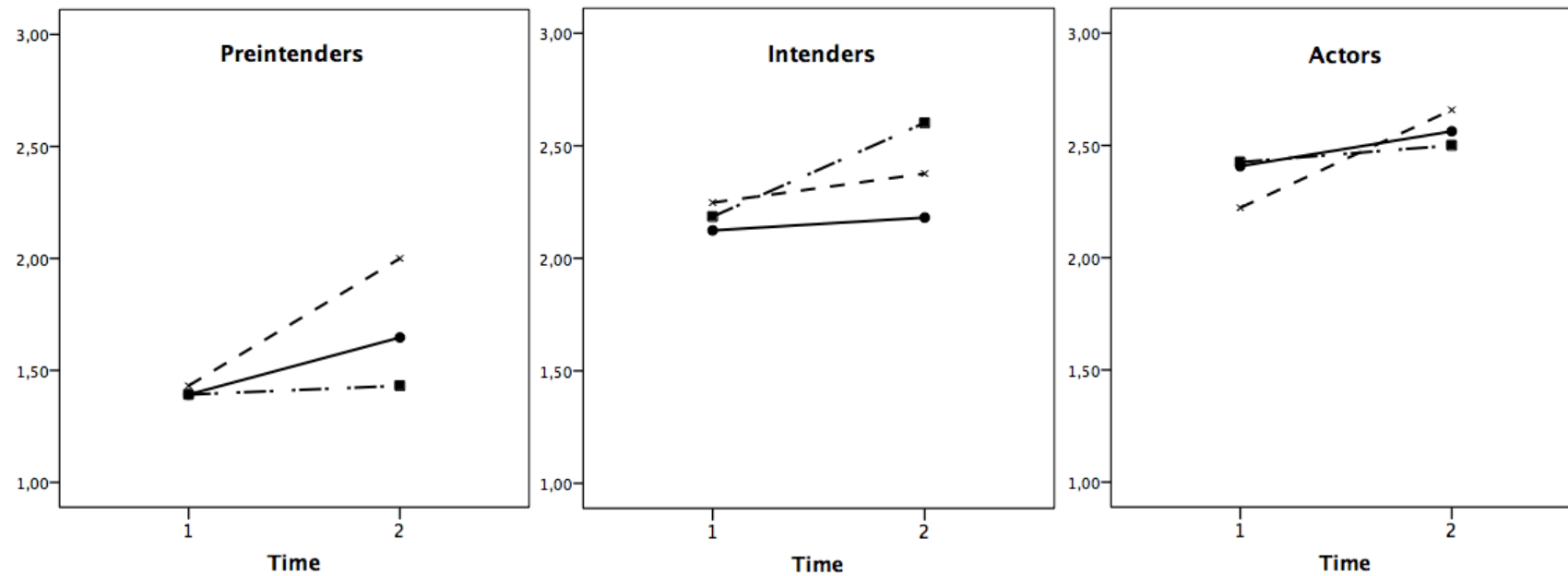
Within-subject contrasts were as follows: A Time effect ( $F(1, 282) = 27.08, p < .001$ ), a Time x Treatment interaction ( $F(2, 282) = 2.35, p < .10, \eta^2 = .02$ ), and a Time x Stage x Treatment interaction ( $F(4, 282) = 2.87, p < .05, \eta^2 = .04$ ).

This triple interaction means that, within each of the three stages, there is a unique pattern of change between T1 and T2, depending on the treatment group. Figure 2 displays the patterns of pre-post mean differences in coping planning for the three stage groups.

Table 1b

Means (*M*), Standard Deviations (*S.D.*), and Sample Sizes (*n*) for **coping planning** regarding sunscreen use (*Time1*, *Time2*), (*N*=292) divided in terms of Stages (*Time1*) and Intervention Groups

	Time 1								Time 2							
	<i>M</i>		<i>(S.D.)</i>		<i>n</i>				<i>M</i>		<i>(S.D.)</i>		<i>n</i>			
	Parsimonious	Comprehensi	Control	total	Parsimonious	Comprehensi	Control	total	Parsimonious	Comprehensi	Control	total	Parsimonious	Comprehensi	Control	total
	planning	ve	group		planning	ve	group		planning	ve	group		planning	ve	group	
	intervention	intervention			intervention	intervention			intervention	intervention			intervention	intervention		
preintenders	1.39	(0.53)	1.43	(0.45)	1.39	(0.54)	1.40	(0.50)	1.43	(0.62)	2.00	(0.83)	1.64	(0.79)	1.69	(0.77)
	n=17	n=17	n=17	n=51	n=17	n=17	n=17	n=51	n=17	n=17	n=17	n=51	n=17	n=17	n=17	n=51
intenders	2.18	(0.65)	2.24	(0.70)	2.12	(0.75)	2.18	(0.70)	2.60	(0.67)	2.37	(0.73)	2.18	(0.80)	2.38	(0.75)
	n=35	n=36	n=31	n=102	n=35	n=36	n=31	n=102	n=35	n=36	n=31	n=102	n=35	n=36	n=31	n=102
actors	2.42	(0.60)	2.22	(0.66)	2.40	(0.86)	2.36	(0.71)	2.50	(0.61)	2.65	(0.53)	2.56	(0.84)	2.56	(0.67)
	n=45	n=54	n=39	n=138	n=45	n=36	n=39	n=138	n=45	n=36	n=39	n=138	n=45	n=36	n=39	n=138
total	2.18	(0.70)	2.07	(0.71)	2.12	(0.85)	2.13	(0.76)	2.36	(0.75)	2.42	(0.71)	2.26	(0.87)	2.35	(0.78)
	n=97	n=107	n=87	N=291	n=97	n=107	n=87	N=291	n=97	n=107	n=87	N=291	n=97	n=107	n=87	N=291



- control
- planning
- ×— comprehensive

Figure 2:

Changes in levels of coping planning in different groups (control, planning, comprehensive) and at different stages (Preintenders [Panel A], Intenders [Panel B], Actors [Panel C])

## Discussion

This randomized controlled trial has examined the effects of two interventions on planning in the context of sunscreen use. There were two dependent variables, action planning and coping planning. Previous studies have found that these are essential factors in the volition phase of health behavior change as they are predictors of successful behavior change and as they mediate between intentions and behaviors (e.g., Lippke, Ziegelmann, & Schwarzer, 2004; Luszczynska, Sobczyk, & Abraham, 2007; Sniehotta, Scholz, & Schwarzer, 2006). In the present data, no main effects of the treatments were found which may sound puzzling at first glance. However, based on the stages of change approach, such main effects are not necessary to document beneficial effects of an intervention. The focus is rather on interactions which means that we look for treatment effects within particular stages. If a time x treatment effect is found within one stage but not in the other, we have identified an audience to which a certain kind of treatment can be successfully tailored. The idea of stage-matched treatments is reinforced by such interactions.

In the present data, main effects of stage on both dependent variables were found which means that intenders have higher levels of planning than preintenders, and actors have higher levels than intenders. These effects can be explained by the stage allocation as it is based upon an algorithm that includes behavior and intentions.

Looking at within-subjects analyses, time effects were documented reflecting an increase in planning levels from Time 1 to Time 2. Time effects in the absence of an overall intervention effect point to the phenomenon that not only the two intervention groups but also the control group have improved. This could be due to “mere measurement”, a well-known outcome in research designs including a pretest that might sensitize participants for the topic of the study.

The differential patterns of results as displayed in Figures 1 and 2 are in line with theory and hypotheses. In *preintenders*, a parsimonious planning intervention seems to be useless as they first need to be moved to the intentional stage. For that, preintenders need the motivational component of the comprehensive intervention. It even might be counter-productive to provide them only with the planning component. Someone who has no intention to change cannot benefit from induced planning activities as this is mismatched to his/her stage (Lippke et al., 2004). Preintenders, however, only benefit from the comprehensive intervention (see the steep increase in the left panels of Figures 1 and 2). The active ingredient here seems to be the risk and resource communication component that had been added to the planning instructions.

*Intenders* benefit from the parsimonious planning intervention but not from the comprehensive intervention (see middle panels in Figures 1 and 2). Adding the risk and resource component might even distract them from planning because there is almost no increase for those with the comprehensive treatment. However, there are no significant differences.

In *actors*, the interventions appear to be beneficial in terms of action planning but less so for coping planning. This could mean that actors are in need of a tailored intervention that would include maintenance self-efficacy in addition to forming coping plans. Increasing maintenance self-efficacy in addition to forming coping plans might help them stay on track with the acquired behavior.

There are several factors that may have influenced these results and implications might guide future studies. First, the staging algorithm might not have been well designed for this sample, especially as behavior was measured only with a proxy. The validity of staging algorithms is a universal problem associated with all stage theories of health behavior change (Lippke et al., 2009). In future studies, it would be good to apply a validated, reliable stage algorithm. However, such a stage algorithm is lacking in the context of sunscreen use, a



behavior that depends on the weather conditions, general lifestyle and conflicting attitudes (like tanning is healthy, Sjöberg, 2003).

Even more, it would be relevant to see whether habit formation occurs and guarantees that every time the person is in a sunny weather the habit of applying sunscreen is activated. Second, the brief online treatments (10-15 minutes) might not be sufficient to yield more substantial outcomes. Future studies might test varied levels of treatment intensity. Third, although the validity of self-reports is usually satisfactory, further studies applying objective measures of sunscreen use should replicate the results of this study.

Nevertheless, the present study is novel in comparison to other studies on planning interventions because two kinds of interventions have been compared with a particular focus on stage-specific effects. The planning intervention here is simply an intense version of the comprehensive intervention, designed to examine the most parsimonious way of treating people who are already motivated. Moreover, this seems to be the first study to evaluate stage-specific effects of different kinds of planning in the context of sunscreen use.

## References

- Abdulla, F.R., Feldman, S.R., Willieford, P.M., Krowchuck, D. & Kaur, M. (2005). Tanning and skin cancer. *Pediatric Dermatology*, 22, 501-512.
- American Cancer Society (2009). *Cancer Facts & Figures*. Atlanta: American Cancer Society.
- Arbour, K.P., & Martin Ginis K.A. (2009). A randomized controlled trial of the effects of implementation intentions on women's walking behaviour. *Psychology and Health*, 24, 49-65.
- Armitage, C. (2007). Effects of an implementation intention-based intervention on fruit consumption, *Psychology and Health*, 22, 917-928.
- Arthey, S., & Clarke, V.A. (1995). Suntanning and sun protection: A review of the psychological literature. *Social Science Medicine*, 40, 265-274.
- Baum A., & Cohen, L. (1998). Successful behavioral interventions to prevent cancer: the example of skin cancer. *Annual Review of Public Health*, 19, 319-333.
- Borland, R., Hill, D., & Noy, S. (1990). Being SunSmart: changes in community awareness and reported behavior following a primary prevention programme for skin cancer control. *Behavior Change*, 7,126-135.
- Boutwell, W.B. (1995). The under cover skin cancer prevention project: a community based programme in four Texas cities. *Cancer*, 75, 657-60.
- Branström, R., Ullen, H., & Brandberg, Y. (2004). Attitudes, subjective norms and perceptions of behavioral control as predictors of sun-related behavior in Swedish adults. *Preventive Medicine*, 39, 992-999.
- Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology & Health*, 24, 317 - 332.
- Diepgen, T.L., & Mahler, V. (2002). The epidemiology of skin cancer. *British Journal of Dermatology*, 146, 1-6.
- Girgis, A., Sanson-Fisher, R. W., Tripodi, D. A., & Golding, T. (1993). Evaluation of interventions to improve solar protection in primary schools. *Health Education Quarterly*, 20, 275-287.
- Green A, Williams G, Neale R, et al., (1999). Daily sunscreen application and betacarotene supplementation in prevention of basal-cell and squamous-cell carcinomas of the skin: a randomized controlled trial, *Lancet*, 354, 723-729.

- Grunfeld, E. (2004). What influences university students intentions to practice safe sun exposure behaviors? *Journal of Adolescent Health, 35*, 486-492.
- Hill, D., White, V., Marks, R., & Borland, R. (1993). Changes in sun-related attitudes and behaviors, and reduced sunburn prevalence in a population at high risk of melanoma. *European Journal of Cancer Prevention, 2*, 447-456.
- Jackson, K.M., & Aiken, L.S., (2006). Evaluation of a multi component appearance based sun protective intervention for young women, uncovering the mechanisms of programme efficacy, *Health Psychology, 25*, 34-46.
- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). From knowledge to action regulation: modelling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology & Health, 16*, 191-206.
- Kasparian, N. A, McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine, 32*, 406-428.
- Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine, 12*, 221-240.
- Lippke, S., Ziegelmann, J. P., Schwarzer, R., & Velicer, W. F. (2009). Validity of stage assessment in the adoption and maintenance of physical activity and fruit and vegetable consumption. *Health Psychology, 28*, 183-193.
- Luszczynska, A. (2006). An implementation intentions intervention, the use of planning strategy, and physical activity after myocardial infarction. *Social Science and Medicine, 62*, 900-908.
- Luszczynska, A., Sobczyk, A., & Abraham, C. (2007). Planning to reduce weight: Implementation intentions intervention helps to reduce body weight among overweight or obese women by prompting action planning. *Health Psychology, 26*, 507-512.
- Mahler, H.I.M., Kulik, J.A., Butler, H.A., Gerrard, M., & Gibbons, F.X. (2008). Social norms information enhances the efficacy of an appearance-based sun protection intervention, *Social Science & Medicine, 67*, 321-329.
- Milne, S., Orbell, S., & Sheeran P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions, *British Journal of Health Psychology, 7*, 163-184.

- Morris, J., & Elwood M. (1996). Sun exposure modification programmes and their evaluation: a review of the literature. *Health Promotion International*, 4, 321-332.
- Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine*, 32, 57-63.
- Orbell, S. & Sheeran, P. (1998). "Inclined abstainers": A problem for predicting health-related behaviour, *British Journal of Social Psychology*, 37, 151-165.
- Pagoto, S., McChargue, D., & Fuqua, R.W. (2003). Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology*, 22, 429-433.
- Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour, *Psychology and Health*, 18, 707-721.
- Prestwich, A., Conner, M., Lawton, R., Bailey, W., Litman, J., & Molyneaux, V. (2005). Individual and collaborative implementation intentions and the promotion of breast self-examination, *Psychology and Health*, 20, 743-760.
- Prochaska, J. O., & DiClemente, C. C. (1983). Stages and processes of self-change of smoking: Toward an integrative model of change. *Journal of Consulting and Clinical Psychology*, 51, 390-395.
- Prochaska, J. O., Velicer, W. F., Rossi, J. S., Redding, C. A., Greene, G. W., Rossi, S. R., et al. (2004). Multiple risk expert system interventions: Impact of simultaneous stage-matched expert system interventions for smoking, high-fat diet, and sun exposure in a population of parents. *Health Psychology*, 25, 503-516.
- Rassaby, J., Larcombe, I., Hill, D. & Wake, F. R. (1983). Slip Slop Slap: health education about skin cancer. *Cancer Forum*, 7,63-69.
- Scholz, U., Schüz, B., Ziegelmann, J. P., Lippke, S., & Schwarzer, R. (2008). Beyond behavioral intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology*, 13, 479-494.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*, 57, 1-29.
- Schwarzer, R., & Luszczynska, A., (2008). How to overcome health-compromising behaviors: The health action process approach. *European Psychologist*, 2, 141-151.

- Sheeran, P. (2002). Intention-behaviour relations: A conceptual and empirical review. In M. Hewstone & W. Stroebe (Eds.), *European Review of Social Psychology*. (Vol. 12, pp. 1-36.): Chichester, UK: John Wiley & Sons.
- Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behaviour: augmenting the predictive validity of the theory of planned behaviour. *European Journal of Social Psychology*, 29, 349-369.
- Sjöberg, L. (2003). Neglecting the Risks: The Irrationality of Health Behavior and the Quest for La Dolce Vita. *European Psychologist*, 8(4), 266-278.
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2006). Action plans and coping plans for physical exercise: A longitudinal intervention study in cardiac rehabilitation. *British Journal of Health Psychology*, 11, 23-37.
- Van Osch, L., Reubsaet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2007). Predicting parental sunscreen use: Disentangling the role of action planning in the intention-behavior relationship. *Psychology and Health*, 1-19.
- Weinstein, N. D., Lyon, J. E., Sandman, P. M., & Cuite, C. L. (1998). Experimental evidence for stages of health behavior change: The precaution adoption process model applied to home radon testing. *Health Psychology*, 17, 445-453.
- Weinstock, M.A., Rossi, J.S., Redding, C.A., & Maddock, J.E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched intervention to increase sun protection among beach goers. *Preventive Medicine*, 35, 584-592.
- Wiedemann, A. U., Lippke, S., Reuter, T., Ziegelmann, J. P., & Schwarzer, R. (2009). How planning facilitates behavior change: Additive and interactive effects of a randomized controlled trial. *European Journal of Social Psychology*. DOI: 10.1002/ejsp.724:

---

# **Chapter 6**

**Facilitating Sunscreen Use in Women by a Theory-Based  
Online Intervention: The Roles of Planning and Self-  
Efficacy**

### **Abstract**

Health behaviour change is not only determined by one's intention but also by volitional factors such as planning and coping self-efficacy. To apply this research question to sunscreen use in women, a volitional intervention was contrasted to a motivational intervention and a control condition. Sunscreen use was measured at baseline, two weeks (Time 2) and one month (Time 3) following the intervention. Results of the randomized controlled trial showed the volitional intervention to be superior in sunscreen use as compared to the motivational and control groups. Coping planning and coping self-efficacy emerged as mediators between action planning and sunscreen use. However, this mediation was found only in the volitional treatment group, not in the others, attesting to the effectiveness of planning and self-efficacy as the main ingredients of the volitional intervention. The findings point to the important role played by coping planning and coping self-efficacy as ingredients of volitional sun protection interventions.

Key words: action planning, coping planning, coping self-efficacy, sunscreen use, intervention effectiveness

## Introduction

The rising incidence of skin cancer (Lens & Dawes, 2004) as well as the ease of preventing its occurrence, make it an important target for prevention campaigns. Sun protection methods comprise sunscreen use, wearing protective clothing and seeking shade. While the latter two indicate that the person reduces sun exposure altogether, the use of sunscreen allows the person to enjoy the healthy properties of the sun and outdoor activities while being protected. Sunscreen use has been proven to be an efficient prevention method (Gonzalez, Fernandez-Lorente, Gilaberte-Calzada, 2008). Studies have tried to find out how to get people to use sunscreen while being in the sun. Barriers towards sunscreen use have been identified such as having a positive attitude towards tanning (Arthey & Clarke, 1995), holding high appearance norms and having low risk perception (Paul, Tzelepis, Parffit, & Giris, 2008). On the other hand, several predictors of sunscreen use have been found such as age, with older people using more sunscreen (Baum & Cohen, 1998), perceived susceptibility for developing skin cancer (Mermelstein & Riesenber, 1992), self-efficacy towards sun protection (Myers & Horswill, 2006) and positive outcome expectancies (deVries, Lezwijn, & Honing, 2005). Women, in particular were shown to value a tan and deliberately seek a tan (Jackson & Aiken, 2000). Therefore, they constitute an important target group for sun protection interventions.

Only few studies have explored the factors that help people move from their intentions to action and found evidence that planning represents a mediator or moderator of the intention-sunscreen use relation, arguing for the inclusion of post-intentional factors in sun protection interventions (Jones, Abraham, Harris, Schulz & Chrispin, 2001; Van Osch, Reubsaet, Lechner, Candel, Mercken, & De Vries, 2007). However, no studies up till now have explored the role of coping self-efficacy in



sunscreen use change, focusing mainly on the role of self-efficacy in intention formation (Jackson & Aiken, 2000).

Different types of interventions have proven effective in getting people to use more sunscreen while in the sun, such as those targeting risk perception (McClendon & Prentice-Dunn, 2001), self-efficacy and image norms (Jackson & Aiken, 2006). However, these did not mainly aim to change post-intentional factors and mostly targeted developing motivation for sun protection. A multi-component stage-matched intervention was effective in changing sun protection and promoting stage progression among beachgoers at 12 and 24 months follow-up (Weinstock, Rossi, Redding, & Maddock, 2002). Beachgoers' sun protection and stage progression, but not sun exposure changed following a multi-component intervention focusing on personalizing risk and offering sun protection education (Pagoto, McChargue, & Fuqua, 2003). A short educational intervention helped teenagers move from precontemplation to contemplation in what concerns sun exposure (Kristjansson, Helgason, Mansson-Brahme, Widlund-Ivarson, & Ullen, 2003), and another intervention based on the Sun Smart expert system helped adolescents reach action and maintenance phases in sun protection (Norman et al., 2007). Threat appraisal information helped people move from precontemplation to contemplation, while the addition of coping information to the threat information helped people move from contemplation to preparation (Prentice-Dunn, McMath, & Cramer, 2009).

Despite the body of evidence for successful interventions in sun protection, there is a lack of studies that specifically test the comparative effectiveness of motivational and volitional interventions in changing sunscreen use.

### ***Motivational and volitional factors in behaviour change***

The theoretical backdrop of the present study is the Health Action Process Approach (HAPA; Schwarzer, 2008). It suggests to divide 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 mindsets 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 is seen as a distal antecedent (e.g., “*I am at risk for developing skin cancer*”) that alone is insufficient to form an intention. Rather, it may set the stage for further elaboration of thoughts about consequences and competencies. Similarly, positive outcome expectancies (e.g., “*If I use sunscreen, I will reduce my risk for developing premature wrinkles*”) are seen as being important in the motivation phase, when a person balances the pros and cons of certain behavioural outcomes. Further, one needs to believe in one's capability to perform the goal behaviour (perceived self-efficacy, e.g., “*I can use sunscreen even if it feels sticky on my skin*”). Perceived self-efficacy operates in concert with positive outcome expectancies, both of which contribute substantially to forming an intention.

After a person develops a motivation 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 plan the concrete goal attainment and how to overcome barriers. Planning mediates between intention and behaviour. Meta-analyses have summarized the findings on the effects of planning (or “implementation intentions”) on health behaviours (for an overview, see Gollwitzer & Sheeran, 2006). Planning is an alterable variable. It can be easily communicated to individuals with self-regulatory deficits. Randomized controlled trials have documented the evidence in favour of such planning interventions to improve the adoption and maintenance of health behaviours (Chapman, Armitage, & Norman, 2009; Luszczynska, 2006).

Self-efficacy refers to the belief of individuals that they can master challenges they encounter while trying to adopt and maintain behaviour change (Bandura, 1997). Coping self-efficacy refers to the belief one can cope with the barriers that could hinder behaviour maintenance. Such a phase-specific variant of self-efficacy has been found predictive of health behaviours in several studies (Schwarzer, 2008).

The HAPA allows for a prediction of behaviour as well as an understanding of the causal mechanisms involved in behaviour change. Thus, a great deal of empirical evidence has been accumulated to support the assumptions of the model for diverse behaviour like healthy eating, performing physical exercise, dental flossing, breast cancer screening or seat belt use (Gutierrez-Dona, Lippke, Renner, Kwon, & Schwarzer, 2009; Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009; Schwarzer, Schüz, Ziegelmann, Lippke, Luszczynska, & Scholz, 2007). However, no studies up till now have explored the effectiveness of HAPA based motivational and 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. Based on previous studies on other behaviours (Milne, Orbell, & Sheeran, 2002) 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 effectiveness of the intervention. We hypothesized that coping self-efficacy and coping planning would constitute mediators of the intervention effect on increasing sunscreen use in participants who have received the volitional intervention because these two putative mediators constitute main ingredients of the volitional treatment.

## **Method**

### *Participants and Procedure*

Participants were recruited through world-wide announcements placed on university websites, blogs and discussion forums starting in June 2010. The online intervention was available in four languages: English, German, Portuguese, and Romanian. Individuals 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), 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: (1) they did not complete the questionnaire at T1, (2) 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. Men (n= 29) were excluded from this analysis in order to obtain a more homogeneous sample of

individuals 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.

### ***Research Design***

An experimental 3 (conditions) x 3 (time) between-factors design with repeated measures 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), planning intervention ( $n=70$ , formed action and coping plans).

### ***Measures***

*Sunscreen use* was measured at Time 1 (T1), Time 2 (T2) and Time 3 (T3) with one item asking people if they apply sunscreen with a SPF 15+ before going out on sunny days. Responses ranged from strongly disagree (1) to strongly agree (4).

*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 where, when 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 T3 ( $\alpha=.88$ ). 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 what to do if they forgot their sunscreen at home, if they feel awkward to use sunscreen because nobody else does and if they forgot to apply sunscreen when they are in the sun. Answers ranged on a Likert scale from 1 (strongly disagree) to 4 (strongly agree).

*Coping self-efficacy* was measured at T3 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 encountering 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.

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

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

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

### ***Interventions***

The *motivational intervention* combined risk and resource communication. Participants first received a message about the risk of unprotected sun exposure highlighting the negative consequences such as premature aging 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 where 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 to use sunscreen (e.g.,

always apply sunscreen like a moisturizer before leaving the house when you go out in the sun). The motivational intervention took around 5 minutes to complete.

The *planning intervention* meant that participants were asked to complete a plan on where, when and how they will use sunscreen. First, they were given a short example of a plan and were then provided with the opportunity to make their own personalized plan by filling in boxes within the online intervention template. After formulating their plan they once more received a feedback of what their exact plan looked like and they had the possibility to adjust the formulation 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 then 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. The planning intervention took around 10 minutes to complete.

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 analyzed 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. Secondly, it was tested separately for each group whether coping planning and coping self-efficacy would mediate between action planning and sunscreen use, employing the algorithms by Preacher and Hayes (2008).



## Results

Sunscreen use was analyzed using a repeated measures ANOVA with intervention group (3 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 x 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 received the volitional intervention, as can be seen in Figure 1.

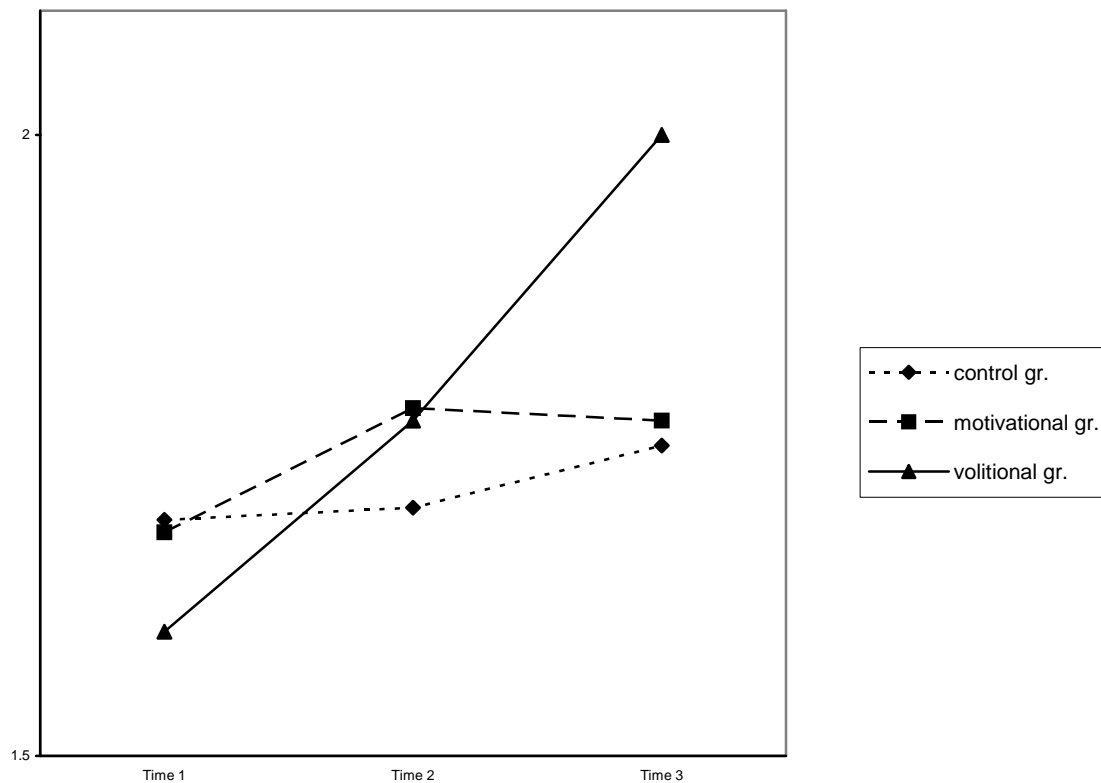


Figure 1: Comparative effects of the intervention on sunscreen use

A mediational analysis was conducted separately within each of the experimental conditions in order to examine whether coping planning and coping self-efficacy mediated between action planning and sunscreen use.

Coping planning emerged as a mediator only in the volitional intervention group. Intervention type (planning versus motivational and control group) moderated the mediational process (see Figure 2). A Sobel test revealed that coping planning (T3) fully mediated the relation between action planning (T2) and sunscreen use (T3) only for participants who had received the volitional intervention ( $z=2.56$ ,  $p<.01$ ). Coping self-efficacy came out as a mediator only within the volitional group and not for the individuals in the motivational or control groups as can be seen in Figure 3. The Sobel test showed coping self-efficacy (T3) to fully mediate the relation between action planning at two weeks after the intervention and sunscreen use at one-month follow-up ( $z=2.60$ ,  $p<.01$ ).

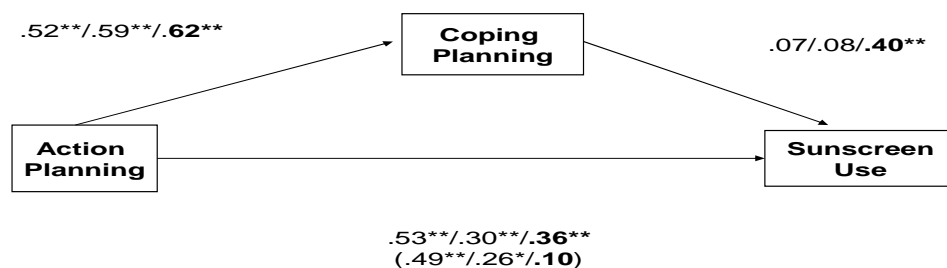


Figure 2: Mediation models with coping planning (T3) as mediator between action planning (T2) and sunscreen use (T3), separately analysed in the three intervention groups. Coefficients are presented from left to right for the control, motivational and **volitional** group. \*  $p<.05$ , \*\* $p<.01$

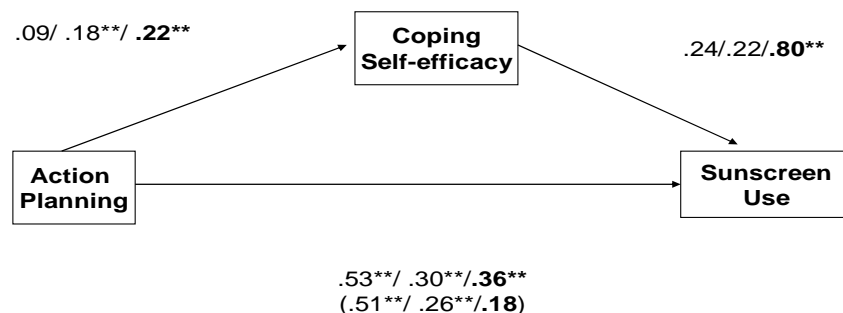


Figure 3: Mediation models with self-efficacy (T3) as mediator between action planning (T2) and sunscreen use (T3), separately analysed in the three intervention groups. Coefficients are presented from left to right for the control, motivational and **volitional** group.

\* $p < .05$ , \*\* $p < .01$

## 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 coping 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, Orbell, & Sheeran, 2002). Thus, in the present study we expected that the volitional (planning) 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 were reporting to use more sunscreen than those in the motivational and control groups. These data lend support to previous findings concerning health behaviour change, where behaviour was improved following a planning intervention (Chapman, Armitage, & Norman, 2009; Luszczynska, 2006; Luszczynska, Tryburcy, & Schwarzer, 2007; Van Osch, Lechner, Reubsaet, Wigger, & de Vries, 2008).

Previous research has shown action planning to be a mediator of the relation between intentions and sunscreen use (Jones et al., 2001; Van Osch et al., 2007). In contrast, in the present study we explored potential mediators between action planning and sunscreen use in the three intervention groups. Coping planning and self-efficacy proved to be mediators of the planning effect on sunscreen use only for those who received the volitional intervention. Women who had made more action plans at two weeks following the intervention, were also those who had developed more coping plans and had higher self-efficacy at one month follow-up and who consequently reported to apply more sunscreen. This is consistent with literature on the effect of planning interventions on behaviour change (Sniehotta, Scholz, & Schwarzer, 2006; Ziegelmann & Lippke, 2007).

The effect of action planning on sunscreen use was mediated by coping planning for those individuals who benefited from the volitional intervention that included both action and coping plans formation. These data lend support to previous findings for the effectiveness of coping planning interventions for long-term smoking relapse (Van Osch et al., 2008). Data are also in line with a study on the superior effectiveness in terms of physical activity change, of a combined action and coping planning interventions in comparison to a mere planning group (Sniehotta, Scholz, &

Schwarzer, 2006) and in line with studies that have shown a synergistic effect of action planning and coping planning on increasing physical activity (Araujo-Soares, McIntyre, Sniehotta, 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, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008).

The effectiveness of the combined planning intervention could be due to the fact that people are required to come up with their own plans, as it has been argued before that the degree of involvement in self-formulated plans may play a motivational role for behaviour adoption. Also, becoming an expert in planning implementation can increase behaviour by enhancing self-efficacy or through acting as a positive reinforcement for the use of planning as a self-regulatory strategy (Sniehotta, 2009). Future research should further look into the mechanisms of how planning functions as a behaviour change strategy when combined with other self-regulatory strategies such as action control.

A number of limitations of the present study need to be addressed. First, there is a restricted generalisability of the results due to the fact that 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 and women (Jackson & Aiken, 2000). Also, since men were shown by previous research to use less sunscreen (Baum & Cohen, 1998), they constitute a vulnerable group for skin

cancer development. 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, Lunde, Steffen, & Maddock, 2006), further 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 research 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 based on planning can help increase sunscreen use in women. This seems to be the first study to show the mediation of coping plans and coping self-efficacy on the effect of action plans on sunscreen use. These findings have implications for health promotion, in terms of designing parsimonious but comprehensive theory- and evidence-based interventions for skin cancer prevention.

### References

- Arthey, S., & Clarke, V.A. (1995). Suntanning and sun protection: A review of the psychological literature. *Social Science Medicine*, 40, 265-274.
- Araujo-Soares, V., McIntyre, T., & Sniehotta, F. (2009). Predicting changes in physical activity among adolescents: the role of self-efficacy, intention, action planning and coping planning. *Health Education Research*, 24, 128-139.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: Freeman.
- Baum, A. & Cohen, L. (1998). Successful behavioural interventions to prevent cancer: the example of skin cancer. *Annual Review of Public Health*, 19, 319-333.
- Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology & Health*, 24, 317-332.
- deVries, H., Lezwijn, J., Hol, M., Honing, C. (2005). Skin cancer prevention : behaviour and motives of Dutch adolescents. *European Journal of Cancer Prevention*, 14, 39-50.
- Gollwitzer, P. M., & Sheeran, P. (2006). Implementation intentions and goal achievement: A meta-analysis of effects and processes. *Advances in Experimental Social Psychology*, 38, 69-119.
- Gonzalez, S., Fernandez-Lorente, M., Gilaberte-Calzada, Y. (2008). The latest on skin photoprotection. *Clinics in Dermatology*, 26, 614-626.
- Gutierrez-Dona, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). Self-efficacy and planning predict dietary behaviours in Costa Rican and South Korean women: two moderated mediations analysis. *Applied Psychology: Health and Well-being*, 1(1), 91-104, Doi:10.1111/j.1758-0854.2008.01001.x.
- Jackson, K.M., & Aiken, L.S. (2006). Evaluation of a multicomponent appearance-based sun protective intervention for young women: uncovering the mechanisms of program efficacy, *Health Psychology*, 25, 34-46. Doi: 10.1037/0278-6133.25.1.34.
- Jackson, K.M., & Aiken, L.S. (2000). A psychosocial model of sun protection and sunbathing in young women: the impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology*, 19, 469-478.

- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). From knowledge to action regulation: modeling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology & Health, 16*, 191-206.
- Kristjansson, S., Bränström, R., Ullen, H., & Helgason, A. R. (2003). Transtheoretical Model: The investigation of adolescents' sunbathing behaviour. *European Journal of Cancer Prevention, 12*, 501-508.
- Lens, M.B., & Dawes, M. (2004). Global perspectives of contemporary epidemiological trends of coetaneous malignant melanoma. *British Journal of Dermatology, 150*, 179-185.
- Lippke, S., Wiedemann, A., Ziegelmann, J., Reuter, T., & Schwarzer, R. (2009). Self-efficacy moderates the mediation of intentions into behaviour via plans. *American Journal of Health Behavior, 33*, 521-529.
- Luszczynska, A. (2006). Effects of an implementation intention intervention on physical activity after MI are mediated by cognitive processes, change in forming action plans. *Social Science and Medicine, 62*, 900-908.
- Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2007). Improving fruit and vegetable consumption: a self-efficacy intervention compared to a combined self-efficacy and planning intervention. *Health Education Research, 22*, 630-638.
- McClendon, B.T., & Prentice-Dunn, S. (2001). Reducing skin cancer risk: an intervention based on protection motivation theory. *Journal of Health Psychology, 3*, 321-328.
- Mermelstein, R.J., & Riesenber, L.A. (1992). Changing knowledge and attitudes about skin cancer risk factors in adolescents. *Health Psychology, 11*, 371-376.
- Milne, S., Orbell, S., & Sheeran, P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions. *British Journal of Health Psychology, 7*, 163-184.
- Myers, L.B., & Horswill M.S. (2006). Social cognitive predictors of sun protection intention and behaviour. *Behavioral Medicine, 32*, 57-63.
- Norman, G.J. et al. (2007). A randomized trial of a multicomponent intervention for adolescent sun protection behaviours. *Archives of Pediatric Adolescent Medicine, 161*, 146-152.



- O’Riordan, D.L., Lunde, K.B., Steffen, A.D., & Maddock, J.E. (2006). Validity of beachgoers self-report of their sun habits. *Archives of Dermatology*, 142, 1304-1311.
- Pagoto, S., McChargue, D., & Fuqua, R.W. (2003). Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology*, 22, 429-433.
- Paul, C., Tzelepis, F., Parffit, N., & Girgis, A. (2008). How to improve adolescents sun protection behaviour? Age and gender issues. *American Journal of Health Behavior*, 32, 387-398.
- Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling procedures for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods*, 40, 879-891.
- Prentice-Dunn, S., McMath, B.F., & Cramer, R.J. (2009). Protection motivation theory and stages of change in sun protective behaviour. *Journal of Health Psychology*, 14, 297-305.
- Scholz, U., Schüz, B., Ziegelmann, J., Lippke, S., & Schwarzer, R. (2008). Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology*, 13, 479-494.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review*, 57, 1-29.
- Schwarzer, R., Schüz, B., Ziegelmann, J. P., Lippke, S., Luszczynska, A., & Scholz, U. (2007). Adoption and maintenance of four health behaviors: Theory-guided longitudinal studies on dental flossing, seat belt use, dietary behavior, and physical activity. *Annals of Behavioral Medicine*, 33:156-166.
- Sniehotta, F. (2009). Towards a theory of intentional behaviour change: plans, planning and self-regulation. *British Journal of Health Psychology*, 14, 261-273.
- Sniehotta, F., Scholz, U., & Schwarzer, R. (2006). Action plans and coping plans for physical exercise: a longitudinal intervention study in cardiac rehabilitation. *British Journal of Health Psychology*, 11, 23-37.
- Van Osch, L., Reubsaet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2007). Predicting parental sunscreen use: Disentangling the role of action

planning in the intention-behavior relationship. *Psychology and Health*, 1-19.

DOI: 10.1080/08870440701596577.

Van Osch, L., Lechner, L., Reubsaet, A., Wigger, S., & de Vries, H. (2008). Relapse prevention in a national smoking cessation contest: effects of coping planning. *British Journal of Health Psychology*, 13, 525-535.

Weinstock, M. A., Rossi, J. S., Redding, C. A., & Maddock, J. E. (2002).

Randomized controlled community trial of the efficacy of a multicomponent stage-matched intervention to increase sun protection among beach goers.

*Preventive Medicine*, 35:584-592.

Ziegelmann, J., & Lippke, S. (2007). Planning and strategy use in health behaviour change: a lifespan view. *International Journal of Behavioral Medicine*, 14, 30-39.

---

## **Chapter 7**

### **General Discussion**

## General Discussion

Skin cancer has come to be the most frequent form of cancer in the Caucasian population (Diepgen & Mahler, 2002) due to ozone layer depletion and the rise in popularity of the “tanned look” that is desired at any health cost (Bränström, Ullen, & Brandberg, 2004; Grunfeld, 2004). Specialists recommend sun protection guidelines, among which sunscreen use was shown to be one of the most effective (Gonzalez et al., 2008). However, data point out that many people fail to apply sunscreen while they are in the sun (Kasparian, McLoone, & Meiser, 2009). In order to understand why this happens and to figure out how to motivate people to use more sunscreen, research has investigated predictors of sunscreen use. Most studies identified motivational factors leading to intention formation (Kasparian et al., 2009; Arthey & Clarke, 1995), and volitional factors received little attention (Jones, Abraham, Harris, Schulz, & Chrispin, 2001; Van Osch, Reubsaet, Lechner, Candel, Mercken, & De Vries, 2007). However, the investigation of volitional factors is important since it has been shown that people do not necessarily act upon their intentions and postintentional factors need to be addressed in order to get people to act (Sniehotta, 2009).

The dissertation aimed to bring its contribution to sun protection research by looking into aspects useful for deepening theoretical understanding and developing theory- and evidence-based sunscreen use promotion interventions. Hence, it explored motivational and volitional factors related to sunscreen use change over time (*Chapter 2*), using as a theoretical background the Health Action Process Approach model (HAPA; Schwarzer, 2008). Mediators and moderators that influence the intention-behaviour relation have been explored in the context of behavioural change in time

---

(*Chapters 3 and 4*), as well as active ingredients responsible for intervention success (*Chapter 6*). The effectiveness of planning interventions for people at different stages of behaviour change (*Chapter 5*) and volitional versus motivational interventions have been tested and contrasted for effectiveness in changing sunscreen use (*Chapters 5 and 6*).

The following discussion of the main findings is guided by the aims and research questions depicted in Chapter 1. Results from the empirical chapters (Chapters 2-6) are examined in relation to each other and further research directions are outlined. Implications for theory, research and practice development are proposed. Aims and research questions, as well as key findings from the five empirical chapters are summarised in Table 1.

Table 1. Summary of the main findings in this thesis.

Aims and research questions	Findings	Conclusions
<p>Chapter 2. To explore for the first time the applicability of the Health Action Process Approach model to sunscreen use. The particular role was to examine preintentional factors played such as positive outcome expectancies, as well as postintentional factors like planning in predicting sunscreen use. The main question was whether the HAPA can be replicated in the case of sunscreen use change over a three-month period.</p>	<p>A structural equation model fitted the data well. Positive outcome expectancies, risk perception, and self-efficacy predicted the behavioural intention. Self-efficacy and planning predicted sunscreen use, and planning mediated the relation between intended and performed sunscreen use.</p>	<p>The findings contribute to the understanding of psychological mechanisms in health behaviour change. They also point to the particular role of mediator variables in the context of sun protection behaviours, which may have implications for designing skin cancer preventive interventions.</p>
<p>Chapter 3. To examine whether self-efficacy mediates between intention and behaviour and if appearance norms and self-efficacy are additive or synergistic predictors of sunscreen use. This is the first study to examine the role of appearance norms as moderators of the relation between intention-self-efficacy and behaviour.</p>	<p>Self-efficacy mediated the intention-behaviour relationship, while appearance norms emerged as a moderator of self-efficacy-sunscreen use relationship.</p>	<p>Findings show that for individuals who think they look more attractive when being tanned, self-efficacy does not have a strong effect on behaviour. Thus, for skin protection motivation to become effective, self-efficacy is needed in conjunction with less positive appearance norms.</p>
<p>Chapter 4. The study aimed at exploring sunscreen use change over time and identifying the underlying social-cognitive variables that might have been responsible for behaviour change. It aimed to examine the role of planning and risk perception in the domain of sunscreen use. The main question was whether an intention-planning-behaviour link existed and whether it is moderated by levels of risk perception. This is the first study to examine the role of risk perception as a moderator of the intention-planning-behaviour relation.</p>	<p>Planning partially mediated the intention-behaviour relationship and risk perception operated as a moderator. The moderator effect was negative, implying that low risk perception in conjunction with high intention was a prerequisite of planning and thus, for the mediation by planning.</p>	<p>Low risk perception reflects health-specific optimism which can be a facilitator of health behaviour change, in this case the change of sunscreen use from Time 1 to Time 3.</p>

<p>Chapter 5. To examine to which degree individuals make plans for sun protection as a means to avoid skin damage and skin cancer. A comprehensive (one-size-fits-all) intervention was compared with an intense, parsimonious planning intervention. It was predicted that differential effects would emerge for the investigated stages of change. This is the first study to examine the effectiveness of planning interventions in relation to stages as defined by the HAPA model.</p>	<p>No overall treatment effects emerged but interactions between time and intervention within stages occurred for action planning and coping planning. The comprehensive intervention was more effective for preintenders, whereas the parsimonious planning intervention proved more effective for intenders.</p>	<p>Results confirm that a parsimonious planning treatment can be beneficial if matched to intentional stage, highlighting the importance of designing tailored interventions in the context of sunscreen use.</p>
<p>Chapter 6. To compare the effectiveness of a motivational and a volitional intervention in changing sunscreen use in women. based on previous studies it was expected that the volitional intervention would be more effective than the motivational and control conditions in increasing sunscreen use. The two main ingredients of the volitional intervention, coping self-efficacy and coping planning, were hypothesised to be mediators of the intervention effect on increasing sunscreen use in participants who have received the volitional intervention. This is the first study to test volitional against motivational and control groups in the context of sunscreen use promotion.</p>	<p>Results of the randomized controlled trial showed the volitional intervention to be superior to in sunscreen change as compared to the motivational and control groups. coping planning and coping self-efficacy emerged as mediators between action planning and sunscreen use only in the volitional treatment group.</p>	<p>Findings attest the effectiveness of planning and self-efficacy as the main ingredients of the volitional intervention and point to the importance of integrating coping planning and coping self-efficacy in volitional sun protection interventions.</p>

### **Predictors of sunscreen use intention and behaviour change**

The HAPA model has been chosen as the theoretical backdrop for the study described in *Chapter 2* because it includes both preintentional and postintentional factors relating to behaviour change, which have rarely been previously investigated together in the context of sunscreen use (Kasparian et al., 2009; Saraya et al., 2004). A longitudinal structural equation model with multiple indicators was examined and proved that the HAPA model fits the data well. The model explained 35% of sunscreen use variance, while 41% of the planning variance was explained by intention and 57% of intention variance was accounted for by social-cognitive predictors, namely positive outcome expectancies, self-efficacy and risk perception. In what concerns the intention formation process, risk perception was shown to make a minor contribution as compared to positive outcome expectancies and self-efficacy. This finding lend support to previous results regarding the HAPA model, which show risk perception to be a weaker predictor of intention than positive outcome expectancies and self-efficacy (Schwarzer, 2008). However, it contrasted with other research in the domain of sunscreen use, which state risk perception to be an important predictor of intention and behaviour (Kasparian et al., 2009; Arthey & Clarke, 1995). Therefore, it was decided to further explore the role of risk perception in sunscreen use change in another study (*Chapter 4*) and also to look at other important predictors of sunscreen use such as appearance norms, that could have influenced the results (*Chapter 3*). Findings also added to the evidence base arguing for the inclusion of postintentional variables in sun protection interventions (Jones et al., 2001; Van



Osch et al., 2007). Thus, it was decided to develop and test the effectiveness of volitional interventions in the domain of sunscreen use (*Chapters 5 and 6*).

### **Motivational and volitional predictors as mediators or moderators of the behaviour change process in the context of sunscreen use**

Appearance norms have been shown by previous literature on skin cancer prevention to play an important role in the decision to adopt sun protection. Considering a tan to be attractive could interfere with health decisions concerning sun exposure and also influence a person's attitude or self-efficacy regarding sun protection. Self-efficacy has been proven to be one of the most important predictors of sunscreen use intention and behaviour (Mahler, Fitzpatrick, Parker, & Lapin, 1997; Myers & Horswill, 2006). Therefore, in the study described in Chapter 3 set out to examine appearance norms in relation to self-efficacy and sunscreen use. Results of the study showed that self-efficacy mediates between intention and sunscreen use, and this link is moderated by appearance norms. Individuals who value a tan, even if they are motivated to use sunscreen and have high self-efficacy, are not likely to use sunscreen. These findings are in line with previous research reflecting the importance of appearance norms (Hillhouse & Turrisi, 2002; Jackson & Aiken, 2000; Jones, Harris, & Chrispin, 2000). Results reflecting the relevance of appearance norms can also be linked with findings from Chapter 2 where risk perception emerged as a less important predictor of intention in comparison to positive outcome expectancies and self-efficacy. In this context, other factors like appearance norms may come into play and lessen the effect of risk perception. This would be in line with earlier research that showed that even if individuals are aware of the risk of unprotected sun exposure, this does not reduce the perceived attractiveness of tanning (Dennis, Lowe, &

Snetselaar, 2009) and that higher appearance norms are associated with less sun protection (Arthey & Clarke, 1995).

Another important mediator that emerged from the literature on sunscreen use is planning. Studies have shown planning to partially mediate between intention and behaviour (Jones et al., 2001; Van Osch et al., 2007). Taking into account the importance of appearance norms (Chapter 3) and the fact that skin cancer and premature wrinkles represent a threat to both appearance and health, the question arose whether the level of perceived risk perception influences the relation between intentions, planning and sunscreen use (Chapter 4). Findings from the longitudinal study depicted in Chapter 4 show that planning mediates the intention-behaviour link and this relation is moderated by levels of risk perception. The moderation is negative, meaning that people with high intentions and low risk perception plan and act upon their plans more than those who are highly motivated but also have a high risk perception. This was interpreted in terms of functional and dysfunctional optimism. Low risk perception stands for optimism. When people are optimistic about their health, they plan more and also are more likely to adopt behaviour. On the other hand, people who hold high risk perceptions might engage in defensive information processing, telling themselves for instance that although it is very important to use sunscreen it does not help to prevent skin cancer so there is no point in adopting this health behaviour. This is in accordance with prior research has shown that when confronted with threatening health information, people sometimes interpret this in a defensive manner and withhold from engaging in health actions (van Koningsbruggen, Das, & Roskos-Ewoldsen, 2009). Thus, risk perception is not only important for developing an intention (Chapter 2), but also it continues to play a role for people

who are motivated to change. Implications for practice come forward, in the sense that optimistic beliefs should be strengthened in order to get people to plan and adopt behaviour. Moreover, after people have developed an intention to act, it seems that other factors like self-efficacy or optimistic beliefs should be promoted in order to foster behaviour adoption (Chapter 4). The important role played by self-efficacy has been previously attested research for other health behaviours (Schwarzer, Richert, Kreasukon, Remme, Wiedemann, & Reuter, 2010; Richert, Reuter, Wiedemann, Lippke, Ziegelmann, & Schwarzer, 2010; Lippke, Wiedemann, Ziegelmann, Reuter, & Schwarzer, 2009; Luszczynska, & Schwarzer, 2003), as well as the relevant influence of optimistic beliefs and risk perception on health (Luo & Isaakovitz, 2007; Schwarzer, 1994). Thus, findings from chapter 3 and 4 lend support to existing evidence and add to the knowledge base on relevant factors in sun protection promotion.

### **Effectiveness of volitional and motivational interventions in promoting sunscreen use: identifying active ingredients of change**

Taking into consideration the importance of planning as a mediator of the intention-behaviour gap (Chapters 2 and 4) and the fact that there is little research on the effectiveness of volitional interventions in the context of sunscreen use, it was decided to develop and test the effectiveness of a planning based intervention for sunscreen use adoption. Tailoring interventions to stages of change has been proven by previous research to be effective in enhancing sun protection (Weinstock, Rossi, Redding, & Maddock, 2002; Pagoto, McChargue, & Fuchua, 2003). However, these stage-matched interventions did not focus on postintentional processes like increasing planning for health behaviour change. Thus, a randomized controlled trial was designed to explore the effectiveness of a

parsimonious planning intervention (including action and coping planning) with a comprehensive one-size fits all intervention (includes risk and resource communication in addition to planning). No overall treatment effects emerged, but there were differential effects for action and coping planning in relation to stages of change. The comprehensive intervention was more effective for preintenders, while the planning intervention proved more effective for intenders (Chapter 5). Results confirm previous findings that parsimonious planning treatments are successful when matched to the intentional stage (Lippke, Schwarzer, Ziegelmann, Scholz, & Schüz, 2010; Lippke, Ziegelmann, & Schwarzer, 2004) and highlight the importance of designing tailored interventions in the context of sunscreen use.

A further study (Chapter 6) was designed to contrast and test the effect of a volitional intervention (planning) to a motivational (risk and resource communication) and control (who received only a feedback on their skin type) on changing sunscreen use in women. Results of the randomized controlled trial proved the volitional intervention to be superior in determining sunscreen use. This is in line with previous studies that demonstrate volitional interventions to be more effective than motivational ones in the domain of physical activity (Milne, Orbell, & Sheeran, 2002) medication intake (Sheeran & Orbell, 1999). Also, they lend support to earlier studies where behaviour was improved following a planning intervention (Chapman, Armitage, & Norman, 2009; Luszczynska, 2006; Luszczynska, Trybucy, & Schwarzer, 2007). Active ingredients of the intervention success were explored. Coping planning and coping self-efficacy emerged as mediators between action planning and sunscreen use only in the volitional group. This attests the effectiveness of coping planning and coping self-efficacy as main ingredients of volitional sun protection interventions and

confirms earlier findings on the success of coping planning interventions in smoking relapse promotion (Van Osch, Lechner, Reubsaet, Wigger, & De Vries, 2008). This is the first study to show the mediation of the action planning-behaviour relation by coping planning and self-efficacy in the domain of sunscreen use. One possible explanation for this finding is that coping plans need longer to be formulated since people first have to be confronted with obstacles before they can form plans on how to cope with these. Moreover, previous studies have proven that action plans are effective for behaviour initiation, whereas coping plans are more important for behaviour maintenance (Scholz, Schüz, Ziegelmann, Lippke, & Schwarzer, 2008). Becoming an expert in planning, might also increase self-efficacy or act as a positive reinforcement for the use of planning as a self-regulatory strategy (Sniehotta, 2009). Further research can look into unravelling the mechanisms of planning effectiveness as a behaviour change strategy when combined with other strategies like action control.

### **Theoretical Implications: Explaining and Modelling Sunscreen Use**

There is a vast amount of literature on predictors of sunscreen use. However, most studies up till now have focused on applying a social-cognitive model to sunscreen use like the Health Belief Model (i.e. Carmel, Shani, & Rosenberg, 1994), the Protection Motivation Theory (i.e. Grunfeld, 2004; McClendon & Prentice-Dunn, 2001), the Theory of Planned Behaviour (Myers & Horswill, 2006), or on investigating mixed predictors from different models (i.e. Jackson & Aiken, 2006). There is a scarcity of research that investigates the role of postintentional factors like planning or coping self-efficacy in the context of sunscreen use. Existing studies have

explored only action planning as a mediator between intention and behaviour (Jones et al., 2001; Van Osch et al., 2007) or used the Transtheoretical Model as a backdrop for developing interventions that were tested for effectiveness in changing sunscreen use (Pagoto, McChargue, & Fuqua, 2003; Weinstock et al., 2002). While both these endeavours bring new knowledge to the field of sun protection, there is a need for a more inclusive as well as parsimonious approach. Taking these existing findings as a starting point, the present dissertation takes research a step further by applying the Health Action Process Approach model (HAPA; Schwarzer, 2008) to help understand psychological mechanisms involved in changing sunscreen use. This model presents the advantage of parsimony and also allows for the testing of both motivational and volitional predictors within the same framework. The study described in Chapter 2 is the first to examine and attest the fit of the HAPA model to sunscreen use. This lends support to previous findings on the HAPA applied to behaviours from more complex ones like dietary habits, physical exercise and smoking to more simple ones like dental flossing or seat belt use (Gutierrez-Dona, Lippke, Renner, Kwon, & Schwarzer, 2009; Luszczynska et al., 2010; Renner et al., 2008; Ziegelmann & Lippke, 2007). Thus, results from Chapter 2 confirm existing data on the usefulness of HAPA and also enrich the evidence base by proving its importance for a seasonal, context dependent habit like using sunscreen. Moreover, results help to set priorities among predictors when considering the design of health promotion interventions. For instance data from Chapter 2 show that risk perception is less important than positive outcome expectancies and self-efficacy in helping people develop a motivation. This confirms previous findings attesting the usefulness of the HAPA model for other behaviours (Schwarzer, 2008) and also helps to further clarify the role of risk

perception as a predictor of intention and sunscreen use as depicted in earlier research in the sun protection context (Kasparian et al., 2009; Arthey & Clarke, 1995).

The role of positive outcome expectancies for using sunscreen has not been thoroughly explored by previous studies. Chapter 2 brings forward relevant evidence in this sense, showing that positive outcome expectancies are better predictors than risk perception. On the other hand, findings in Chapter 4 attest that having low risk perception helps people make plans and act more, thus arguing for the importance of resource communication (enhancing optimism, positive outcome expectancies, self-efficacy) for motivational and volitional purposes.

One possible explanation for the small effect of risk perception on intention formation could be attributed to other factors like the influence of appearance norms, as for people who value a tan, tanning is more important than the risk of getting skin cancer. Prior research has shown that men who considered a tan to be attractive, also perceived less risk to develop skin cancer and used a smaller amount of sunscreen (Maddock, Redding, Rossi, & Weinstock, 2005). Moreover, sometimes, even if people are aware of the risks of unprotected sun exposure, this does not reduce their perception that a tan is attractive (Dennis, Lowe, & Snetselaar, 2009).

Appearance norms about being tan and self-efficacy are among the most important predictors of sunscreen use, as shown by previous research (Hillhouse & Turrisi, 2002). Earlier studies showed that women tend to use more sun protection methods, but on the other hand also report feeling more confident and attractive with a tan (Broadstock, Borland, & Gason, 1992). Thus, a relation between appearance norms and self-efficacy was considered interesting to explore.

As the HAPA model includes self-efficacy as both a preintentional and postintentional predictor, but does not explicitly include appearance norms as a

predictor, the latter one was explored as a moderator. Self-efficacy proved to be a mediator between intention and behaviour, confirming previous results (Schwarzer, 2008). Also, in terms of theory of sunscreen use adoption, these findings attest the important role played by self-efficacy in helping motivated individuals to act upon their intentions. Chapter 3 depicts the first study that shows appearance norms can play more than the role of a predictor and can also act as a moderator. Thus, in the present case, it is not enough to increase people's self-efficacy, it is also important to work on their appearance norms. These data lend support to previous findings on explaining sunscreen use and developing interventions using both self-efficacy enhancement techniques and changing appearance norms about attractiveness of a tan (Jackson & Aiken, 2000, 2006). Present data also add to the existing body of evidence in the domain of sunscreen use by replicating earlier findings in a Romanian sample.

Literature in the domain of behaviour change has recognized and established the existence of an intention-behaviour gap (Sheeran, 2002) that needs to be explored in order to identify what helps individuals act upon their plans. Previous studies in the field of sun protection have examined the role of planning as such a mediator between intentions and behaviour adoption (Jones et al., 2001; Van Osch et al., 2007).

Chapters 2 and 4 in the present dissertation also attest the existence of an intention-planning-behaviour link, thus lending support to existing evidence. In addition to proving the role of planning as mediator, the study in Chapter 4 also looks at moderators of this mediation. In this context, risk perception is shown to be a mediator in the sense that having high intention and low risk perception helps individuals make plans and use more sunscreen. Earlier studies have shown risk perception to be a predictor of sun protection intention and behaviour (Arthey & Clarke, 1995). Results from Chapter 2 in this thesis also show risk perception to be a



predictor of intention formation, while Chapter 4 reflects its importance as moderator of a postintentional link between intentions, planning and sunscreen use. These findings help in further elaborating on the relation between optimism and health behaviour adoption. Sometimes people underestimate their risk of developing an illness, which has been conceptualized as the “optimistic bias” (Weinstein, 1982, 2000). Unrealistic optimism refers to the tendency to perceive oneself as being less vulnerable or invulnerable to negative life events or health threats and is associated with taking less precautions (Radcliffe & Klein, 2002). This biased perception of health risks has been termed “defensive optimism” as opposed to “functional optimism” (Schwarzer, 1994; Taylor & Brown, 1994). Functional optimism is based on beliefs about one’s resources including ability and effort to deal with adversity. Dispositional optimists are people who expect positive outcomes in various life domains, including health. In the present thesis, low levels of risk perception pertain to a person’s optimism towards not developing skin cancer. It is shown that this is a case of functional optimism, that leads to forming plans and behaviour adoption and lends support to previous studies showing that individuals high in dispositional optimism are more likely to engage in health promotion behaviours (Luo & Isaacowitz, 2007). In addition, Chapter 4 depicts the first study to address the role played by risk perception in influencing the mediating relation between intentions, planning and sunscreen use and in highlighting the significance of low risk perception or health specific optimism in the elaboration of plans and putting them into practice.

Volitional mediators were further explored in Chapter 6. Results show that coping planning and coping self-efficacy mediate between action planning and sunscreen use. This adds knowledge to the existing evidence base on action planning bridging the intention-behaviour gap in the context of health actions (Scholz et al.,

2008; Wiedemann, Schüz, Sniehotta, Scholz, & Schwarzer, 2009) as well as the particular case of sunscreen use (Jones et al., 2001; Van Osch et al., 2007). It also lends support to data showing that action plans are important for behaviour initiation, while coping plans are essential for its maintenance (Scholz et al., 2008) and to earlier studies that show action self-efficacy to predict intention and coping self-efficacy behaviour (Scholz, Sniehotta, & Schwarzer, 2005).

### **Methodological Implications: Investigating Change in Sunscreen Use**

The present thesis brings forward certain important implications in terms of study design and methodology. First, longitudinal designs with two (Chapter 3 and 5), or three measurement points (Chapter 2, 4 and 6) have been used within the five studies depicted in the empirical chapters. This is an advantage in comparison to earlier studies where inferences on predictors of sunscreen were drawn mainly from cross-sectional data. The main contribution of the study depicted in Chapter 2 is that it helps understand motivational and volitional predictors of sunscreen use in health behaviour change over time in comparison to earlier studies on predictors that made use of cross-sectional designs (Grunfeld, 2003; Pagoto et al., 2004) even when the study is based on a staging model like the TTM (Kristjanson, Bränström, Ullen, & Helgason, 2003). Another strength is that SEM is used as a statistical method to analyse the longitudinal data in Chapter 2. Prior studies have applied SEM to cross-sectional data in order to inform on predictors of sunscreen use (Jones et al., 2001).

Mediation analysis is important in order to study how behaviour change takes place, while moderation analysis reflects for whom a particular change mechanism is valid (MacKinnon & Luecken, 2008). Therefore, applying moderated mediation

analysis is very important for describing how an effect occurs and for which particular group it is relevant. This has important implications for predicting behaviour change and designing interventions. Thus, the moderated mediations applied in Chapter 3 and 4 are significant for theory and intervention elaboration. Previous studies on predictors looked more at simple mediations (Jones et al., 2001; Van Osch et al., 2007), but findings from the present thesis bring research one step further by identifying moderators of the intention-behaviour gap and making proposals for designing tailored interventions. Moreover, there are few studies with moderated mediation and longitudinal design in sunscreen use. There is previous evidence on planning being both a mediator and moderator of the intention-behaviour link within a cross-sectional study (Jones et al., 2001; Van Osch et al., 2007). Also, in what concerns other health behaviours there is evidence on intention strength moderating the intention-planning-behaviour relation (Wiedemann et al., 2009). However, this thesis presents the first studies to look at appearance norms and risk perception as moderators of the mediating effects of planning and self-efficacy in general and in the context of sunscreen use (Chapters 3 and 4).

Identifying mediators is very important for finding secondary behavioural outcomes. Sometimes, behavioural change cannot be achieved through one intervention, but other secondary outcomes leading to behaviour change, like planning or self-efficacy, can be enhanced. Thus, two studies from the present dissertation looked at intervention effects on planning and behaviour change, by investigating staging effects (Chapter 5) and contrasting volitional and motivational interventions (Chapter 6). A strength in this context is represented also by the use of randomized controlled trials (RCT) with online data. This allows for the recruitment of participants of different age, education and nationality (the questionnaire was

available in English, German, Portuguese and Romanian). However, one shortcoming of online studies is the high drop out rate that did not allow for conducting also cross-cultural analyses due to the small final sample size. On the other hand, an important point is that the use of RCT allowed for applying experimental designs to investigating behaviour change over time. This brings new knowledge in the field of sunscreen use promotion as there are few prior studies testing volitional interventions using RCT in this context (Norman et al., 2007; Prentice-Dunn, Mcmath, & Cramer, 2009) and no prior studies using the HAPA model as a theoretical background of the intervention content.

### **Future directions for research**

Findings from the present thesis show that the HAPA model can be well applied to sunscreen use prediction (Chapter 2). However, further studies should test the HAPA model against other social-cognitive models like the Theory of Planned Behaviour or Protection Motivation Theory or other concepts like appearance norms in order to identify which is the most effective and parsimonious theoretical background for designing interventions.

In the study in Chapter 4, low risk perception was regarded as a proxy measure of health optimism and an empirical distinction between different kinds of optimism was not made. Thus, future studies should explore the relation between low risk perception and functional and dysfunctional optimism (Schwarzer, 1994) and see if only functional optimism facilitates the translation of intentions into practice. Also, for a full account of the determinants of sunscreen use, more social-cognitive variables need to be included in a causal model such as appearance norms.

The validity of staging algorithms represents a universal problem, associated with all stage theories of health behaviour change (Lippke, Ziegelmann, Schwarzer, & Velicer, 2009). Future studies should apply a validated reliable stage algorithm to sunscreen use change. However, such an algorithm is lacking at the moment, especially since this particular behaviour depends on weather, lifestyle conditions and conflicting attitudes like valuing a tan. Thus, further research can use the study in Chapter 5 as a starting point for improving such staging algorithms in the context of sun protection.

The study in Chapter 6 is the first to test and contrast volitional versus motivational and control interventions in the context of sunscreen use. However, the evidence base can be improved by the use of a full-factorial design where a volitional intervention would be tested against a motivational, control and all-inclusive intervention.

In general, although the validity of self-report measures in sun protection has been proven to be satisfactory (O’Riordan, Lunde, Steffen, & Maddock, 2006; Dwyer, Blizzard, Gies, Aschbolt, & Roy, 1996), further studies could apply objective measures of sunscreen use in order to replicate the findings from the empirical chapters included in this thesis. Also, both predictors and intervention effects would benefit from being tested within larger and more heterogeneous sample sizes. For instance findings in Chapter 6 would be interesting to replicate with a male population or the intervention effect tested using gender as a moderator to see what differences emerge and inform future tailoring of intervention messages.

In what concerns the improvement of designing theory-based interventions, future studies can test the effectiveness of interventions based on different staging and social-cognitive models to map the most successful intervention components. Active

ingredients of intervention effectiveness should also further be explored using findings in Chapter 6 as a starting point, in order to identify the best strategies for behaviour change. Regarding staging effects of interventions (Chapter 5), future research can make use of matched and mismatched designs to test what works best for individuals who are preintenders, intenders or actors in relation to sunscreen use.

### **Implications for skin cancer prevention and sun protection interventions**

Findings from the empirical chapters included in the present thesis also bring an important contribution to designing and evaluating evidence and theory-based interventions to promote sunscreen.

Results from Chapter 2 attest the importance of addressing both motivational and volitional factors when developing sunscreen use interventions. In conformity with prior studies, it is shown that risk perception plays a less important part in intention formation in comparison to positive outcome expectancies and self-efficacy (Schwarzer, 2008). Thus, even if risk communication should be included in order to motivate people to use sunscreen, a greater emphasis should be put on developing self-efficacy and positive outcome expectancies, or what was called resource communication. Risk communication has been shown to be most effective when tailored to individual risk (Glanz, Schoenfeld, & Steffen, 2010). Decisional balance can be discussed in order to develop positive outcome expectancies, since this has been proven to be an important strategy in earlier studies (Adams, Norman, Howell, Sallis, & Patrick, 2009). For self-efficacy enhancement, modelling was shown to be an effective strategy in the context of sun protection (Jackson & Aiken, 2006).

Chapters 3 and 4 point out the importance of addressing self-efficacy and planning as components of volitional interventions to improve sunscreen use, as these turned out to be mediators of the intention-behaviour gap. However, one should also take into consideration appearance norms and risk perceptions of the target population. Findings in Chapter 3 lend support to previous research that argues for the effectiveness of appearance based interventions in sun protection (Jackson & Aiken, 2000, 2006; Mahler, Kulik, Butler, Gerrard, & Gibbons, 2008). Thus, when designing self-efficacy messages, the appearance norms of the target group should be taken into account. Data from Chapter 4 show that risk perception continues to play a role even after people are motivated to act, in the sense that having low risk perception is associated with planning and more behaviour adoption. This highlights the relevance of providing planning interventions in conjunction with enhancing optimism in order to help people act upon their sunscreen use intentions.

Earlier research illustrates the effectiveness of community based interventions like “Slip!Slop!Slap!” (Rassaby, Larcombe, Hill, & Wake, 1983), the SunSmart campaign (Borland, Hill, & Noy, 1990; Hill, Marks, White & Borland, 1993), the Under Cover Skin Cancer Prevention Project (Boutwell, 1995), or the Skin Safe Program (Girgis, Sanson-Fisher, Tripodi, & Golding, 1993). Although these are successful in changing sun protection intentions and behaviour, they do not inform on specific program ingredients that account for their effectiveness. The studies in Chapter 5 and 6 inform on these active intervention ingredients and therefore, contribute to the development of the knowledge base.

Planning interventions have been shown to be successful in changing exercise behaviour (Prestwich, Lawton, & Conner, 2003; Arbour & Martin Ginis, 2009), fruit intake (Armitage, 2007), breast self-examination (Prestwich, Conner, Lawton, Bailey,

Litman, & Molyneaux, 2005) or the effectiveness of forming action and coping plans in changing physical exercise (Sniehotta, Scholz, & Schwarzer, 2006; Scholz et al., 2008). In spite of evidence for the importance of addressing both motivational and volitional aspects in interventions, there are few randomized controlled trials that report on the effectiveness of combining motivational and volitional interventions: for exercise behaviour (Milne, Orbell, & Sheeran, 2002) and medication intake (Sheeran & Orbell, 1999). There is also empirical support for the effectiveness of stage-matched interventions based on the TTM (Pagoto et al., 2003; Weinstock et al., 2002). Nevertheless, these studies did not focus on post-intentional processes such as increasing planning to change behaviour. The study in Chapter 5 attests the effectiveness of planning interventions as matched to the intender stage and shows that preintenders do not benefit from planning, lending support to previous studies on other health behaviours (Lippke et al., 2004). Thus, sunscreen use interventions should be tailored to the target group needs and planning interventions should be addressed to individuals who have already formed an intention to act.

Prior research has demonstrated the benefit of planning interventions for adoption and maintenance of health behaviours (Chapman et al., 2009; Luszczynska, 2006). The study in Chapter 6 enriches the evidence base by illustrating the relevance of planning interventions in the case of sunscreen use. Moreover, results attest for the superiority of volitional interventions in enhancing behaviour in comparison to motivational interventions. Thus, motivational interventions should be designed to stimulate intention formation, while volitional interventions should be implemented to trigger sunscreen use adoption.

Previous studies have found action and coping planning to be essential ingredients of behaviour change process within the volitional phase (Lippke et al.,



2004; Luszczynska, Sobczyk, & Abraham, 2007; Sniehotta et al., 2006). Findings in Chapter 6 inform on the active ingredients that volitional interventions should include in order to enhance sunscreen use. Thus, coping planning and coping self-efficacy constitute relevant components to be taken into account when designing volitional interventions in the context of sunscreen use. Also, action and coping planning should be combined, as attested also by prior research (Sniehotta et al., 2006). Intervention effects in terms of staging could also be explored to see whether action plans are effective for behaviour initiation and coping plans for behavioural maintenance as illustrated by earlier studies (Scholz et al., 2008).

Overall, findings from the present thesis have implications for health promotion, in terms of designing parsimonious but comprehensive theory- and evidence-based interventions for skin cancer prevention. Results show that the HAPA can be successfully applied to explain sunscreen use change over time and inform practice. For instance, when designing motivational interventions, self-efficacy and positive outcome expectancies should be favored over risk perception and planning should be targeted in volitional interventions. Moreover, findings point out that reducing appearance norms and risk perception need to be aimed at in conjunction with enhancing self-efficacy and planning when elaborating volitional interventions. In order to be successful, interventions also need to be tailored to the specific needs of preintenders, intenders and actors. Preintenders were shown to benefit from resource communications interventions leading to intention formation, while intenders particularly benefited from volitional interventions comprising the formation of action and coping plans. Volitional interventions are more effective than motivational ones in determining people to use more sunscreen. Coping planning and coping self-efficacy emerged as active ingredients of the former and should be therefore included

when designing effective volitional interventions. Starting out from these findings, future research should test interventions based on different social-cognitive or staging models to identify the best theoretical background. Also, effective strategies for behavior change need further examination in the context of sunscreen use. Matched and mismatched designs can be applied in this context to identify which specific strategies work best for preintenders, intenders and actors in order to get them to become motivated, to adopt and to maintain sunscreen use.

### References

- Adams, M.A., Norman, G.J., Hovell, M.F., Sallis, J.F., & Patrick, K. (2009). Reconceptualizing decisional balance in an Adolescent Sun Protection intervention: mediating effects and theoretical interpretations. *Health Psychology, 28*, 217-225.
- Arbour, K.P., & Martin Ginis K.A. (2009). A randomized controlled trial of the effects of implementation intentions on women's walking behavior. *Psychology and Health, 24*, 49-65.
- Armitage, C. (2007). Effects of an implementation intention-based intervention on fruit consumption, *Psychology and Health, 22*, 917-928.
- Arthey, S., & Clarke, V.A. (1995). Suntanning and sun protection: A review of the psychological literature. *Social Science Medicine, 40*, 265-274.
- Borland, R., Hill, D., & Noy, S. (1990). Being SunSmart: changes in community awareness and reported behavior following a primary prevention programme for skin cancer control. *Behavior Change, 7*, 126-135.
- Boutwell, W.B. (1995). The under cover skin cancer prevention project: a community based programme in four Texas cities. *Cancer, 75*, 657-60.
- Brändström, R., Ullen, H., Brandberg, Y. (2004). Attitudes, subjective norms and perception of behavioural control as predictors of sun-related behaviour in Swedish adults. *Preventive Medicine, 39*, 992-999.
- Broadstock, M., Borland, R., & Gason, R. (1992). Effects of suntan on judgement of healthiness and attractiveness by adolescents. *Journal of Applied Social Psychology, 22*, 157-172.
- Carmel, S., Shani, E., & Rosenberg, L. (1994). The role of age and an expended Health Belief Model in predicting skin cancer protective behaviour. *Health Education Research, 9*:433-447.
- Chapman, J., Armitage, C. J., & Norman, P. (2009). Comparing implementation intention interventions in relation to young adults' intake of fruit and vegetables. *Psychology & Health, 24*, 317 - 332.
- van Koningsbruggen, G.M., Das, E., & Roskos-Ewoldsen, D.R. (2009). How self-affirmation reduces defensive processing of threatening health information: Evidence at the implicit level. *Health Psychology, 28*, 563-568.

- Dennis, L. K., Lowe, J. B., & Snetselaar, L. G. (2009). Tanning behaviour among young frequent tanners is related to attitudes and not lack of knowledge about the dangers. *Health Education Journal*, 68, 232-243.
- Diepgen, T.L., & Mahler, V. (2002). The epidemiology of skin cancer. *British Journal of Dermatology*, 146 (Suppl. 61), 1-6.
- Dwyer, T., Blizzard, L., Gies, P. H., Ashbolt, R., & Roy, C. (1996). Assessment of habitual sun exposure in adolescents via questionnaire: A comparison with objective measurement using polysulphone badges. *Melanoma Research*, 6: 231-239.
- Girgis, A., Sanson-Fisher, R. W., Tripodi, D. A., & Golding, T. (1993). Evaluation of interventions to improve solar protection in primary schools. *Health Education Quarterly*, 20, 275-287.
- Gonzalez, S., Fernandez-Lorente, M., Gilaberte-Calzada, Y. (2008). The latest on skin photo protection. *Clinics in Dermatology*, 26, 614-626.
- Grunfeld, E. A. (2004). What influences university students intentions to practice safe sun exposure behaviors? *Journal of Adolescent Health*, 35: 486-492.
- Gutierrez-Dona, B., Lippke, S., Renner, B., Kwon, S., & Schwarzer, R. (2009). Self-efficacy and planning predict dietary behaviours in Costa Rican and South Korean women: two moderated mediations analysis. *Applied Psychology: Health and Well-being*, 1(1), 91-104, Doi:10.1111/j.1758-0854.2008.01001.x.
- Hill, D., White, V., Marks, R., & Borland, R. (1993). Changes in sun-related attitudes and behaviors, and reduced sunburn prevalence in a population at high risk of melanoma. *European Journal of Cancer Prevention*, 2, 447-456.
- Hillhouse, J. J., & Turrisi, H. (2002). Examination of the efficacy of an appearance-focused intervention to reduce UV exposure. *Journal of Behavioural Medicine*, 25, 395-409. Doi: 0160-7715/02/0800-0395/0.
- Jackson, K. M., & Aiken, L. S. (2000). A psychological model of sun protection and sunbathing in young women: The impact of health beliefs, attitudes, norms, and self-efficacy for sun protection. *Health Psychology*, 19:469-478.
- Jackson, K.M, & Aiken, L.S., (2006). Evaluation of a multi component appearance based sun protective intervention for young women, uncovering the mechanisms of programme efficacy, *Health Psychology*, 25, 34-46.

- Jones, F., Abraham, C., Harris, P., Schulz, J., & Chrispin, C. (2001). From knowledge to action regulation: modeling the cognitive prerequisites of sun screen use in Australian and UK samples. *Psychology & Health, 16*, 191-206.
- Jones, F., Harris, P., & Chrispin, C. (2000). Catching the sun: An investigation of skin exposure and sun protective behaviour. *Psychology, Health & Medicine, 50*, 131-141.
- Kasparian, N. A, McLoone, J. K., & Meiser, B. (2009). Skin cancer-related prevention and screening behaviors: A review of the literature. *Journal of Behavioral Medicine, 32*, 406-428.
- Kristjansson, S., Bränström, R., Ullen, H., & Helgason, A. R. (2003). Transtheoretical Model: The investigation of adolescents' sunbathing behavior. *European Journal of Cancer Prevention, 12*: 501-508.
- Lippke, S., Ziegelmann, J. P., & Schwarzer, R. (2004). Initiation and maintenance of physical exercise: Stage-specific effects of a planning intervention. *Research in Sports Medicine, 12*, 221-240.
- Lippke, S., Wiedemann, A. U., Ziegelmann, J. P., Reuter, T., & Schwarzer, R. (2009). Self-efficacy moderates the mediation of intentions into behavior via plans. *American Journal of Health Behavior, 33*, 521-529.
- Lippke, S., Schwarzer, R., Ziegelmann, J. P., Scholz, U., & Schüz, B. (2010). Testing stage-specific effects of a stage-matched intervention: a randomized controlled trial targeting physical exercise and its predictors. *Health Education & Behavior, 37*(4), 533-546. - DOI: 10.1177/1090198109359386.
- Luo, J., & Isaacowitz, D. M. (2007). How optimists face skin cancer information: Risk assessment, attention, memory and behavior. *Psychology and Health, 22*, 963-984.
- Luszczynska, A., & Schwarzer, R. (2003). Planning and self-efficacy in the adoption and maintenance of breast self-examination: A longitudinal study on self-regulatory cognitions. *Psychology and Health, 18*, 93-108.
- Luszczynska, A. (2006). An implementation intentions intervention, the use of planning strategy, and physical activity after myocardial infarction. *Social Science and Medicine, 62*, 900-908.
- Luszczynska, A., Sobczyk, A., & Abraham, C. (2007). Planning to reduce weight: Implementation intentions intervention helps to reduce body weight among

- overweight or obese women by prompting action planning. *Health Psychology*, 26, 507-512.
- Luszczynska, A., Tryburcy, M., & Schwarzer, R. (2007). Improving fruit and vegetable consumption: a self-efficacy intervention compared to a combined self-efficacy and planning intervention. *Health Education Research*, 22, 630-638.
- MacKinnon, D. P., & Luecken, L. J. (2008). How and for whom? Mediation and moderation in health psychology. *Health Psychology. Suppl. Issue: Mediation and Moderation* 27, S99-S100.
- Maddock, J. E., Redding, C. A., Rossi, J. S., Weinstock, M. A. (2005). Development and validation of an appearance motivation attitudes scale for sun protection. *Psychology & Health*, 20, 775-788.
- Mahler, H.I.M., Kulik, J.A., Butler, H.A., Gerrard, M., & Gibbons, F. (2008). Social norms information enhances the efficacy of an appearance based sun protection intervention. *Social Science and Medicine*, 67, 321-329, doi:10.1016/j.socscimed.2008.03.037.
- Mahler, H. I. M., Fitzpatrick, B., Parker, P., & Lapin, A. (1997). The relative effects of a health-based versus an appearance-based intervention designed to increase sunscreen use. *American Journal of Health Promotion*, 11: 426-429.
- McClendon, B. T., & Prentice-Dunn, S. (2001). Reducing skin cancer risk: An intervention based on Protection Motivation Theory. *Journal of Health Psychology*, 6:321-328.
- Milne, S., Orbell, S., & Sheeran P. (2002). Combining motivational and volitional interventions to promote exercise participation: Protection motivation theory and implementation intentions, *British Journal of Health Psychology*, 7, 163-184.
- Myers, L. B., & Horswill, M. S. (2006). Social cognitive predictors of sun protection intention and behavior. *Behavioral Medicine*, 32, 57-63.
- Norman, G.J. et al. (2007). A randomized trial of a multicomponent intervention for adolescent sun protection behaviours. *Archives of Pediatric Adolescent Medicine*, 161, 146-152.
- O’Riordan, D.L., Lunde, K.B., Steffen, A.D., & Maddock, J.E. (2006). Validity of beachgoers self-report of their sun habits. *Archives of Dermatology*, 142, 1304-1311.

- Pagoto, S., McChargue, D., & Fuqua, R.W. (2003). Effects of a multicomponent intervention on motivation and sun protection behaviors among Midwestern beachgoers. *Health Psychology, 22*, 429-433.
- Prentice-Dunn, S., McMath, B. F., & Cramer, R. (2009). Protection Motivation Theory and Stages of Change in sun protection behavior. *Journal of Health Psychology, 14*, 297-305.
- Prestwich, A., Lawton, R., & Conner, M. (2003). The use of implementation intentions and the decision balance sheet in promoting exercise behaviour, *Psychology and Health, 18*, 707-721.
- Prestwich, A., Conner, M., Lawton, R., Bailey, W., Litman, J., & Molyneaux, V. (2005). Individual and collaborative implementation intentions and the promotion of breast self-examination, *Psychology and Health, 20*, 743-760.
- Radcliffe, N. M., & Klein, W. M. P. (2002). Dispositional, unrealistic, and comparative optimism: Differential relations with knowledge and processing of risk information and beliefs about personal risk. *Personality and Social Psychology Bulletin, 28*, 836-846.
- Rassaby, J., Larcombe, I., Hill, D. & Wake, F. R. (1983). Slip Slop Slap: health education about skin cancer. *Cancer Forum, 7*, 63-69.
- Richert, J., Reuter, T., Wiedemann, A. U., Lippke, S., Ziegelmann, J., & Schwarzer, R. (2010). Differential effects of planning and self-efficacy on fruit and vegetable consumption. *Appetite, 54*, 611-614. doi: 10.1016/j.appet.2010.03.006.
- Scholz, U., Schüz, B., Ziegelmann, J., Lippke, S., & Schwarzer, R. (2008). Beyond behavioural intentions: Planning mediates between intentions and physical activity. *British Journal of Health Psychology, 13*, 479-494.
- Scholz, U., Sniehotta, F. F., & Schwarzer, R. (2005). Predicting physical exercise in cardiac rehabilitation: The role of phase-specific self-efficacy beliefs. *Journal of Sport & Exercise Psychology, 27*, 135-151.
- Sheeran, P. (2002). Intention-behavior relations: A conceptual and empirical review. *European Review of Social Psychology, 12*, 1-36.
- Sheeran, P., & Orbell, S. (1999). Implementation intentions and repeated behavior: augmenting the predictive validity of the theory of planned behavior. *European Journal of Social Psychology, 29*, 349-369.

- Schwarzer, R., Richert, J., Kreausukon, P., Remme, L., Wiedemann, A. U., & Reuter, T. (2010). Translating intentions into nutrition behaviors via planning requires self-efficacy: Evidence from Thailand and Germany. *International Journal of Psychology, 54*, 260-268.
- Sniehotta, F. (2009). Towards a theory of intentional behaviour change: plans, planning and self-regulation. *British Journal of Health Psychology, 14*, 261-273.
- Sniehotta, F. F., Scholz, U., & Schwarzer, R. (2006). Action plans and coping plans for physical exercise: A longitudinal intervention study in cardiac rehabilitation. *British Journal of Health Psychology, 11*, 23-37.
- Schwarzer, R. (2008). Modeling health behavior change: How to predict and modify the adoption and maintenance of health behaviors. *Applied Psychology: An International Review, 57*, 1-29.
- Schwarzer, R. (1994). Optimism, vulnerability, and self-beliefs as health-related cognitions: A systematic overview. *Psychology and Health, 9*, 161-180.
- Taylor, S.E., & Brown, J.D. (1994). Positive illusions and well-being revisited: Separating fact from fiction. *Psychological Bulletin, 116*, 21-27.
- Van Osch, L., Lechner, L., Reubsæet, A., Wigger, S., & de Vries, H. (2008). Relapse prevention in a national smoking cessation contest: effects of coping planning. *British Journal of Health Psychology, 13*, 525-535.
- Van Osch, L., Reubsæet, A., Lechner, L., Candel, M., Mercken, L., & De Vries, H. (2007). Predicting parental sunscreen use: Disentangling the role of action planning in the intention-behavior relationship. *Psychology and Health, 1*-19. DOI: 10.1080/08870440701596577.
- Weinstein, N. D. (1982). Unrealistic optimism about susceptibility to health problems. *Journal of Behavioral Medicine, 5*: 441-460.
- Weinstein, N. D. (2000). Perceived probability, perceived severity and health-protective behavior. *Health Psychology, 19*, 135-140.
- Weinstock, M.A., Rossi, J.S., Redding, C.A., & Maddock, J.E. (2002). Randomized controlled community trial of the efficacy of a multicomponent stage-matched intervention to increase sun protection among beach goers. *Preventive Medicine, 35*, 584-592.
- Wiedemann, A. U., Lippke, S., Reuter, T., Ziegelmann, J. P., & Schwarzer, R. (2009). How planning facilitates behavior change: Additive and interactive effects of a



randomized controlled trial. *European Journal of Social Psychology*. DOI: 10.1002/ejsp.724.

Ziegelmann, J., & Lippke, S. (2007). Planning and strategy use in health behaviour change: a lifespan view. *International Journal of Behavioral Medicine*, 14, 30-39.

## **Curriculum Vitae**

**Irina Catrinel Craciun**

For reasons of data protection, the curriculum vitae is not included in the online version.

## List of publications

### ARTICLES

#### 2010

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2010). Risk perception moderates how intentions are translated into sunscreen use. *Journal of Behavioral Medicine, 33*, 392-398. doi: 10.1007/s10865-010-9269-5.

#### Submitted:

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2010). A Mediator Model of Sunscreen Use: A Longitudinal Analysis of Social-Cognitive Predictors and Mediators, submitted to *International Journal of Behavioral Medicine*.

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2010). Translating Intentions into Sunscreen Use: An Interaction of Self-Efficacy and Appearance Norms, submitted to *Journal of Applied Social Psychology*.

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2010). Stage-Matched Interventions to Enhance Planning for Sunscreen Use, submitted to *European Psychologist*.

Craciun, C., Schüz, N., Lippke, S., & Schwarzer, R. (2010). Facilitating Sunscreen Use in Women by a Theory-Based Online Intervention: The Roles of Planning and Self-Efficacy, submitted to *Psychology and Health*.

#### 2009

Mereuta, O., & Craciun, C. (2009), Parents Illness Perceptions, Maladaptive Behaviors, and their Influence on the Emotional Distress of the Child, a pilot study on Romanian Pediatric Cancer Group, vol. XIII, 207-217.

#### 2008

Craciun, C., & Baban, A. (2008). Exploring smoking in Romanian Adolescents: Prevalence, predictors and meanings of smoking. *Cognition, Brain, Behavior: an Interdisciplinary Journal, 4 Creier, Cognition, Comportament*, 435-452.

Craciun, C., & Baban, A. (2008). The role of self-efficacy, past habit and action plans in children's eating habits. *Creier, Cognition, Comportament, 2*, 205-218.

**2007**

Baban, A., & Craciun, C. (2007) Changing Health-Risk Behaviours: a Review of Theory and Evidence-Based Interventions in Health Psychology. *J. of Cognitive and Behavioural Psychotherapies*, VII,1: 45-66.

**2005**

Szentagotai, A , & Craciun, C. (2005). Children's' representations of pain. *Creier, Cognition, Comportament*, vol. IX, nr. 1, 85-96. (BDI)

**I. BOOK CHAPTERS****2010**

Baban A., & Craciun C. (2010). Internal and External Assets and Romanian Adolescents ' Health: an Evidence Based Approach to Health Promoting Schools Policy, in A. Morgan, M. Davies, & E. Ziglio (Eds.), *Health Assets in Global Context*, pp.321-337, Springer Link, DOI: 10.1007/978-1-4419-5921-8\_17.

**2009**

Craciun, C., Baban, A. (2009). Motivational Interviewing: application principles and its relevance for clinical practice, in D. Dumitrascu (Ed.), *Current problems in biopsychosomaticmedicine*, 223-229, Medical University Press, Cluj Napoca

**2008**

Baban, A., Craciun, C., Balazsi, R., Ghenea, R. & Olsawsky, V. (2008). Romania: Facing the Challenge of Translating Research into Practice, Policy and Partnerships to Promote Mental Health among Adolescents. In *Social Cohesion for Mental Wellbeing among Adolescents*, Copenhaga: WHO, p. 168-183.

Băban, A., Marcu, O. & Crăciun C. (2008) Social exclusion of institutionalized children in Romania. In *Child abandonment: an emergency*. Milan: Franco Angeli Press.

Baban, A., Kallay, E., & Craciun, C. (2008). The role of educational counselling in the secondary profilaxy of cardio-vascular diseases in women at menopause.

In *Studii și cercetări din domeniul științelor socio-umane*, vol. 15, Editura Argonaut, Cluj-Napoca.

### **In press**

Craciun, C. (in press), “Sănătatea sexuală la adolescenți” [“Adolescent sexual health”] in A. Baban (Ed.), *Comportament si sananatare la copiii si adolescentii din Romania*. [Behavior and health in Romanian children and adolescents] Cluj Napoca: ASCR.

Craciun, C. (in press), “Capitalul social și sănătatea la adolescenți” [“Social capital and health in adolescents”] in A. Baban (Ed.), *Comportament si sananatare la copiii si adolescentii din Romania*. [Behavior and health in Romanian children and adolescents] Cluj Napoca: ASCR.

Craciun, C. (in press), “Percepția ale sănătății și stilului de viață la copii și adolescenți” [“Health and lifestyle perceptions in children and adolescents”] in A. Baban (Ed.), *Comportament si sananatare la copiii si adolescentii din Romania*. [Behavior and health in Romanian children and adolescents]. Cluj Napoca: ASCR.

### **III. SHORT COMMUNICATIONS IN INTERNATIONAL PUBLICATIONS**

Baban, A., Craciun, C., Kallay, E., & Balazi, R. (2009), The role of social capital in explaining differences in Romanian adolescents health and risk behavior, *Psychology & Health*, pp.87

Cao, D., Schwarzer, R., Wiedeman, A., Craciun, C., Xie, G., & Kreasukon, P., (2009), Exercise social support and perceived self-efficacy have effects on adolescents extracurricular physical activity, *Psychology & Health*, pp. 120

Craciun, C., & Mallach, N., (2009), What makes intenders plan and planners act? Analysing the relation between intentions, planning and sunscreen use, *Psychology & Health*, pp. 139

Todorova, I., Baban, A., Alexandrova-Karamanova, A., & Craciun, C. (2009), Social and contextual themes in adolescents narratives of health, food and the body, *Psychology & Health*, pp 385

Baban, A., Craciun, C., Marcu, O., Balazsi, R. (2007) Social determinants of health and wellbeing among Romanian adolescents, *Health Psychology Review*, 1, 280-281

**IV. OTHER PUBLICATIONS**

2007, “Practical guide for parents of hospitalized children”

2008, “Practical guide for parents of children with cardiovascular disease”

2008, “Practical guide for parents of children with diabestes”

2008, “Practical guide for parents of children with cancer”

**V. REVIEWS**

2007, review of the book “Analiza de continut” (Content anlysis), author Mircea Agabrian, in *Cognition, Brain, Behavior*, .2, vol. XI.

2006, review of the book “Sexuality and Gender in Post communist Eastern Europe and Russia”, Aleksandr Stulhofer și Theo Standfort (editori), *Cognition, Brain, Behavior*, vol. X, 1, 2006

**Erklärung**

Hiermit versichere ich, dass ich die vorgelegte Arbeit selbstständig verfasst habe.  
Andere als die angegebenen Hilfsmittel habe ich nicht verwendet. Die Arbeit ist in  
keinem früheren Promotionsverfahren angenommen oder abgelehnt worden.

Berlin, 2010

Catrinel Craciun