Child Sun Safety: Application of an Integrated Behavior Change Model

Kyra Hamilton & Aaron Kirkpatrick

Griffith University

Amanda Rebar

Central Queensland University

Martin S. Hagger

Curtin University and University of Jyväskylä

Full citation: Hamilton, K., Kirkpatrick, A., Rebar, A., & Hagger, M. S. (2017). Child Sun Safety: Application of an Integrated Behavior Change Model. *Health Psychology*.

http://dx.doi.org/10.1037/hea0000533

Author Note

Kyra Hamilton, School of Applied Psychology, Menzies Health Institute Queensland, Griffith University, Brisbane, Queensland, Australia and School of Psychology and Speech Pathology, Health Psychology and Behavioural Medicine Research Group, Curtin University, Perth, Western Australia, Australia; Aaron Kirkpatrick, School of Applied Psychology, Menzies Health Institute Queensland, Griffith University, Brisbane, Queensland, Australia; Amanda Rebar, School of Health, Medical and Applied Sciences, Central Queensland University, Queensland, Australia; Martin S. Hagger, School of Psychology and Speech Pathology, Health Psychology and Behavioural Medicine Research Group, Curtin University, Perth, Western Australia, Australia and

Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland. Martin S. Hagger's contribution was supported by a Finland Distinguished Professor (FiDiPro) award from Tekes, the Finnish funding agency for innovation and a Kennedy Y. H. Wong Distinguished Visiting Professorship from Hong Kong Baptist University.

Correspondence concerning this article should be addressed to Dr. Kyra Hamilton, School of Applied Psychology, Griffith University, 176 Messines Ridge Road, Mt Gravatt, QLD 4122. Email: kyra.hamilton@griffith.edu.au

Abstract

Objective: Childhood sun exposure increases risk of skin cancer in later life. Parents of young children play an important role in minimizing childhood sun exposure. The aim of the current study was to identify the motivational, volitional, and implicit antecedents of parents' sun-protective behaviors based on an Integrated Behavior Change model. **Methods:** Parents (N = 373) of 2 to 5 year-old children self-reported their intentions, attitudes, subjective norm, perceived behavioral control, autonomous and controlled motivation, action plans, habit, and past behaviors with respect to sun-protective behaviors for their children. Two weeks later (n = 273), the parents self-reported their participation in sun-protective behaviors for their child. **Results:** Data were analyzed using variance-based structural equation modelling. Results showed significant direct effects of attitudes, subjective norm, perceived behavioral control, and past behavior on intentions, and significant direct effects of autonomous motivation, perceived behavioral control, intentions, action planning, habit, and past behavior on parents' participation in sun-protective behaviors for their child. There were also significant total indirect effects of autonomous motivation on intentions mediated by attitudes and subjective norm. **Conclusions:** Current results indicate that parents' sun-protective behaviors toward their children are a function of motivational (autonomous motivation, intentions), volitional (action planning), and implicit (habit) factors. The findings from the current study provide formative data to inform the development of behavior change interventions to increase parents' participation in sun-protective behaviors for their children.

Key words: sun safety; children; parents; integrated behavior change model; autonomous motivation; theoretical integration; self-determination theory; theory of planned behavior

One in every three cancers diagnosed is a skin cancer (WHO, 2015), with Australia reported as having the world's highest age-standardized incidence rate of skin melanoma (AIHW, 2012). Skin cancers predominately develop as a result of a lifetime of excessive exposure to ultraviolet (UV) radiation in sunlight (WHO, 2015). An estimated 50% of total UV exposure to age 60 occurs before the age of 20 years, and silicone casts of the skin of teenagers aged 13–15 years in four cities in eastern Australia showed 40% to 70% already had signs of UV-induced skin damage (Green, Wallingford, & McBride, 2011). Childhood sun exposure and multiple sunburns are associated with increased lifetime risk of skin cancer (Cancer Council Australia, 2016; Green et al., 2011). This is a concern given that most children (69%) report having been sunburnt one or more times (Green et al., 2011). Sun-protective behaviors such as the consistent use of sunscreen during childhood has been estimated to reduce lifetime skin cancer risk by up to 80% (Stern, Weinstein, & Baker, 1986). Reducing exposure to harmful levels of UV radiation in childhood is therefore vital in decreasing skin cancer risk in later life (Hornung, 2000). As young children have limited capacities for self-regulating their sun-protective behaviors, parental guidance is needed (Hamilton, Cleary, White, & Hawkes, 2016; Hamilton, Kirkpatrick, Rebar, White, & Hagger, 2017). However, even if parents are motivated to ensure their child engages in appropriate sun protection, corresponding behaviors may not ensue (Hamilton et al., 2016).

It is well known that people who are motivated to act often do not behave according to their intentions (Gollwitzer & Sheeran, 2006) and instead act 'mindlessly' or impulsively, paying little attention to the reasoning behind their behavior or its consequences (Strack & Deutsch, 2004). The reasons for these failures to act may be because individuals are faced with multiple impediments (such as distractions and competing parenting demands, Hamilton, Spinks, White, Kavanagh, & Walsh, 2016; Hamilton & White, 2010; Spinks & Hamilton, 2016) that tend to derail attempts to engage in intended behaviors. If individuals are not equipped with means to meet these obstacles or their cognitive capacity is low, then motivation alone will be insufficient to ensure they act on their

intentions. To overcome this limitation, volitional and implicit processes are thought to operate in concert with and independent of motivational processes.

Theoretical Bases of Behavior Change

For decades, social psychologists and behavioral scientists have attempted to develop comprehensive, parsimonious theoretical models that are effective in predicting people's intentions and behavior. Human behavior, however, is complex with multiple processes guiding decision making. Motivational models and theories such as theory of planned behavior (Ajzen, 1991) and self-determination theory (Deci & Ryan, 1985); volitional, dual-process models such as health action process approach (Schwarzer, 2008); and implicit, automatic theories such as reflective impulsive model (Strack & Deutsch, 2004) have been attempts aimed at better understanding human behavior. Researchers have also attempted to integrate and extend these models to further understanding of the processes that impact health behavior engagement and maintenance (e.g., Allom, Mullan, Cowie, Hamilton, 2016; Arnautovska, Fleig, O'Callaghan, & Hamilton, 2017; Hagger, Chan, Protogerou, & Chatzisarantis, 2016a; Hagger & Chatzisarantis, 2014; Hagger, Trost, Keech, Chan, & Hamilton, 2017; Hamilton, Cox, & White, 2012; Reyes Fernández, Knoll, Hamilton, & Schwarzer, 2016).

For example, Hagger and Chatzisarantis (2014) recently proposed an integrated behavior change (IBC) model. The model integrates processes from key motivational theories that have been previously employed to predict participation in health-related behaviors. The model outlines the factors that relate to intention formation (Ajzen, 1991; Deci & Ryan, 1985), the self-regulatory and volitional processes that lead to the enactment of intentions (Gollwitzer & Sheeran, 2006; Schwarzer, 2008), and the non-conscious, implicit processes that lead to behavioral engagement beyond an individual's awareness (Hagger, 2016; Strack & Deutsch, 2004). The integrated model addresses the limitations of traditional social cognitive and motivational models that do not account for volitional and implicit processes (for a complete overview of the model see Hagger & Chatzisarantis, 2014). Three processes in the integrated model - motivational, volitional, and

implicit – are proposed to guide behavior change. The relative contribution of each process is important when identifying the pathways to action and should be considered when designing interventions to change behavior. To date, little research has examined how these three processes operate together to explain behavior, and no attempt has been made to formally test these three processes in the area of sun safety. Further, given that parents are likely to express positive attitudes and intentions regarding their children's health behaviors but fail to act consistent with their beliefs, the model may shed light on the processes for these failures and point to possible strategies to intervene.

The Current Study and Hypotheses

The aim of the current study was to test the predictions of an IBC model in the context of parents' behavior to sun protect their young children. The approach is unique as it is the first to simultaneously account for three sets of processes likely to impact on behavior derived from theories of motivation, social cognition, and volition: motivation, volitional, and implicit. The motivational pathways are represented by the effects of motivational and social cognitive constructs from the integration of self-determination theory and theory of planned behavior, respectively. The volitional pathways are represented by the effects of action planning on the intention-behavior relationship. The implicit pathways are represented by participants' self-reported habit. All of these processes are stated formally in a series of a priori hypotheses listed in Appendix A (supplemental materials). We outline the hypotheses in the next section. The hypotheses are illustrated in Figure 1, which can be used as a reference guide alongside the hypotheses listed in Appendix A to clarify model predictions.

Turning first to the motivational effects in the proposed model, autonomous forms of motivation from self-determination theory (Deci & Ryan, 1985) are hypothesized to serve as distal predictors of the social cognitive antecedents of behavior from the theory of planned behavior, attitudes (H_1), subjective norm (H_2), and perceived behavioral control (H_3). These effects are based on previous integration of these theories consistent with the premise that autonomous forms of

motivation lead to adaptive outcomes because they are self-endorsed and satisfy psychological needs. Attitudes, subjective norm, and perceived behavioral control are proposed to mediate autonomous motivation effects on intentions and behavior because individuals are proposed to align their beliefs with their motives. These effects have been supported empirically in multiple studies (e.g., Hagger & Chatzisarantis, 2016; Hagger et al., 2017, 2016a,b). In contrast, controlled forms of motivation are hypothesized to predict subjective norm only (H_5) and have null effects on attitudes (H_4) and perceived behavioral control (H_6). Non-self determined beliefs reflect externally-referenced motives, are not need satisfying and, therefore, tend not be congruent with attitudes and perceived behavioral control. Conversely, as subjective norm reflects social pressure for engaging in the future action, these beliefs tend to be aligned with subjective norm. Consistent with the theory of planned behavior (Ajzen, 1991) and meta-analytic studies in health behavior (McEachan, Conner, Taylor, & Lawton, 2012; Rich, Brandes, Mullan, & Hagger, 2016), attitudes (H_7), subjective norm (H_8), and perceived behavioral control (H_9) are proposed to predict intentions; and intentions (H_{10}) and perceived behavioral control (H_{11}) are proposed as predictors of behavior. The model also accounts for the predictions of self-determination theory which proposes direct relations of autonomous (H_{15}) and controlled (H_{16}) motivation on behavior, with support found for these effects in studies in health contexts (Hagger & Chatzisarantis, 2015).

Consistent with theories and models that propose a volitional process that operates in a post-decisional manner to facilitate the enactment of goal intentions, it is proposed that intentions would predict action planning (H_{12}) and action planning would predict behavior (H_{13}). These predictions are consistent with the health action process approach (Schwarzer, 2008) and previous studies adopting the model across various health behaviors (e.g., Reyes Fernández et al., 2016; Zhou, Miao, Hamilton, Knoll, Schwarzer, 2015). It is further proposed that action planning would moderate the intention-behavior relationship consistent with the model of action phases (Gollwitzer & Sheeran, 2006) (H_{17}). This is based on the premise that individuals adopting planning strategies are more likely to convert their good intentions into action behavior, and has been empirically supported in a

number of studies (Gollwitzer & Sheeran, 2006). The IBC model also predicts that individuals with considerable experience with the behavior and likely to have developed a routine to engage in the behavior, will have a more automatic, non-intentional pathway to behavior. These effects have been predicted in studies using dual process approaches to health behavior (Hagger, 2016; Rebar et al., 2016; Strack & Deutsch, 2004) and is represented by the direct effect of habit on behavior (H_{14}). Finally, the effects in the model are expected to be independent of past behavior in that proposed effects will hold even while controlling for past behavior. This is an important consideration given the pervasive effects of past behavior on behavior in tests of psychological theories in health contexts (Hagger et al., 2016a). Accordingly, past behavior is essential to evaluate whether a model has efficacy in accounting for unique variance in the behavioral outcome. If past behavior attenuates all model effects to trivial values, then the model would be considered redundant. In the current study, it is proposed that significant effects of past behavior on all constructs in the model will emerge (H_{18}).

A set of indirect effects consistent with the premises of the IBC model are also specified. Consistent with Ajzen's (1991) exposition of the theory of planned behavior and previous research (Hagger et al., 2016a), it is proposed that indirect effects of attitudes (H_{19}), subjective norm (H_{20}), and perceived behavioral control (H_{21}) on behavior through intentions will emerge. Consistent with the integration of the theory of planned behavior and self-determination theory, it is proposed that autonomous motivation will predict intentions (H_{22}) through attitudes, subjective norm, and perceived behavioral control, and predict behavior through these variables and intentions (H_{24}). Empirical research has supported these indirect effects in health contexts (Hagger & Chatzisarantis, 2016). Similarly, the same pattern of effects for controlled motivation on intentions (H_{23}) and behavior (H_{25}) is expected, but mediated by subjective norm and subjective norm and intentions, respectively. This is, again, congruent with the premise that subjective norm reflects perceived pressures from significant others and controlled motives reflect externally-referenced reasons for action. Finally, consistent with hypotheses from the health action process approach (Schwarzer,

2008), action planning is proposed to mediate the effect of intentions on behavior (H_{26}). These effects are, however, conditional on the multiple direct effects that make up the mediation effects.

Method

Participants

Participants (N = 373) were residents of Queensland, Australia and comprised parents who had at least one child aged between 2 and 5 years who usually resided in the same household as the parent. Parents were independent, with only one partner from each couple completing the questionnaire. Two weeks later, 273 (73% of the baseline sample) of the parents completed the follow-up survey. Lack of time and going on school holidays were the main reasons for attrition. Participants were recruited via online advertising (e.g., online parenting forums such as "BubHub" and "Raising Children Network", social media such as "Facebook"), face-to-face (e.g., dance schools, shopping centres), and through schools and childcare facilities. As an incentive to participate in the study, participants were offered the opportunity to enter a prize draw to win one of three double movie passes. Sample demographic characteristics are presented in Table 1.

Design and Procedure

The study was conducted at two major universities in Queensland, Australia – Griffith University and Central Queensland University. The University Human Research Ethics Committee of both universities approved the study. Data were collected between October 2014 and August 2015, with recorded UV index values during the data collection months ranging between 4-13, indicative of a UV exposure category of "moderate" to "extreme" (ARPNSA, 2017). Sun protection is highly recommended for UV index values of 3 or higher (Cancer Council Australia, 2016). The study used a correlational design with a two week behavioral follow-up. At Time 1 (T1), participants completed a questionnaire either face-to-face or on-line assessing motivational processes (autonomous and control motivation, attitudes, subjective norm, perceived behavioral control, intentions, and past behavior), volitional processes (action planning), and automatic processes (habit). Demographic variables were also collected. At Time 2 (T2), a follow-up

telephone call was conducted to measure the decisions parents had made regarding their children's sun-protective behaviors during the previous two weeks. Consent was gained through the completion of the T1 questionnaire, and consent to contact participants for the T2 follow-up was given through the provision of contact details. Data across each of the time points were able to be de-identified and matched using a unique code identifier created by the participant.

Measures

Psychological constructs were measured on multi-item psychometric instruments developed using standardized guidelines and validated in previous studies and adapted for use with the target behavior in the current study (Hamilton et al., 2016; Thomson, White, & Hamilton, 2012; White Starfelt, Young, Hawkes, Leske, & Hamilton, 2015). Brief details of the measures are provided below and a full set of items are available in Appendix B (supplemental materials). Items from each instrument were used as indicators of latent variables representing each model construct in a structural equation model.

Sun-protective behavior. The target behavior was *sun-protective behaviors* based on the guidelines of sun protection outlined by Cancer Council Australia (2016): (a) applying SPF 30+ sunscreen; (b) wearing sun-protective clothing such as a hat, long-sleeved shirt, and sunglasses; and (c) seeking shade between 10am and 3pm. The target behavior was to be adopted every time their child was outdoors in direct sunlight for more than 10 minutes. Parents were asked to think of the sun-protective behaviors they engaged in for their youngest child aged 2 to 5 years. Given that adequate sun protection does not require performing of all sun-safety behaviors simultaneously (e.g., if a person wears a hat, seeks shade, and applies sunscreen, long-sleeved clothing may not be necessary), separate measures of individual sun-protective behaviors are not essential to reflect adequate protection (Hamilton et al., 2016; White et al., 2015). Examples of sun-protective measures were provided to parents and they then decided whether the measures they had undertaken for their child provided sufficient sun protection.

At T1 and T2, sun-protective behaviors performed by the parent for their child in the previous two weeks was measured using four items (e.g., "Think about the past 2 weeks. In general, how often did you perform sun-protective behaviors for your child") with responses given on 7-point Likert scales ranging from *never* (1) to *always* (7). Similar measures have been used in studies on sun safety (White et al., 2015).

Intention. Parent intention to perform sun-protective behaviors for their child was measured using four items (e.g., "I intend to perform sun-protective behaviors for my child every time they go in the sun for more than 10 minutes in the next 2 weeks", scored (1) *strongly disagree* to (7) *strongly agree*).

Attitude. Parent attitude to perform sun-protective behaviors for their child was assessed using five semantic differential items (e.g., "Performing sun-protective behaviors for my child every time they go in the sun for more than 10 minutes during the next 2 weeks would be... *bad* – *good*", scored (1) to (7).

Subjective norm. Subjective norm was measured using five items assessing how likely parents' believe important others in their life would want them to perform sun-protective behaviors for their child (e.g., "Those people who are important to me would want me to perform sun-protective behaviors for my child every time they go in the sun for more than 10 minutes in the next 2 weeks", scored (1) *strongly disagree* to (7) *strongly agree*).

Perceived behavioral control. Perceived behavioral control was assessed using four items measuring parents' level of self-efficacy and control over performing sun-protective behaviors for their child (e.g., "I have complete control over whether my child's sun-protective behaviors are performed every time they go in the sun for more than 10 minutes in the next 2 weeks", scored (1) *strongly disagree* to (7) *strongly agree*).

Autonomous and controlled motivation. An adapted version of Ryan and Connell's (1989) measure of perceived locus of causality was used to measure parents' autonomous and controlled motivation to perform sun-protective behaviors for their child. Participants were presented with

initial instructions: "The following questions relate to the reasons why you would perform sun-protective behaviors for your child every time they go in the sun for more than 10 minutes. Different people have different reasons for doing that, and we want to know how true each of the following reasons is for you". They were next presented with a common stem: "The reason I would perform sun-protective behaviors for my child every time they go in the sun for more than 10 minutes is:…" followed by four reasons for autonomous motivation (e.g., "…because it is very important for my child being as healthy as possible") and four reasons for controlled motivation (e.g., "…because others would be upset with me if I did not"). Responses were measured on seven-point scales ranging from (1) *not at all true* to (7) *very true*.

Action planning. Action planning was measured by four items developed by Sniehotta, Schwarzer, Scholz, and Schuz (2005) and assessed the extent to which parents had made a plan in relation to performing sun-protective behaviors for their child every time they go in the sun for more than 10 minutes during the next 2 weeks. Participants were required to respond to the stem: "I have made a plan regarding..." followed by the four items of the scale (e.g., "…when to perform sun-protective behaviors for my child") on Likert scales ranging from *not at all true* (1) to *exactly true* (7).

Habit. The 12-item Self-Report Habit Index (Verplanken & Orbell, 2003) was used to measure the extent to which child sun-protective behaviors were performed habitually by parents. Participants were required to respond to the stem: "Performing sun-protective behaviors on my child is something…" followed by the 12 items of the scale (e.g., "…I do frequently") on Likert scales ranging from *strongly agree* (1) to *strongly disagree* (7).

Demographic variables. Participants self-reported their gender, age in years, number of children, highest education level (junior school, senior school, TAFE/high school diploma, university undergraduate degree, university postgraduate degree), ethnicity (Caucasian, Indigenous/Torres Strait Islander, Asian, Pacific Islander, African, other), employment status (currently unemployed/full-time caregiver, currently employed full-time, part-time/casual

employed, full-time/part-time student), and family income (zero-$18,000, $18201-$37,000, $37001-$80,000, $80,001-$180,000, $180,000+). For subsequent analyses, these variables were represented as dichotomous dummy-coded variables for highest education level (1 = university undergraduate degree, university postgraduate degree; 0 = primary school or secondary school or TAFE/high school diploma), ethnicity (1 = Caucasian; 0 = non-Caucasian), employment status (1 = currently employed full-time; 0 = currently unemployed/full-time caregiver or employed part-time/casual employed or full-time/part-time student), and family income (1 = zero-$18,000; 0 = $18201-$37,000 or $37001-$80,000 or $80,001-$180,000 or $180,000+).

Data Analysis

We used variance-based structural equation modeling (VB-SEM) to test our hypothesized model. VB-SEM is similar to covariance-based SEM in that it explicitly models measurement error using latent factors. However, VB-SEM is based on ranked data and is, therefore, distribution-free and less affected by model complexity, sample size, or non-normality. This makes it optimal for use in the current analysis given the complexity of the model and the greater statistical power offered by the VB-SEM method. Models were estimated using the Warp PLS v5.0 software (Kock, 2015). Missing data were treated using stochastic hierarchical regression imputation which has been shown to minimize standard errors in simulations with the amount of data replaced ranging from 0.37% to 1.10% across all variables (Kock, 2015). Items from the measures of the psychological and behavioral constructs were set as indicators of latent variables. All paths among constructs of the proposed model detailed in Figure 1 and Appendix A (supplemental material) were specified as free parameters in the model. In addition, paths were included from the demographic variables to each of the psychological and behavioral variables in the model to statistically control for these variables.

Validity of the proposed measures was assessed by observing the parameters of the measurement aspects of the SEM. The loading of each indicator on its respective latent factor was expected to exceed .700. Composite reliability coefficients (ρ) and average variance extracted (AVE) statistics, which test the sufficiency of scale items as indicators the latent variables and

whether the items account for sufficient variance in the factor, both indicators of construct validity, were expected to exceed .700 and .500, respectively. Discriminant validity of latent variables was confirmed if the square-root of the AVE of the variable was larger than its correlation with the other variables in the model.

Overall goodness of fit of the proposed model was evaluated using multiple criteria: the goodness-of-fit (GoF) index with values of .100, .250, and .360 corresponding to small, medium, and large effect sizes, respectively (Tenenhaus, Vinzi, Chatelin, & Lauro, 2005), the average path coefficient (APC) and the average R^2 (ARS), both of which should be significantly different from zero for an adequate model, and the average variance inflation factor for model parameters (AVIF) statistic, with values less than 5.000 indicating a well-fitting model (Kock, 2015). Hypothesized mediation effects were tested by calculating indirect effects using a bootstrap resampling method with 100 replications.

Results

Participants

Demographic characteristics of the sample at the two time points are presented in Table 1. Data were missing from 100 participants due to absences at either time point, resulting in a final sample of 273 participants (females = 238; males = 35, *M* age = 34.80, SD = 5.21). Attrition analyses indicated that there were no significant differences in number of children ($t(371) = 0.495$, $p = .062$, $d = 0.051$), age ($t(371) = 1.73$, $p = .084$, $d = 0.179$), highest education level ($\chi^2(1) = 0.567$, $p = .452$, $d = 0.077$), or psychological and behavioral variables (attitudes, subjective norm, perceived behavioral control, intentions, autonomous motivation, controlled motivation, action planning, habit, and past behavior) measured at the first time point (Wilks' Lambda = .966, $F(9,352) = 1.379$, $p = .196$, $d = 0.122$) between participants that dropped out of the study and those who completed the T2 assessment. There were, however, differences in gender distribution ($\chi^2(1) = 6.87$, $p = .009$, $d = 0.274$), ethnic distribution ($\chi^2(1) = 9.11$, $p = .003$, $d = 0.315$), employment status ($\chi^2(1) = 19.25$, $p < .001$, $d = 0.465$), and family income ($\chi^2(1) = 4.34$, $p = .009$, $d = 0.217$). There

was a greater proportion of females, non-Caucasians, full-time employees, and high income earners among participants that dropped out relative to those that remained in the study.

Preliminary Analyses

Measurement model statistics from the VB-SEM confirmed that the latent variables met criteria for construct and discriminant validity. Factor loadings for each latent factor are presented in Appendix C (supplemental materials). All loadings exceeded the .700 criterion supporting the validity of the factors. The only exception was one item for the SRHI, but given this factor was indicated by 12 items, the errant loading was not considered a threat to validity. Composite reliability coefficients, AVE, and intercorrelations for model variables are presented in Table 2. Reliability coefficients exceeded the .700 criterion and AVE values exceeded the recommended .500 criterion for all factors. Factor correlations among the latent variables also indicated no problems with discriminant validity. Goodness of fit statistics revealed acceptable overall fit of the model with the data according to the multiple indices adopted (GoF Index = .527; APC = .111, p = .016, ARS = .337, $p < .001$; AVIF = 1.195).

Model Effects

Standardized parameter estimates for tests of hypothesized structural relations among the IBC model factors identified in Figure 1 and Appendix A (supplemental materials) are presented in Figure 2. A full breakdown of estimates including direct, indirect, and total effects are presented in the table in Appendix D (supplemental materials). In addition, effects of control variables in the model are available in a separate table in Appendix E (supplemental materials). Autonomous motivation had statistically significant direct effects on attitudes (H_1), subjective norm (H_2), and perceived behavioral control (H_3), as predicted. Controlled motivation had a statistically significant effect on subjective norm (H_5), and no effect on attitudes (H_4) and perceived behavioral control (H_6) consistent with hypotheses. This suggests that parents who endorsed more self-determined reasons for acting were more likely to hold positive attitudes, perceived control, and normative beliefs for engaging in sun-protective behaviors for their children. As predicted, attitudes (H_7), subjective

norm (H_8), and perceived behavioral control (H_9) were all statistically significant positive predictors of intentions. These results suggest that parents' attitudes, perceptions of control, and beliefs about norms with respect to sun-protective behaviors for their children directly impacted their self-reported intentions to engage in such behaviors. There were also statistically significant positive effects of intentions on behavior (H_{10}) and action planning (H_{12}), and of action planning on behavior (H_{13}), as hypothesized. It seems that parents who form intentions and action plans for sun-protective behaviors for their children are more likely to report having engaged in those behaviors. In addition, perceived behavioral control (H_{11}) and habit (H_{14}) were significant predictors on behavior, as hypothesized. Autonomous motivation was also a significant direct predictor of behavior (H_{15}), consistent with our hypothesis. There was no statistically significant direct effect of controlled (H_{16}) motivation on behavior, so this hypothesis was rejected. Also, contrary to hypotheses (H_{17}), action planning did not moderate the intention-behavior relationship. Past behavior statistically significantly predicted all variables in the model as hypothesized (H_{18}).

Turning to the hypothesized indirect effects, there were no statistically significant indirect effects of attitudes (H_{19}), subjective norm (H_{20}), and perceived behavioral control (H_{21}) on behavior, leading to a rejection of these hypotheses. There was, however, a significant total indirect effect of autonomous motivation on intentions mediated by attitudes, subjective norm, and perceived behavioral control consistent with our hypothesis (H_{22}, $\beta = .180$, $p = .001$). Parents who hold autonomous motives to engage in sun-safety behaviors are more likely to form intentions to engage in those behaviors because their beliefs are aligned with their motives and intentions accordingly. There was, however, no total indirect effect of controlled motivation on intentions through subjective norm, so this hypothesis was rejected (H_{23}, $\beta = .039$, $p = .260$). There was no significant total indirect effect of autonomous motivation on behavior through attitudes, subjective norm, perceived behavioral control, and intentions, leading to a rejection of our hypothesis (H_{24}, $\beta = .044$, $p = .231$). Similarly, controlled motivation did not significantly predict behavior through subjective

norm and intentions (H_{25}, $\beta = .007$, $p = .426$). Finally, there was no indirect effect of intentions on behavior through action planning, so this hypothesis was also rejected (H_{26}, $\beta = .023$, $p = .296$).

Discussion

The aim of the current study was to test the predictions of an IBC model (Hagger & Chatzisarantis, 2014) with respect to parents' sun-protective behaviors for their children. The model identified key processes derived from multiple theoretical models of motivation, social cognition, and volition and adopted hypotheses from self-determination theory, theory of planned behavior, the health action process approach and action-control theory, and dual process models of action. Results indicated significant effects of motivational, volitional, and implicit factors on parents' intentions and behavior to engage in sun-protective behaviors for their children. Intentions, perceived behavioral control, and autonomous motivation had small but significant direct effects on behavior. Action planning and habit were also direct predictors of behavior, also with small effect sizes, supporting the effects of volitional strategies and implicit processes. The relative contribution of intentions, action planning, and habit on behavior were similar, indicating that each process appears to have independent effects on behavior. Importantly, the effects were independent of past behavior, so these psychological factors account for unique variance in behavior, regardless of previous experience.

A key contribution of the current research is the confirmation of multiple pathways by which parents' psychological constructs affect sun-protective behaviors toward their children. Consistent with the social cognitive and motivational theoretical components that comprise the deliberative/reasoned component of the IBC model, belief-based (e.g., attitudes) and motivational (autonomous motivation) factors predicted the sun safety behavior of parents for their children. However, we also found that volitional and implicit processes accounted for significant variance in behavior, independent of the deliberative component. Specifically, it seems that both action planning and habit are important unique predictors of behavior. It is interesting, however, that

planning did not account for the intention-behavior effect, as predicted by the health action process approach (Schwarzer, 2008), but predicted behaviour directly.

A number of potential interpretations of this pattern of effects exist. It is possible, for example, that all of these effects are present simultaneously for all participants, such that the behavior is controlled, in part, by all three processes at once. A more likely interpretation, however, is that the different processes impact behavior for specific groups of people with certain characteristics with sufficient strength to present as non-trivial effects at the group level. In other words, some participants' behavior may be more controlled by deliberative effects while others may be more influenced by volitional or implicit factors. This trade-off between deliberative and volitional or implicit factors likely occurs between people as well as within people, shifting across time as behaviors become more habitual. The critical question arising from this interpretation is what conditions determine the processes that control the behavior. In other words, what moderator or set of moderators will determine whether the deliberative and intentional, volitional, or implicit processes predominate in determining parents' sun-protective behavior toward young children?

In the current research, such moderators were unmeasured. Future studies, therefore, would need to systematically identify candidate moderators of these processes and test their impact within an analysis of the validity of the nomological network (Hagger et al., 2016). For example, individual difference factors such as capacity of self-regulation or conscientiousness may moderate the impact of the intentional pathways on behavior. Self-control or affective states may moderate the within-person links between intentions and behavior. The inclusion of such moderators, which have yet to be specified in the IBC model but have been explored in other tests of the component theories (Rhodes, Courneya, & Jones, 2002), may further elucidate the factors that magnify or diminish the proposed processes on behavior according to the model.

The current research also has ramifications for improving sun protection behavior. Based on the findings that motivational, volitional, and implicit factors are all key processes in sun-protection behavior of parents toward their children, future interventions and campaigns should target all three

processes to increase sun-protective intentions and behavior of parents for their young children, ideally using a multifaceted approach. Ongoing Australian community-based campaigns (e.g., "SunSmart") are aimed at improving the awareness and knowledge about UV exposure and messages have, to a large extent, taken the form of education and risk awareness (e.g., "UV. It all adds up" - a recent campaign aimed at increasing people's awareness of the risk of developing skin cancer through incidental exposure to UV radiation) and reminders to be sun safe (e.g., "Slip [on sun-protective clothing]! Slop [on SPF 30+ sunscreen]! Slap [on a broad brimmed hat]! Seek [shade]! Slide [on sunglasses]!"). Community and nation-wide programs have established an improvement in attitudes and behavior over time which corresponds with the public campaigning of these sun-safe messages (e.g., Volkov et al., 2013), and some programs for parents have been shown to increase sun protection for their children (Dadlani & Orlow, 2008). However, reviews on health behavior interventions suggest that the evidence relates more to short-term effects rather than sustained, longer-term impact (Jepson, Harris, Platt, & Tannahill, 2010). Further, it is suggested that multi-component programs achieve greater success in changing behavior (Chase, 2015; Dadlani & Orlow, 2008). Given that current interventions more commonly employ motivational as opposed to structural or environmental strategies to change behavior, the findings of the current study suggest that future interventions should complement techniques targeting motivation and planning with structural and environmental strategies (e.g., prompts or cues to activate implicit constructs for desired behaviors or structuring the environment so as to make unwanted behaviors difficult), which would either activate implicit factors that lead to sun-protective habits or prevent individuals acting 'mindlessly'. By identifying key theory-based constructs, the findings of the current study can be translated into practice by linking key predictors identified with relevant behavior change techniques (see Kok et al., 2016), to develop effective empirical- and theory-based interventions to facilitate parents provision of sun-protection for their young children.

Based on the findings of the current study there are some specific strategies to consider when understanding parental sun protection decisions for young children. First, parents should be

provided with choices for performing such behaviors to instil a sense of internal value and interest toward sun protecting their children, thus improving parents' ratings of their beliefs toward behavioral performance. This strategy is particularly important given that self-determined motivation drives parents' intentions via their social-cognitions. Second, strategies to increase parents' attitudes (e.g., information giving), perceptions of social norms (e.g., social support provisions), and perceptions of control (e.g., behavioral modelling) should be considered to promote intentions as a direct predictor of behavior. Third, given volitional and implicit processes also emerged as direct predictors of behavior, these processes are also important to consider. Engaging parents in formulating plans for sun-safety, monitoring their behavior, and providing cues to action may facilitate greater participation in sun protection behaviors by parents for their children.

Strengths and Limitations

To date, there is a dearth of research that has investigated how motivational, volitional, and implicit processes operate to explain behavior or that attempted to integrate these multiple processes into a testable model. The current study was the first to apply a comprehensive IBC model to the area of sun safety. However, as is the case with most correlational research designs, we recognize that our results do not permit the inference of causality on the basis of the data, only theory. Future research that attempts to manipulate theoretical constructs and measures their influence on behavior change is essential in supporting the tenets of the IBC model for this behavior. The current research does, however, highlight important potential routes to behavioral engagement, which can be used as a basis for interventions that may be efficacious in eliciting behavior change. Moreover, the current study focused on a key target group, parents of young children, whose decisions play an important role in the enforcement and adoption of their children's sun-protective behaviors (Hamilton et al., 2016; Thomson et al., 2012). In addition, a large community-based sample of parents from a region with a high risk of skin cancer was obtained. These findings and future strategies could be used for not only other high risk populations but for various risk populations as well.

Despite these strengths, the results should be considered in light of some limitations. Although various sampling methods were used, the sample predominately comprised married Caucasian mothers and the attrition rate was 27%, with a greater proportion of females, non-Caucasians, full-time employees, and high income earners remaining in the study. Although other studies have found attrition to be higher among parent samples and involving multiple follow-ups (Hamilton, Daniels, Murray, White, & Walsh, 2012; Thomson et al., 2012; Walsh, Hamilton, White, & Hyde, 2015), current results may not generalize across other family structures and cultural groups and reflect predominately the decision making processes of mothers. Measurement limitations also need to be taken into account when interpreting the findings. The study used self-report measures of sun-protective behavior, which may be susceptible to social desirability and recall bias. This was evident by the high means of both intentions and follow-up behavior observed in the current study, contrasting to empirical research which suggests fewer than 50% of parents reported providing regular sun protection for their children (Johnson, Davy, Boyett, Weathers, & Roetzheim, 2001). Further, reporting behavior via a telephone follow-up may have induced demand characteristics, inflating estimates of sun-protective behavior. Although there is no gold standard for measuring sun protection behavior (Dadlani & Orlow, 2008), self-report, prospective diaries, and observation techniques show small positive correlations (Buller & Borland, 1999). In addition, previous research demonstrates an acceptable overlap between self-report and objective measures of sun exposure as well as sun-protective behaviors (Hillhouse, Turrisi, Jaccard, & Robinson, 2012). Also, the item stems of the TPB measures were devised specifically for the target behaviour (albeit adapted from established TPB guidelines and similar TPB studies). Ideally, some preliminary pilot testing of these measures would have ensured that the scales were valid and reliable prior to their use in the current investigation. Finally, in the current study all the sun-protective behaviors were combined in an overall measure of sun protection. This decision was made based on previous research suggesting that adequate sun protection does not require performing of all sun-protective behaviors simultaneously and, thus, separate measures of individual sun-protective behaviors are

not essential to reflect adequate protection (Hamilton et al., 2016; White et al., 2015). Nevertheless, given sunscreen is reported as the most common method of sun protection that parents use for their children (Johnson et al., 2001), it may be advantageous for future research to identify parents' specific intentions and behaviors by examining individual sun-protective behaviors.

Conclusion

The current study tested an IBC model in a sun safety context. Overall, we found support for the majority of the core proposed effects among the motivational, volitional, and implicit factors in the model, as well as their effects on parents' behavior for their children's sun protection. The current study fills a significant knowledge gap in the literature on the multiple processes that guide health behavior and suggests that the IBC model may have utility in explaining health behavior. Future research should investigate possible moderators to establish which of the motivational, volitional, or implicit processes predominate in determining action. Despite the correlational design of the current study, findings suggest multiple potential routes to behavioral performance that can serve as a basis for the development of future sun safety interventions that are efficacious in eliciting behavior change. Future interventions aimed at improving sun-protective practices of parents for their children should therefore consider the application of an IBC model and the multiple-processes it advocates as necessary for motivated action.

References

Allom, V., Mullan, B., Cowie, E., & Hamilton, K. (2016). Physical activity and transitioning to college: The importance of intentions and habits. *American Journal of Health Behavior, 40,* 280-290. doi:http://dx.doi.org/10.5993/AJHB.40.2.13.

Ajzen, I. (1991). The theory of planned behaviour. *Organizational Behaviour and Human Decision Processes, 50,* 179-211. doi:10.1016/0749-5978(91)90020-T

Arnautovska, U., Fleig, L., O'Callaghan, F., & Hamilton, K. (2017). A longitudinal investigation of older adults' physical activity: Testing an integrated dual-process model. *Psychology & Health, 32*, 166-185. doi:10.1080/08870446.2016.

ARPNSA. (2017). *Australian UV index monthly summaries.* Retrieved 26/01/2017 from: http://www.arpansa.gov.au/uvindex/monthly/ausmonthlyindex.htm

AIHW. (2012). *Cancer in Australia: an overview, 2012* (Cancer series no. 74. Cat no. CAN 70). Canberra: Australian Institute of Health and Welfare & Australasian Association of Cancer Registries.

Buller, D. B., & Borland, R. (1999). Skin cancer prevention for children: a critical review. *Health Education & Behavior, 26*, 317-341. doi:10.1177/109019819902600304

Cancer Council Australia. (2016). *Skin cancer*. Retrieved 12/02/2016 from: http://www.cancer.org.au/about-cancer/types-of-cancer/skin-cancer.html

Chase, J. A. (2015). Interventions to increase physical activity among older adults: A meta-analysis. *The Gerontologist, 55,* 706-718. doi:10.1093/geront/gnu090

Dadlani, C., & Orlow, S. J. (2008). Planning for a brighter future: a review of sun protection and barriers to behavioural change in children and adolescents. *Dermatology Online Journal*. Retrieved 12/08/2016 from http://escholarship.org/uc/item/6vs1r0r9

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic Motivation and Self-Determination in Human Behavior*. New York: Plenum Press.

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. doi:10.1016/S0065-2601(06)38002-1

Green, A. C., Wallingford, S. C., & McBride, P. (2011). Childhood exposure to ultraviolet radiation and harmful skin effects: Epidemiological evidence. *Progress in Biophysics and Molecular Biology, 107*, 349-355. doi:10.1016/j.pbiomolbio.2011.08.010

Hagger, M. S. (2016). Non-conscious processes and dual-process theories in health psychology. *Health Psychology Review, 10*, 375-380. doi:10.1080/17437199.2016.1244647

Hagger, M. S., Chan, D. K. C., Protogerou, C., & Chatzisarantis, N. L. D. (2016a). Using meta-analytic path analysis to test theoretical predictions in health behavior: An illustration based on meta-analyses of the theory of planned behavior. *Preventive Medicine, 89*, 154-161. doi:10.1016/j.ypmed.2016.05.020

Hagger, M. S., & Chatzisarantis, N. (2014). An integrated behavior change model for physical activity. *Exercise and Sport Sciences Reviews, 42*, 62-69. doi:10.1249/JES.0000000000000008

Hagger, M. S., & Chatzisarantis, N. L. D. (2015). Self-determination theory. In M. Conner & P. Norman (Eds.), *Predicting and changing health behaviour: Research and practice with social cognition models* (3rd ed., pp. 107-141). Maidenhead, UK: Open University Press.

Hagger, M. S., & Chatzisarantis, N. L. D. (2016). The trans-contextual model of autonomous motivation in education: Conceptual and empirical issues and meta-analysis. *Review of Educational Research, 86*, 360-407. doi:10.3102/0034654315585005

Hagger, M. S., Sultan, S., Hardcastle, S., Reeve, J., Patall, E. A., Fraser, B., … Chatzisarantis, N. (2016b). Applying the integrated trans-contextual model to mathematics activities in

the classroom and homework behavior and attainment. *Learning and Individual Differences, 45*, 166-175. doi:10.1016/j.lindif.2015.11.017.

Hagger, M. S., Trost, N., Keech, J., Chan, D. K. C., & Hamilton, K. (2017). Predicting sugar consumption: application of an integrated dual-process, dual-phase model. Advance online publication. *Appetite*. doi:10.1016/j.appet.2017.04.032

Hamilton, K., Cleary, C., White, K. M., & Hawkes, A. (2016). Keeping kids sun safe: Exploring parents' beliefs about their young child's sun-protective behaviours. *Psycho-Oncology, 25*, 158-163. doi:10.1002/pon.3888.

Hamilton, K., Cox, S. & White, K. M., (2012). Testing a model of physical activity among mothers and fathers of young children: Integrating self-determined motivation, planning, and theory of planned behavior. *Journal of Sport & Exercise Psychology, 34*, 124-145.

Hamilton, K., Daniels, L., Murray, N., White, K.M., & Walsh, A. (2012). Mothers' perceptions about introducing complementary feeding at 6 months: identifying critical belief-based targets for promoting adherence to current infant feeding guidelines. *Journal of Health Psychology, 17*, 121-131. doi:10.1177/1359105311409786.

Hamilton, K., Kirkpatrick, A., Rebar, A., White, K.M. & Hagger, M.S. (Epub ahead of print, 2017). Protecting young children against skin cancer: Parental beliefs, roles, and regret. *Psycho-Oncology*. doi:10.1002/pon.4434.

Hamilton, K., Spinks, T., White, K. M., Kavanagh, D. J., & Walsh, A. M. (2016). A psychosocial analysis of parents' decisions for limiting their young child's screen time: an examination of attitudes, social norms and roles, and control perceptions. *British Journal of Health Psychology, 21*, 285-301. doi:10.1111/bjhp.12168.

Hamilton, K., & White, K. M. (2010). Understanding parental physical activity: meanings, habits, and social role influence. *Psychology of Sport and Exercise, 11*, 275-285.

Hamilton, K., White, K. M., Young, R., Hawkes, A., Starfelt, L. C., Leske, S. (2012). Identifying critical sun-protective beliefs among Australian adults. *Health Education Research, 27*, 834-843. doi:10.1093/her/cys093.

Hillhouse, J., Turrisi, R., Jaccard, J., & Robinson, J. (2012). Accuracy of self-reported sun exposure and sun protection behaviour. *Prevention Science: The Official Journal of the Society for Prevention Research, 13*, 519-531. doi:10.1007/s11121-012-0278-1

Hornung, R. L. (2000). Sun protection in children. *Current Problems in Pediatrics, 30*, 305-307. doi:10.1016/S0045-9380(00)80024-9

Jepson, R. G., Harris, F. M., Platt, S., & Tannahill, T. (2010). The effectiveness of interventions to change six health behaviours: a review of reviews. *BMC Public Health, 10*, 538. doi:10.1186/1471-2458-10-538

Johnson, K., Davy, L., Boyett, T., Weathers, L., & Roetzheim, R. G. (2001). Sun protection practices for children: Knowledge, attitudes, and parent behaviours. *Archives of Pediatrics & Adolescent Medicine, 155*, 891-897. doi:10.1001/archpedi.155.8.891

Kok, G., Gottlieb, N. H., Peters, G.-J. Y., Mullen, P. D., Parcel, G. S., Ruiter, R. A. C., . . . Bartholomew, L. K. (2016). A taxonomy of behavior change methods: An intervention mapping approach. *Health Psychology Review, 10*, 297-312. doi:10.1080/17437199.2015.1077155

Kock, N. (2015). *WarpPLS 5.0 User Manual*. Laredo, TX: ScriptWarp Systems.

McEachan, R. R. C., Conner, M. T., Taylor, N., & Lawton, R. J. (2012). Prospective prediction of health-related behaviors with the Theory of Planned Behavior: A meta-analysis. *Health Psychology Review, 5*, 97-144. doi:10.1080/17437199.2010.521684

Rebar, A. L., Dimmock, J. A., Jackson, B., Rhodes, R. E., Kates, A., Starling, J., & Vandelanotte, C. (2016). A systematic review of the effects of non-conscious regulatory processes in physical activity. *Health Psychology Review, 10*, 395-407. doi:10.1080/17437199.2016.1183505

Reyes Fernández, B., Knoll, N., Hamilton, K., Schwarzer, R. (2016). Social-cognitive antecedents of hand washing: action control bridges the planning-behavior gap. *Psychology & Health, 31,* 993-1004. doi:10.1080/08870446.2016.1174236

Rhodes, R. E., Courneya, K. S., & Jones, L. W. (2002). Personality, the Theory of Planned Behavior, and exercise: a unique role for extroversion's activity facet. *Journal of Applied Social Psychology, 32,* 1721-1736. doi:10.1111/j.1559-1816.2002.tb02772.x

Rich, A., Brandes, K., Mullan, B. A., & Hagger, M. S. (2015). Theory of planned behavior and adherence in chronic illness: A meta-analysis. *Journal of Behavioral Medicine, 38,* 673-688. doi:10.1007/s10865-015-9644-3

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality & Social Psychology, 57,* 749-761. doi:10.1037/0022-3514.57.5.749

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

Sniehotta, F. F., Schwarzer, R., Scholz, U., & Schuz, B. (2005). Action planning and coping planning for long-term lifestyle change: Theory and assessment. *European Journal of Social Psychology, 35,* 565-576.

Spinks, T., & Hamilton, K. (2016). Investigating mothers' decisions to give their 2-3 year old a nutritionally balanced diet. *Journal of Nutrition Education and Behavior, 48,* 250-257.

Stern, R. S., Weinstein, M. C., & Baker, S. G. (1986). Risk reduction for nonmelanoma skin cancer with childhood sunscreen use. *Archives of Dermatology, 122,* 537-545. doi:10.1001/archderm.1986.01660170067022

Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behavior. *Personality and Social Psychology Review, 8,* 220-247.

Tenenhaus, M., Vinzi, V. E., Chatelin, Y.-M., & Lauro, C. (2005). PLS path modeling. *Computational Statistics & Data Analysis, 48,* 159-205.

Thomson, C. E., White, K. M., Hamilton, K. (2012). Investigating mothers' decisions about their child's sun-protective behaviour using an extended Theory of Planned Behaviour. *Journal of Health Psychology, 17*, 1001-1010. doi:10.1177/1359105311433905.

Verplanken, B., & Orbell, S. (2003). Reflections on past behavior: A self report index of habit Strength. *Journal of Applied Social Psychology, 33*, 1313-1330.

Volkov, A., Dobbinson, S., Wakefield, M., & Slevin, T. (2013). Seven-year trends in sun protection and sunburn among Australian adolescents and adults. *Australian And New Zealand Journal Of Public Health, 37*, 63-69. doi:10.1111/1753-6405.12012

Walsh, A., Hamilton, K., White, K. M., & Hyde, M. (2015). Use of online health information to manage children's health care: a prospective study investigating parental decisions. *BMC Health Services Research*, 15:131. doi:10.1186/s12913-015-0793-4.

White, K. M., Starfelt, L. C., Young, R. M., Hawkes, A. L., Leske, S., & Hamilton, K. (2015). Predicting Australian adults' sun-safe behaviour: Examining the role of personal and social norms. *British Journal of Health Psychology, 20*, 396-412. doi:10.1111/bjhp.12108

WHO. (2015). Ultraviolet radiation and the INTERSUN Programme. Retrieved 29/03/15, from http://www.who.int/uv/en/

Zhou, G., Gan, Y., Miao, M., Hamilton, K., Knoll, N., & Schwarzer, R. (2015). The role of action control and action planning on fruit and vegetable consumption. *Appetite, 91*, 64-68. doi:10.1016/j.appet.2015.03.022

Table 1
Child Sun Safety: Demographic Data and Descriptive Statistics for Study Variables Across Time Points

Variable	Time 1	Time 2
Participants	373	273
Age, *M* years (SD)	35.09 (5.39)	34.80 (5.21)
Parent gender (*n* female, *n* male)	314, 59	238, 35
Child gender of youngest child aged 2 to 5 years (*n* female, *n* male)	192, 181	138, 135
Employment status		
currently unemployed/full-time caregiver	78	65
currently employed full-time	141	85
part-time/casual employed	126	100
full-time/part-time student	28	23
Ethnicity		
Caucasian	335	253
Indigenous/Torres Strait Islander	8	5
Asian	10	2
Pacific Islander	5	3
African	8	7
Other	7	3
Income[a]		
zero-$18,000	8	6
$18201-$37,000	21	20
$37001-$80,000	72	49
$80,001-$180,000	215	165
$180,000+	54	32
Education level[b]		
Junior school	9	8
Senior school	41	27
TAFE/diploma	104	75
University undergraduate degree	132	100
University postgraduate degree	85	62
Psychological variables, *M* (SD)		
Attitude	5.82 (1.04)	5.90 (1.10)
Subjective norm	5.91 (0.93)	6.23 (0.69)
Perceived behavioral control	5.73 (1.13)	5.89(0.96)
Intention	6.24 (0.91)	6.43 (0.69)
Autonomous motivation	6.25 (0.97)	6.41 (0.68)
Controlled motivation	4.04 (1.52)	4.41 (1.24)
Action planning	4.94 (1.51)	5.18 (1.46)
Habit	4.78 (1.22)	5.01 (1.28)
Past behavior	5.41 (1.49)	5.70 (1.31)
Behavior	–	5.64 (1.34)

Note. [a]Three participants did not report their income; [b]Two participants did not report their education level.

Table 2

Child Sun Safety: Measurement Model Statistics and Factor Intercorrelations for Integrated Behavior Change Model Latent Variables

Variable	AVE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1. Attitude	.680***	.914															
2. Sub. norm.	.591***	.314***	.876														
3. PBC	.580***	.361***	.330***	.847													
4. Intention	.840***	.521***	.473***	.463***	.955												
5. Past behavior	.844***	.388***	.375***	.296***	.461***	.956											
6. Behavior	.825***	.336***	.321***	.298***	.442***	.667***	.950										
7. Aut. mot.	.696***	.423***	.440***	.297***	.607***	.540***	.373***	.901									
8. Con. mot.	.561***	.166**	.191**	.220***	.300***	.331***	.180**	.347***	.836								
9. Act. Plan.	.840***	.194**	.182**	.172**	.325***	.399***	.354***	.331***	.242***	.955							
10. Habit	.665***	.424***	.342***	.273***	.466***	.644***	.522***	.527***	.320***	.398***	.960						
11. No. of children	–	.051	-.076	-.030	-.074	-.173**	-.020	-.107	-.032	.033	-.048	–					
12. Age	–	-.075	.007	-.169**	-.102	.043	.066	-.000	-.069	-.017	-.004	.155*	–				
13. Gender	–	.003	.074	-.089	-.030	-.035	-.011	-.025	-.023	.026	-.000	-.076	.251***	–			
14. Emp. status	–	.041	-.002	-.148*	.012	-.009	-.007	-.003	-.055	.011	-.027	-.079	.073	.503***	–		
15. Income	–	-.067	-.108	-.203***	-.115	-.076	-.057	-.077	-.077	-.093	-.153**	.007	.223***	.173**	.148**	–	
16. Ethnicity	–	.035	.026	.040	.003	.048	-.032	.115	.144*	.045	-.015	.007	-.009	.053	-.007	.238***	
17. Education	–	.073	.016	-.048	.033	.044	.112	.026	-.020	.076	.004	.050	.123*	-.008	-.056	.112	-.

Note. Composite reliability coefficients shown on principal diagonal; AVE = Average variance extracted; Sub. norm = Subjective norm; PBC = Perceived behavioral control; Aut. motivation = Autonomous motivation; Con. motivation = Controlled motivation; Act. plan. = Action planning; Emp. status = Employment status.

***p < .001 **p < .01 *p < .05.

Figure 1. Child sun safety: Hypothesized relations among integrated behavior change model constructs.

Note. Broken lines between constructs indicate effects tested in the model but hypothesized to be null. The following covariates were set to predict all model variables but omitted from the diagram for clarity: Parents' past sun safety behavior for their children, age, gender, employment status, income, ethnicity, education, and number of children were included as control variables. All hypothesized effects were proposed to be positive in direction, with the exception of H_4 and H_6, which were hypothesized to be non-significant.

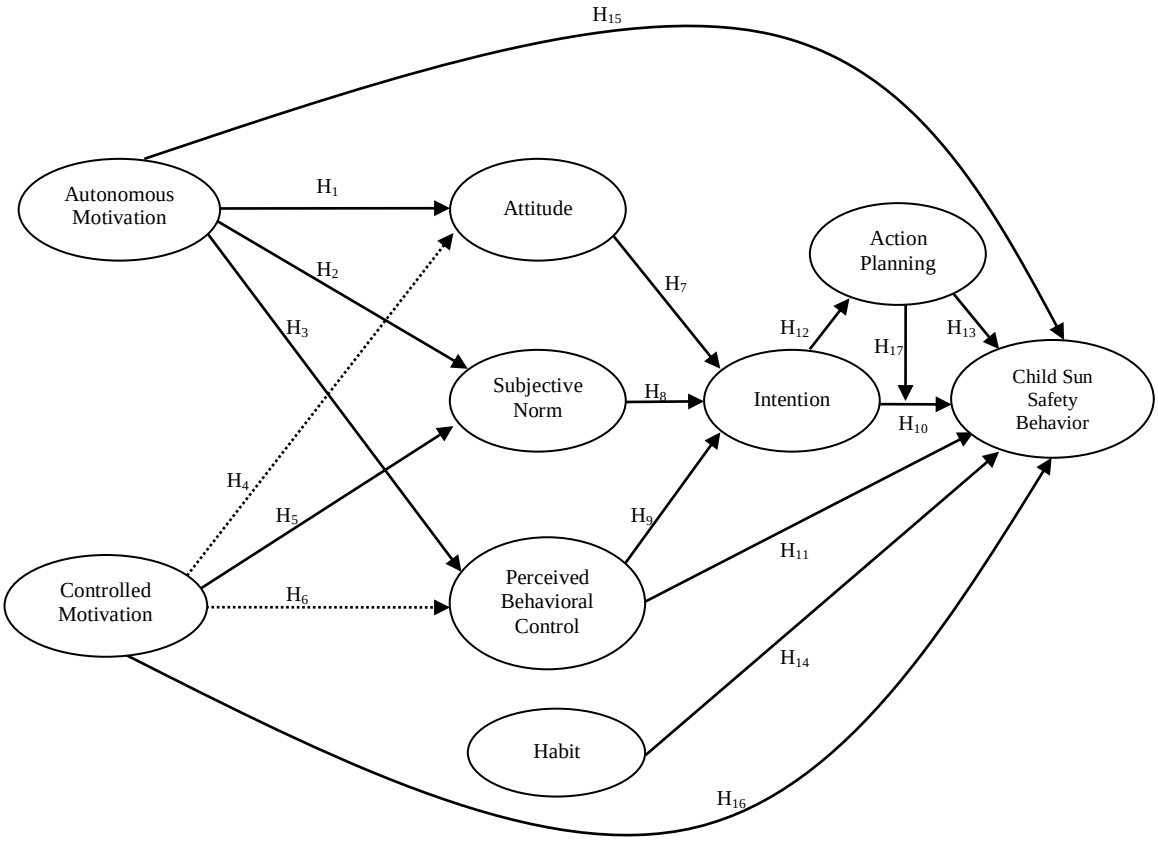

Figure 2. Child sun safety: Standardized path coefficients for structural equation model of relations among integrated behavior change model constructs including past behavior.

Note. Broken lines between constructs indicate effects tested in the model but hypothesized to be null.