Article:

Conner, M orcid.org/0000-0002-6229-8143, McEachan, R, Taylor, N et al. (2 more authors) (2015) Role of affective attitudes and anticipated affective reactions in predicting health behaviors. Health Psychology, 34 (6). pp. 642-652. ISSN 0278-6133

https://doi.org/10.1037/hea0000143

Role of Affective Attitudes and Anticipated Affective Reactions in Predicting Health Behaviors

Mark Conner[1*], Rosemary McEachan[2], Natalie Taylor[2,3], Jane O'Hara[2], Rebecca Lawton[1,2]

[1]University of Leeds, UK

[2]Bradford Institute of Health Research, UK

[3]University of New South Wales, Australia

* Address for correspondence:

Professor Mark Conner

Institute of Psychological Sciences

University of Leeds

LEEDS LS2 9JT

U.K.

email: m.t.conner@leeds.ac.uk

Running head: AFFECT AND HEALTH BEHAVIOR

The research reported here was supported by a grant from the British Academy.

Accepted 27 June 2014

Role of Affective Attitudes and Anticipated Affective Reactions in Predicting Health Behaviors

Abstract

Objective: Two measures of affect (affective attitude, AA; anticipated affective reaction, AAR) have frequently been used individually but rarely simultaneously in correlational studies predicting health behaviors. This research assessed their individual and combined impact in predicting intention and action for a range of health behaviors controlling for Theory of Planned Behavior (TPB) variables. **Main Outcome Measures**: Self-reported intentions and performance of health behaviors. **Design**: Study 1 is a meta-analysis of published studies (k = 16) measuring the relevant variables. In Study 2 adults (N = 426) completed questionnaires assessing TPB variables, past behavior, AA, AAR and subsequent behavior for a range of health behaviors. **Results**: Across both studies AA and AAR were only moderately inter-correlated, although both had significant correlations with both intentions and behavior. AA was a significant predictor of intentions and behavior after controlling for TPB variables (Studies 1 and 2) plus past behavior (Study 2). In Study 1 AAR was a significant predictor of behavior but not intentions when controlling for TPB variables. In Study 2 AAR was a significant predictor of intentions when controlling for both TPB variables plus past behavior (Study 2) but was not a significant predictor of behavior when controlling for either of these variables. Several relationships were moderated by health-behavior category. **Conclusions**: Both AA and AAR are important predictors of health behaviors and can have independent effects on intentions and action. Studies manipulating both variables to test their independent and combined effects on behavior change are required.

Key words: theory of planned behavior; affective attitude; anticipated affective reaction; health behavior.

Social Cognition Models such as Ajzen's (1991) Theory of Planned Behavior (TPB) have been praised for strong predictions of various health behaviors based on a small number of cognitive variables but criticized for failing to consider the role of affective variables. The present research examined the simultaneous predictive power of two key affective variables (affective attitudes, AA; anticipated affective reactions, AAR) in predicting intentions and action for a range of health behaviors and the impact of controlling for cognitive predictors from the TPB and past behavior.

The TPB and other social cognition models (Conner & Norman, 2005) have long been used to understand and predict various health behaviors. The TPB holds that behavior is determined by intentions and perceived behavioral control (PBC). Intentions are measured as plans or motivation to act, while PBC is measured as the perceived degree of control or (similar to self-efficacy) confidence the individual has over performing the behavior. Intentions themselves are held to be determined by attitudes, subjective norms, and PBC. Attitudes are measured as the overall evaluation of the behavior, while subjective norms are measured as perceptions of the reactions and behavior of important others. Despite its use in this domain prompting debate (e.g., Ajzen, 2014; Sniehotta, Presseau, & Araujo-Soares, 2014), the TPB has been shown to strongly predict various health behaviors (McEachan, Conner, Taylor, & Lawton, 2011). It is, however, firmly grounded in the cognitive tradition and focuses on cognitive at the expense of affective influences. Previous work has noted the failure of the TPB and similar models to adequately account for the role of affect (e.g., Manstead & Parker, 1995). There is a long established distinction between cognitive and affective attitudes (e.g., Abelson, Kinder, Peters, & Fiske, 1982) that more recently has been included in the TPB. For example, Ajzen and Fishbein (2005) noted that researchers measuring attitudes within the TPB should tap both cognitive/instrumental and affective components.

Usually such affective components of attitudes are tapped by semantic differentials such as 'unpleasant-pleasant' or 'unenjoyable-enjoyable' while cognitive or instrumental components of attitudes are tapped by items such as 'harmful-beneficial' or 'worthless-valuable' (Crites, Fabrigar,

& Petty, 1982). A number of studies of health behaviors have demonstrated such affective attitudes (AA) to be strong predictors of intentions and action (e.g., Lawton, Conner, & McEachan, 2009; Lawton, Conner & Parker, 2007) often at the expense of instrumental attitudes.

A second, distinct body of research has examined affective influences within models such as the TPB in a different way. The affect measures used in such research are usually labelled anticipated affective reactions (AAR) with the majority of research focusing on anticipated regret (Rivis, Sheeran, & Armitage, 2009; Sandberg & Conner, 2008). AA and AAR can be distinguished in three important ways. First, AAR tend to focus on what Giner-Sorolla (2001) describes as self-conscious emotions (e.g. regret, guilt), whereas AA tend to focus on hedonic emotions (e.g., enjoyment, excitement). Second, research on AAR has tended to examine the negative affect associated with non-performance of the behavior, while research on AA has tended to focus on the positive affect associated with performance of the behavior. Third, work on AAR tends to focus on the affect that is expected to follow performance or non-performance of a behavior, while AA tends to focus on the affect that is expected to occur while the behavior is being performed. In support of these conceptual differences, health behavior studies have demonstrated the discriminant validity of measures of AA and AAR (Conner, Godin, Sheeran, & Germain, 2013).

Despite these differences relatively few studies in the health domain have examined the simultaneous effects of AA and AAR as determinants of intentions and behavior within the context of the TPB. Examining the role of AA and AAR within the context of the TPB allows us to examine their effects while controlling for known key cognitive determinants of intentions and behavior. The present research aimed to examine the predictive power of AA and AAR across a range of health behaviors to aid generalizability. A further aim was to examine whether their power to predict intentions and behavior varied as a function of the category of health behavior examined. A common distinction among categories of health behaviors (e.g., Roysamb, Rise, & Kraft, 1997) is between protection (e.g., physical activity), risk (e.g., smoking) and detection (e.g., screening).

Lawton et al. (2009) use Russell's (2003) theory of emotion to argue that the influence of AA will be strongest for those behaviors that have a more immediate impact on the senses or physiological state and weakest amongst behaviors where the impact is less immediate. Russell (2003) proposes that affective qualities are attributed to behaviors as a result of experiencing the emotion when enacting the behavior and that this guides intention and action. In modulating our general mood state we may engage in behaviors to which we attribute changes in affect. So when we engage in exercise we do so to make ourselves feel energized or when we smoke we do so to feel relaxed. These affective qualities attributed to the behaviors may then motivate further enactment of the behavior, particularly in circumstances where core affect is off-balance, e.g. we feel tired or anxious. Various health risk (e.g., drinking alcohol) and health protection (e.g., exercise) behaviors are likely to have more immediate impact on the senses or physiological state, while various detection behaviors (e.g., self-examination) are likely to have less immediate impact. On this basis we might expect AA to have a stronger impact on intentions and actions for risk and protection behaviors compared to detection behaviors. Although less clear cut, AAR might be expected to have a stronger effect on detection compared to protection or risk behaviors because it is the less immediate AAR such as regret or guilt that are likely to dominate here in the absence of AA effects.

In summary, the present research examined the role of AA and AAR as predictors of intentions and action across a range of health behaviors when measured alongside other cognitive predictors from the TPB. Study 1 was a meta-analysis of the available studies reporting these relationships and health-behavior category as a potential moderator of these effects. Study 2 was a prospective test of the effects of AA and AAR on intentions and action across a range of protection, risk and detection health behaviors in the same sample of individuals and the effects of controlling for both TPB variables plus past behavior. We test for significant differences in the effects of AA and AAR on intention and action across these three categories of health behavior.

Study 1

Study 1 reports a meta-analysis of published studies that measured AA, AAR and the components of the TPB in relation to a health behavior and also measured action using a prospective design.

Method

Search and Inclusion/Exclusion Criteria

To obtain relevant studies a range of search strategies were employed. First, several electronic databases (ISI Web of Science, MEDLINE, PsycINFO) were searched on 7th January 2014 using the following search strings: theory of planned behavi*, Ajzen, affective attitude, anticipated affect*, anticipated regret. Second, citation searches were performed in ISI Web of Science on two key papers (Rivis et al., 2009; Sandberg & Conner, 2008). Third, reference lists of all included articles were manually searched. The following inclusion/exclusion criteria were then applied: (a) studies had to report a prospective test of the TPB to a health behavior; (b) all components of the TPB (intention, attitude, subjective norm, PBC, behavior) and a measure of AAR had to be included and all bivariate correlations reported; (c) papers from meeting abstracts or unpublished research were not included. Where examination of a study revealed the use of a measure of attitude combining affective (e.g., unpleasant-pleasant) and cognitive/instrumental (e.g., unhealthy-healthy) elements, authors were contacted to request correlations for the individual components (i.e., affective attitude and instrumental attitude separately). Based on these search criteria and inclusion/exclusion criteria a total of 14 papers (containing 16 independent tests, N = 6121) were retained in the review.

Coding

Studies (Table 1) were coded into protection (e.g., exercise; k = 5); risk (e.g., smoking; k = 6); detection (e.g., breast self-examination; k = 3); and other (e.g., blood donation; k = 2) behaviors. Given the limited number of studies in the ‘other’ category this was not further considered in analyzing the moderating effect of behavior-category. We also coded whether behavior measures were self-report (k = 12) or objective (k = 4) and time delay from completing cognition measures to measurement of behavior (Table 1). However, no significant moderating effects for any relationships with behavior emerged for either type of behavior measure or time delay and so these moderators are not further considered here.

Analysis

Random effects meta-analysis was conducted using the comprehensive meta-analysis program (Borenstein, Hedges, Higgins, & Rothstein, 2005) with effect size estimates weighted by sample size. Mean effect sizes (r_+), standard deviations, heterogeneity estimates (*Q* statistic), percentage of variation accounted for by statistical artifacts (I^2), and fail-safe numbers (FSN) were computed. FSNs were compared against Rosenthal's (1984) tolerance level to assess potential file drawer problems. We also used the Duval and Tweedie (2000) trim and fill procedure to identify potential publication bias. Significant *Q* and I^2 greater than 75% were taken as indicators of heterogeneity. A moderator variable was considered to be significant when the 95% confidence intervals (95%CI) around the estimates of effect sizes (r_+) for the different levels of a moderator did not overlap. In such instances we report the mean effect size (r_+) at each level of the moderator variable and the associated 95%CI.

Results

General test of the model

The magnitude of the mean frequency-weighted correlations (r_+), the standard deviation (SDr_+), heterogeneity of findings across studies (Q statistic), the percent variation accounted for by statistical artifacts (I^2), and fail-safe numbers (FSN) are presented in Table 2. In line with TPB tenets, intention ($r_+ = .431$) and PBC ($r_+ = .326$) showed the strongest relationships with subsequent behavior. These represent medium-large effects according to Cohen's (1992) classification of effect sizes and are of similar magnitude to those reported in meta analyses of the TPB to health behaviors (McEachan et al., 2011). AA ($r_+ = .274$) and AAR ($r_+ = .228$) were the next strongest predictors of behavior with small-medium sized effects. Instrumental attitudes ($r_+ = .183$) and subjective norms

(r_+ = .141) showed the weakest relationships, although still in the small-medium sized range. In relation to correlations with intentions, the predictors were less differentiated. PBC (r_+ = .557) had a large sized effect on intentions, with AAR (r_+ = .474), cognitive/instrumental attitude (r_+ = .410), and AA (r_+ = .403) having medium-large sized effects and subjective norms (r_+ = .315) a medium sized effect. AA and AAR showed only a moderate degree of overlap (r_+ = .289). All fail-safe numbers exceed Rosenthal's (1984) recommended tolerance level suggesting it is unlikely that file drawer studies with null effects would render the reported relationships as non-significant. Trim and fill analyses (Duval & Tweedie, 2000) in the Comprehensive Meta-Analysis program revealed two effect sizes were affected by this procedure: in the affective attitude-instrumental attitude relationship 3 studies were 'trimmed' changing the effect size from .510 (95%CI = .422—.589) to .453 (95%CI = .356—.540); in the perceived behavioral control-intentions relationship 1 study was 'trimmed' changing the effect size from .557 (95%CI = .488—.619) to .541 (95%CI = .470—.605).

Regression analyses (Table 3, Step 2) based on these mean correlations (Table 2) indicated that adding AA and AAR after controlling for the other components of the TPB explained significant additional variance in both intentions (2.1% of additional variance explained; $F(2,6115) = 108.5$, $p < .001$) and behavior (2.1% of additional variance explained; $F(2,6114) = 82.5$, $p < .001$). AA was a significant predictor of both intentions and behavior, while AAR was a significant predictor of behavior but not intentions. When not controlling for other components of the TPB both AA and AAR were significant independent predictors of both intention (18.9% of variance explained; $F(2,6118) = 715.2$, $p < .001$; AA: $B = .353$, $SE = .012$, $\beta = .353$, $p < .001$; AAR: $B = .172$, $SE = .012$, $\beta = .172$, $p < .001$) and behavior (9.9% of variance explained; $F(2,6118) = 337.0$, $p < .001$; AA: $B = .227$, $SE = .013$, $\beta = .227$, $p < .001$; AAR: $B = .162$, $SE = .013$, $\beta = .162$, $p < .001$).

Moderators

It is worth noting that all the overall mean correlations reported in Table 2 were subject to substantial variability as demonstrated by the significant values for the Q statistic for all correlations.

The I^2 values, ranging between 77% (AA–Behavior relationship) and 95% (Intention–Behavior relationship), also indicated substantial variability, and highlighted the need to look for moderators. Health-behavior category was a significant moderator for four of the correlations (Table 2). Most importantly, and partially consistent with predictions, the relationship between AA and intentions was significantly stronger for risk ($r_+ = .511$, *95%CI* = .440—.576, $k = 6$) than detection ($r_+ = .253$, *95%CI* = .124—.374, $k = 3$) behaviors, but not different from protection ($r_+ = .357$, *95%CI* = .260—.448, $k = 5$) behaviors. The relationship between AA and AAR was also significantly stronger for risk ($r_+ = .446$, *95%CI* = .307—.567, $k = 6$) than detection ($r_+ = .015$, *95%CI* = -.212—.241, $k = 3$) behaviors but not different from protection ($r_+ = .253$, *95%CI* = .077—.414, $k = 5$) behaviors. Less central to our predictions, the relationship between PBC and intention was significantly stronger for protection ($r_+ = .671$, *95%CI* = .569—.752, $k = 5$) than risk ($r_+ = .429$, *95%CI* = .301—.541, $k = 6$) behaviors but not different from detection ($r_+ = .615$, *95%CI* = .469—.729, $k = 3$) behaviors. Finally, the relationship between subjective norm and behavior was significantly stronger for risk ($r_+ = .202$, *95%CI* = .100—.300, $k = 6$) than protection ($r_+ = -.027$, *95%CI* = -.147—.093, $k = 5$) behaviors but not different from detection ($r_+ = .263$, *95%CI* = .118—.397, $k = 3$) behaviors.

Discussion

Study 1 reported a meta-analysis of the available studies focusing on health behaviors examining the impact of AA and AAR in the context of the TPB. The two affect variables were found to have a modest degree of intercorrelation (i.e., small-medium effect size, $r_+ = .289$), although this was significantly larger for risk behaviors than for detection behaviors. Both AA and AAR were shown to have small-medium sized correlations with behavior and medium-large sized correlations with intentions, although the AA–intention relationship was significantly weaker for detection behaviors compared to risk behaviors, as predicted. Regression analyses demonstrated both AA and AAR to have independent effects on both intentions and behavior, although the beta weight for AAR on intentions became non-significant when controlling for other TPB variables

(Table 3). Lack of significant moderating effects for type of behavior measure (objective vs. self-report) and time delay from measure of cognitions to measure of behavior suggest the findings are consistent across these moderators (although the number of studies limits the power of such analyses). The large fail safe numbers observed and the results of the trim and fill analyses support the idea that the present findings are not unduly influenced by issues linked to file drawer or publication bias. Together these findings provide strong support for considering both AA and AAR as important, independent predictors of intentions and action across a range of health behaviors.

However, there are a number of limitations with Study 1 that mean that the above conclusions must be treated with some caution. First, the number of tests included in the meta-analysis is modest in terms of absolute number of tests ($k = 16$) and in terms of the range of health behaviors included (Table 1). This may limit the generalizability of the findings and did limit the power of the moderation tests by behavior-category. With this in mind we dropped comparisons with the ‘other behavior’ category because the number of studies was so limited ($k = 2$). Second, although the above studies were all prospective tests of the TPB, they did not control for the influence of past behavior. We were therefore unable to estimate the effects of these affect variables on intentions and behavior when controlling for past behavior, an important consideration when addressing behavior change (Weinstein, 2007). Study 2 was designed specifically to address these weaknesses by examining the effects of these two affect variables in the context of TPB variables plus past behavior in a single sample across a broad range of health behaviors. Using one sample partly controls for any impact of sample variation across different categories of health behavior.

Study 2

Study 2 was a prospective study that assessed AA, AAR, TPB variables, past behavior and then later behavior in a sample of UK adults. A range of health behaviors (split into protection, risk and detection categories) were examined within the same individuals to help remove any impact of sample variations on differences across behaviors.

Method

Respondents and Procedure

Following ethical approval, participants were recruited in England via a variety of means (e.g., local newspaper advert, Local Government newsletter, internet advert) to a study requiring the completion of questionnaires on three occasions each approximately one month apart. In return for their time, respondents received £20 (approximately $40) worth of gift vouchers following the return of the final questionnaire. Data from the first two phases of the study, Time 1 and Time 2 (one month later) are reported here. A maximum of 426 participants provided useable data (approximately 77% of the number of questionnaires sent out at baseline), although full data was not available for all participants on all behaviors (see below). The sample included 315 females (74%) and 111 males with a median age of 38 years. The majority of the sample were in a relationship (71%), either married (40%), cohabiting (18%) or living separately (13%); 59% had at least one child. The highest educational qualification of the sample was: GCSE (American high school diploma at 10th grade; 32%), A-level (American SAT; 18%), vocational qualification (13%), degree (24%) or postgraduate qualification (12%). Comparisons with National Statistics for England (Census data, 2001) showed the sample to be similar to the national population from which they were drawn for age (mean age = 38.6 years for England) and education (20% at degree level or above for England), but less likely to be married (49% for England) and more likely to be female (52% for England).

Measures

Participants completed a questionnaire measuring the same constructs for each of 20 health-related behaviors. Inclusion of behaviors was based on UK government targets for health (Department of Health, 1999, 2004) and health behaviors prevalent in the psychological and public health literature. There were 10 health protection (eat 5 fruit and vegetables per day, wear a helmet when riding a bicycle, take recommended levels of physical activity, exercise regularly, eat a low fat diet, use sunscreen of at least 15SPF when exposed to the sun, adhere to all medication prescribed by a doctor, take vitamin supplements, brush teeth twice a day, floss teeth daily); 6 health risk (binge drinking, drink more than the recommended daily limits of alcohol, smoking, using illegal drugs, exceeding the posted speed limit when driving, drinking and driving); and 4 detection (visit dentist for yearly check-ups, attend health screening appointment when invited, visit doctor for a health problem, testicular/breast self-examination) behaviors. Where guidelines existed, the behaviors were specified in detail, e.g., eating five fruit and vegetables per day; using sunscreen of at least 15SPF (sun protection factor). All questions except behavior were responded to on a 1-7 scale and were rescored such that higher values represented more positive views of positive health behaviors (or more negative view of negative health behaviors). Due to time and space considerations single item measures were used for a number of constructs. Although the majority of behaviors were relevant to all participants, several behaviors were only relevant to a sub-set of participants. In the analyses we only included those participants who, in a separate item, reported: driving a car (n = 274) for drink driving and speeding behaviors; riding a bike (n = 68) for wearing a cycle helmet; being invited for screening (n = 63) for health screening attendance; needing to visit a doctor (n = 186) for visit doctor; being exposed to the sun (n = 209) for sunscreen use; being prescribed medication (n = 150) for taking medication; being a smoker (n = 73) for smoking.

Intention was measured by two items that remained consistent across behaviors (e.g., 'I intend to exercise regularly over the next four weeks, strongly disagree-strongly agree'; 'I am likely to exercise regularly over the next four weeks, very unlikely-very likely'; mean r = .58)[1]. Instrumental attitude was measured using two items that were consistent across behaviors (e.g., 'Exercising regularly over the next four weeks would be: harmful-beneficial, worthless-valuable'; mean r = .50). Affective attitude was measured as the average of two items that remained consistent across behaviors (e.g., 'Exercising regularly over the next four weeks would be: unpleasant-pleasant, not enjoyable-enjoyable', mean r = .86). Anticipated affective reaction was measured using a single item that was consistent across behaviors (e.g., 'I will feel regret if I do NOT exercise over the next four weeks, definitely no-definitely yes'). Subjective norms were measured by two items that remained consistent across behaviors (e.g., 'Most people that are important to me think that… I should-I should not… exercise regularly over the next four weeks'; 'I think that most people who are important to me will exercise regularly over the next four weeks, definitely no-definitely yes'; mean r = .40). PBC was measured by two items that remained consistent across behaviors (e.g., 'If it were entirely up to me, I am confident that I could exercise regularly over the next four weeks, strongly disagree-strongly agree'; 'I have control over whether or not I exercise regularly over the next four weeks, strongly disagree-strongly agree'; mean r = .41)[2].

Past behavior was measured using a single item that was consistent across behaviors (e.g., In the past four weeks, I have exercise regularly, never-always, scored 1-7). Behavior was measured using a single item at follow-up by asking participants to record the number of days on which they had engaged in the behavior (e.g., 'On how many days in the past four weeks have you exercised?'). There were six exceptions to this procedure. For sunscreen use, which is context dependent, the question posed was: 'In the past four weeks I have used sunscreen of at least 15SPF when exposed to the sun, never-always', scored 1-7. For the measure for self-examination (of breasts or testicles), which was anticipated to occur only a few times in the four week period of the study, it was 'In the past four weeks I have performed self-examination' (Never, 1 time, 2 times, 3 times, 4 times, 5 times or 6+ times, scored 1-7). Finally, for taking medication, visiting the dentist, attending a health screening appointment, and visiting the doctor the measure took the form of a dichotomous choice (e.g., 'Have you visited the dentist for a check-up in the past four weeks?, no-yes'). We dichotomized all continuous behavior measures to allow us to combine analyses across all behaviors (0 indicated not performing more healthy behavior; 1 indicated performing more healthy behavior one or more times).

Analyses

Data were analyzed in SPSS (version 20, SPSS Inc) and HLM (version 7, SSI). A number of participants had missing data on at least one variable for all behaviors and were excluded. ANOVA and chi-squared tests revealed no significance differences between those excluded in this way (N = 50) and those retained (N = 376) on age, gender, relationship status, number of children, or highest educational qualification (ps > .25). We further excluded data from those behaviors which had missing data on any measured variable. These procedures resulted in a total of 5571 person-behavior data points spread across 376 individuals that were used in analysis (number of individuals providing data for each behavior: eat five fruit and vegetables per day, n = 364; wear a helmet when riding a bicycle, n = 50; take recommended levels of physical activity, n = 371; exercise regularly, n = 367; eat a low fat diet, n = 365; use sunscreen of at least 15SPF when exposed to the sun, n = 209; adhere to all medication prescribed by a doctor, n = 150; take vitamin supplements, n = 366; brush teeth twice a day, n = 362; floss teeth daily, n = 365; binge drinking, n = 366; drink more than the recommended daily limits of alcohol, n = 368; smoking, n = 63; using illegal drugs, n = 361; exceeding the posted speed limit when driving, n = 235; drinking and driving, n = 231; visit dentist for yearly check-ups, n = 365; attend health screening appointment when invited, n = 63; visit doctor for a health problem, n = 186; testicular/breast self-examination, n = 364). We computed mean and SDs for all measured variables in SPSS.

Although 5571 observations were available for testing relationships between TPB and affect variables, the fact that each individual provides multiple observations needed to be controlled for in any analyses, i.e., behavior is clustered within individuals. In order to provide comparisons with Study 1 we first computed correlations among all measured variables in SPSS (in order to control for the fact that each individual provided data on multiple behavior we included a dummy coded variable for each participant in these analyses). The relationships among TPB and affect variables were further analyzed using Hierarchical Linear Modeling using HLM7 (Raudenbush & Bryk, 2002). In order to allow variation across individuals we used random effects (as was the case in Study 1). The data contained a two level hierarchical structure, Level 1 being the within-person variation and Level 2 being the between-person variability. The Level 1 predictor variables were centered around the group mean. In relation to predictions of intentions we initially computed a baseline intercept only model to compare against other models. The first model included the main TPB variables (instrumental attitude, subjective norm, PBC). In the second model we added the affect variables (AA, AAR), and in the third model we added past behavior. We report unstandardized coefficients, standard errors and standardized coefficients (calculated using the procedure outlined by Hox, 2002). For each model we report the deviance statistic to indicate model fit and a chi-squared test of the change in deviance compared to the earlier model to indicate significance of improvement of fit. A similar approach was employed in relation to predictions of behavior but using a Bernoulli model because of the dichotomous nature of the behavior measure. Again we initially computed an intercept only model to compare other models against. The first model included the main TPB variables (intention, instrumental attitude, subjective norm, PBC). In the second model we added the affect variables (AA, AAR), and in the third model we added past behavior. We report unstandardized coefficients, standard errors and odds ratios. For each model we also report the -2 log-likelihood statistic (-2LL) to indicate model fit and a chi-squared test of the change in -2LL compared to the earlier model to indicate significance of improvement of fit.

In order to test for significant differences in the power of AA and AAR to predict intentions and action for different categories of health behaviors, Level 1 interaction terms between each affect variable and a dichotomous variable indicating behavior category (e.g., protection versus risk or detection behavior) were created. A series of models then tested whether the two interaction variables were significant when controlling for other predictors (i.e., Model 3 plus the dichotomous behavior-category variable). Where there was a significant change in model fit when adding the interaction terms we report unstandardized coefficients and standard errors for the significant interaction terms. For significant interactions we used simple slope analyses to explore the direction of differences using the free software provided by Preacher at http://www.people.ku.edu/~preacher/.

Results

Descriptives and Partial Correlations

Table 4 shows the descriptives for each measure. In general measures showed reasonable variation and were not heavily skewed, although instrumental attitude had a high mean and slightly smaller SD. Table 4 also reports the partial correlations between behavior, TPB variables, AA, AAR and past behavior (after partially out the effects of the N – 1 dummy coded participant variables). Consistent with Study 1 and previous meta-analyses of the TPB (e.g., McEachan et al., 2011), intentions (r = .413) and past behavior (r = .413) showed medium-large sized correlations with behavior. AA, PBC, instrumental attitude, AAR, and subjective norm showed medium-large sized correlations with behavior (rs = .275—.409). Similarly, past behavior, subjective norm and AAR showed large sized correlations with intentions (rs = .605—.793), while PBC, instrumental attitude, and AA showed medium-large sized correlations with intentions (rs = .424—.468). The AA—AAR correlation was of a medium size (r = .369; Table 4).

Regressions

In relation to predictions of intentions, multilevel modelling (Table 5, left-hand column, Step 1) indicated that adding TPB variables (instrumental attitude, subjective norms, PBC) significantly reduced the deviance statistic compared to the intercept only model ($\chi^2(9) = 3728.0$, $p < .001$). Adding AA and AAR (Table 5, left-hand column, Step 2) further significantly reduced the deviance statistic ($\chi^2(11) = 802.5$, $p < .001$), as did adding past behavior (Table 5, left-hand column, Step 3; $\chi^2(7) = 1713.9$, $p < .001$). All predictors were significant at each step with past behavior, subjective norm and AAR being the strongest predictors at the final step. Entering only AA and AAR also significantly significantly reduced the deviance statistic compared to the intercept only model ($\chi^2(5) = 2955.8$, $p < .001$) with both predictors being significant, although effects for AAR were stronger (AA: B = .267, SE = .016, β = .232, $p < .001$; AAR: B = .532, SE = .016, β = .555, $p < .001$)

In relation to predictions of behavior, multilevel modelling (Table 5, right-hand column, Step

1) indicated that adding TPB variables (intentions, instrumental attitude, subjective norms, PBC) significantly reduced the -2LL ($\chi^2(14) = 142.5$, $p < .001$). Adding AA and AAR (Table 5, right-hand column, Step 2) further significantly reduced the -2LL ($\chi^2(13) = 7403.5$, $p < .001$), as did adding past behavior (Table 5, right-hand column, Step 3; $\chi^2(8) = 44.3$, $p < .001$). All predictors, except subjective norm and AAR, were significant at each step with AA, instrumental attitude and PBC being the strongest predictors at the final step. Entering only AA and AAR also significantly significantly reduced the -2LL compared to the intercept only model ($\chi^2(5) = 355.2$, $p < .001$) with both predictors being significant, although stronger effects were observed for AA (AA: *B* = .525, *SE* = .024, *Odds Ratio* = 1.691, $p < .001$; AAR: *B* = .217, *SE* = .019, *Odds Ratio* = 1.242, $p < .001$)

Moderation Effects of Behavior-category

We next tested whether the relationship between the two affect variables and intentions or action as reported in Table 5 was significantly moderated by behavior-category (controlling for the other components of the TPB, and past behavior; Table 5, Step 3, left-hand column). In relation to prediction of *intention* there were no significant interactions between behavior category and AA for any of the comparisons. In relation to predicting intention from AAR, each of the interactions for comparisons between protection versus risk or detection behaviors (*B* = .090, SE = .017, $p < .001$), risk versus protection or detection behaviors (*B* = -.115, SE = .019, $p < .001$), and between detection versus protection or risk behaviors (*B* = -.064, SE = .024, $p < .01$) were significant. Simple slopes analyses showed the power of AAR to predict intentions to be significant for each behavior category and also to significantly increase from risk behaviors (*B* = .018, SE = .014, $p < .001$) to protection behaviors (*B* = .084, SE = .01528, $p < .001$) and to significantly increase again for detection behaviors (*B* = .152, SE = .013, $p < .001$) behaviors.

In relation to prediction of *action* there was only one significant interaction between behavior category and AA for the comparison between protection versus risk or detection behaviors (*B* = -.247, SE = .040, $p < .001$). Simple slopes analyses showed AA to be a stronger predictor of action for protection behaviors (*B* = .359, SE = .029, $p < .001$) than risk or detection behaviors (*B* = .088, SE = .032, $p < .01$). In relation to AAR, each of the interactions for comparisons between protection versus risk or detection behaviors (*B* = .144, SE = .033, $p < .001$), risk versus protection or detection behaviors (*B* = .172, SE = .039, $p < .001$), and between detection versus protection or risk behaviors (*B* = -.302, SE = .043, $p < .001$) were significant. Simple slopes analyses showed AAR to be a significant predictor of action for detection (*B* = .091, SE = .024, $p < .01$) but not significant for protection (*B* = -.032, SE = .028, ns) or risk (*B* = -.030, SE = .032, ns) behaviors.

Discussion

Study 2 replicates and extends the findings of Study 1. Both AA and AAR are shown to have medium-large sized correlations (Table 4) with, and be significant independent predictors of, intentions and action across a broad range of health behaviors. These effects persisted for AA when controlling for TPB variables plus past behavior, while AAR was only a significant predictor of intentions (Table 5). Study 2 also explored the moderating effect of health behavior category on the impact of AA and AAR on intentions and action. In relation to predictions of *intention*, there were no significant differences in effects for AA across the three behavior categories. This might suggest the potential value of targeting AA to change intentions to perform a broad range of health behaviors. In contrast AAR was a significantly stronger predictor of intentions to engage in detection, then protection, and finally risk behaviors (when controlling for other TPB variables and past behavior). This might suggest the particular importance of targeting AAR to increase intentions to engage in detection behaviors. However, the fact that AAR was a significant predictor for each category of health behavior suggests the potential value of targeting AAR to change intentions to perform a broad range of health behaviors. In relation to prediction of *action*, AA was a significantly stronger predictor of protection behaviors compared to risk or detection behaviors (when controlling for TPB variables and past behavior), although it was also a significant predictor of each. In relation to prediction of action, AAR was only a significant predictor for detection behaviors. Taken together these findings suggest that interventions targeting AA might be particularly influential in changing protection behaviors due to its' significant direct effects and indirect effects via intentions. In contrast the findings suggest that interventions targeting AAR might be particularly influential in changing detection behaviors due to its' significant direct effects and indirect effects via intentions.

There are a number of strengths and limitations to Study 2. First, one strength of Study 2 was the examination of multiple behaviors in a single sample of individuals allowing us to minimize the possibility that any differences across behaviors observed were simply due to sampling differences. Second, a weakness of Study 2 was the reliance on self-reported measures of behavior. McEachan et al. (2011) showed the TPB to be less predictive of objectively measured behaviors and we were unable to assess whether AA and AAR are also weaker predictors for objectively assessed behaviors. The lack of any differences in predictive power for self-reported versus objectively assessed behaviors in Study 1 suggests this may not be a problem. Nevertheless it would be useful for future studies to confirm the power of AA and AAR constructs to predict objectively measured behavior.

General Discussion

The two studies presented in this paper focused on exploring the impact of affect variables on intentions and action across health behaviors and the effects of controlling for TPB variables and also past behavior. A fairly consistent pattern emerged across studies supporting the value of examining both affect variables simultaneously. AA and AAR were only moderately related across studies (r = .289—.369). Both showed small-moderate sized correlations with behavior (r_{AA} = .274—.409; r_{AAR} = .228—.302) and moderate-large correlations with intentions (r_{AA} = .403—.424; r_{AAR} = .474—.605) across studies. Importantly when considered simultaneously both emerged as significant predictors of both intentions and behavior. This effect remained for AA when controlling for TPB variables (Studies 1 and 2) plus past behavior (only tested in Study 2). AAR was only a significant predictor of behavior in Study 1 when controlling for TPB variables and only a significant predictor of intentions in Study 2 when controlling for TPB variables or TPB variables plus past behavior. Despite this somewhat differentiated pattern this would suggest the value of considering *both* types of affective influence on health behaviors.

Across the two studies we also observed a number of moderation effects in the relationship between the two affect variables and intentions or behavior. We had predicted that AA would have stronger impacts on intentions and actions for protection and risk behaviors compared to detection behaviors and that AAR would have stronger effects on detection compared to protection or risk behaviors. Findings provide only partial support of the first prediction. Study 1 found the AA-intention correlation to be significantly stronger in risk compared to detection behaviors, although the difference for protection versus detection behaviors was not significant and no significant differences were found for AA-behavior correlations. In Study 2 the AA-intention relationship was not significantly stronger in protection or risk compared to detection behaviors (when controlling for TPB variables and past behavior). Also in Study 2 the AA-behavior relationship was significantly stronger in protection compared to risk or detection behaviors (when controlling for TPB variables and past behavior). Thus the overall findings would provide tentative support for the idea that AA is more important (directly and indirectly via intentions) as a determinant of protection or risk behaviors perhaps because emotion is more immediately related to performance of such behaviors (Lawton et al., 2009; Russell, 2003). In relation to our second prediction the findings were also somewhat inconsistent. AAR did not emerge as a stronger predictor of intentions or action for detection behaviors in Study 1. However, in Study 2 the AAR-intention relationship was strongest in detection behaviors (when controlling for TPB variables and past behavior), although they were significant for each behavior-category and also significantly stronger for protection compared to risk behaviors. In addition, the AAR-behavior relationship in Study 2 was significantly stronger for detection compared to protection or risk behaviors (when controlling for TPB variables and past behavior). Support for the idea that AAR is more important for detection behaviors than risk or protection behaviors is restricted to Study 2.

The present results also have practical implications. In particular the findings presented here would suggest the value of targeting both AA and AAR as a means to change health behaviors. The data also provide some support for the idea that targeting AA may be particularly effective for changing protection or risk behaviors, while targeting AAR may be particularly effective for changing detection behaviors. A growing number of studies have shown the value of targeting affective attitudes as a means to change health behavior (e.g., Conner, Rhodes, Morris, McEachan, & Lawton, 2011). Rhodes, Fiala, and Conner (2010) reviewed a range of such studies in relation to changing physical activity and reported significant but small-medium sized effects on behavior. Sheeran, Harris, and Epton (2014) reviewed studies that target AA (such as fear or worry) and AAR (such as regret and guilt). Studies that successfully changed AA were associated with significant small-medium sized effects on intentions ($d_+ = .31$, $k = 97$) and behavior ($d_+ = .21$, $k = 46$). There were fewer studies that successfully changed AAR, but those that did were associated with significant small-medium sized effects on intentions ($d_+ = .27$, $k = 10$) and behavior ($d_+ = .30$, $k = 3$). Interestingly the authors suggest the effects were stronger for guilt than for regret (which was the focus of most of the studies reported here). Very few studies have attempted to simultaneously change both AA and AAR. One exception is the study by Wardle, Williamson, Sutton, Biran, McCaffery, Cuzick, and Atkin (2003) on colorectal cancer screening. Using a leaflet targeting both affect constructs this study observed small changes in AA ($d_+ = .38$) and AAR ($d_+ = .36$) but only very modest and non-significant changes in intentions ($d_+ = .18$) and behavior ($d_+ = .07$). Additional studies designed to change AA and AAR individually and in combination using factorial designs in different categories of health behaviors could provide further insights into their relative independence and the impacts of changing one or both on changes in intentions and action.

In conclusion, the present research shows the importance of AA and AAR as determinants of intentions and action across a range of health behaviors. Importantly it shows that both affect variables can have simultaneous, independent effects on both intentions and action and that these effects generally remain significant when we control for known key cognitive determinants as represented in by variables in the TPB and also past behavior. AA appears to be particularly important for protection and risk behaviors, while AAR appear to be particularly important for detection behaviors. Future research could usefully further explore a broader range of AAR (e.g., guilt; see review by Sheeran et al., 2014), examine the joint effects of these two affect variables particularly for objectively measured health behaviors, and use experimental designs to individually and jointly manipulate the two variables.

Footnotes

1. For drinking and driving the inter-item correlation was low and only the first item was used.
2. For floss teeth daily, binge drinking, drink more than the recommended daily limits of alcohol, smoking, using illegal drugs, exceeding the posted speed limit when driving, drinking and driving the inter-item correlation was low and only the first item was used.

References

Abelson, R.P., Kinder, D.R., Peters, M.D., & Fiske, S.T. (1982). Affective and semantic components in political person perception. Journal of Personality and Social Psychology, **42**, 619-630. doi: 10.1037/0022-3514.42.4.619

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

Ajzen, I. (2014). The theory of planned behaviour is alive and well, and not ready to retire: a commentary on Sniehotta, Presseau, and Araújo-Soares. Health Psychology Review, in press. doi: 10.1080/17437199.2014.883474

Ajzen, I., & Fishbein, M. (2005). The influence of attitudes on behavior. In D. Albarracin, B.T. Johnson, and M.P. Zanna. (Eds.), Handbook of attitudes and attitude change: Basic principles (pp. 173-221). Mahwah, NJ: Erlbaum.

Borenstein, M., Hedges, L. V., Higgins, J., & Rothstein, H. (2005). Comprehensive meta-analysis version 2. Englewood, N.J.: Biostat.

Cohen, J. (1992). A power primer. Psychological Bulletin, **112**, 155-159. doi: 10.1037/0033-2909.112.1.155

*Conner, M., & Abraham, C. (2001). Conscientiousness and the Theory of Planned Behavior: Towards a more complete model of the antecedents of intentions and behavior. Personality and Social Psychology Bulletin, **27**, 1547-1561. doi: 10.1177/01461672012711014

*Conner, M., Godin, G., Sheeran, P., & Germain, M. (2013). Some feelings are more important: Cognitive attitudes, affective attitudes, anticipated affect and blood donation. Health Psychology, **32**, 264-272. doi: 10.1037/a0028500

*Conner, M., Lawton, R., Parker, D., Chorlton, K., Manstead, A.S.R., & Stradling, S. (2007). Application of the Theory of Planned Behaviour to the prediction of objectively assessed breaking of posted speed limits. British Journal of Psychology, **98**, 429-453. doi: 10.1348/000712606X133597

Conner, M. & Norman, P. (2005) (Eds.). Predicting health behaviour: Research and practice with social cognition models (2nd Edn.). Maidenhead: Open University Press.

Conner, M., Rhodes, R., Morris, B., McEachan, R., & Lawton, R. (2011). Changing exercise through targeting affective or cognitive attitudes. Psychology & Health, **26**, 133-149. doi: 10.1080/08870446.2011.531570

*Conner, M., Sandberg, T., McMillan, B., & Higgins, A. (2006). Role of anticipated regret in adolescent smoking initiation. British Journal of Health Psychology, **11**, 85-101. doi: 10.1348/135910705X40997

Crites, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes: Conceptual and methodological issues. Personality and Social Psychology Bulletin, **20**, 619-634. doi: 10.1177/0146167294206001

Department of Health. (1999). Saving lives: Our healthier nation. The Stationary Office.

Department of Health. (2004). Choosing health: Making healthier choices easier. Department of Health.

Duval, S. & Tweedie, R. (2000). A nonparametric “trim and fill" method of accounting for publication bias in meta-analysis. Journal of the American Statistical Association, **95(449)**, 89-98. doi: 10.1080/01621459.2000.10473905

*Elliot, M.A., & Thompson, J.A. (2010). The social cognitive determinants of offending drivers' speeding behaviour. Accident Analysis and Prevention, **42**, 1595-1605. doi: 10.1016/j.aap.2010.03.018

Giner-Sorolla, R. (2001). Guilty pleasures and grim necessities: Affective attitudes in dilemmas of self-control. Journal of Personality and Social Psychology, **80**, 206-221. doi: 10.1037/0022-3514.80.2.206

*Godin, G., Belanger-Gravel, A., Gagne, C., & Blondeau, D. (2008). Factors predictive of signed consent for posthumous organ donation. Progress in Transplantation, **18**, 109-117. doi:

Hox, J. (2002). *Multilevel analysis: techniques and applications*. Lawrence Erlbaum Associates, London.

*Jackson, K., Smith, A., & Conner, M. (2003). Applying an extended version of the Theory of Planned Behaviour to physical activity. Journal of Sports Science, **21**, 119-133. doi: 10.1080/0264041031000070976

Lawton, R., Conner, M., & McEachan, R. (2009). Desire or reason: Predicting health behaviors from affective and cognitive attitudes. Health Psychology, **28**, 56-65. doi: 10.1037/a0013424

Lawton, R., Conner, M., & Parker, D. (2007). Beyond cognition: Predicting health risk behaviors from instrumental and affective beliefs. Health Psychology, **26**, 259-267. doi: 10.1037/0278-6133.26.3.259

*Lechner, L., de Nooijer, J., & de Vries, H. (2004). Breast self-examination: longitudinal predictions of intention and subsequent behaviour. European Journal of Cancer Prevention, **13**, 369-376.

doi: 10.1097/00008469-200410000-00003

Manstead, A.S.R., & Parker, D. (1995). Evaluating and extending the Theory of Planned Behaviour. In W. Stroebe and M. Hewstone (Eds.), European Review of Social Psychology, **6**, 69-95. doi: 10.1080/14792779443000012

McEachan, R.R.C., Conner, M., Taylor, N.J., & Lawton, R.J. (2011). 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

*McMillan, B., Conner, M., & Higgins, A. (2005). Using an extended theory of planned behaviour to understand smoking amongst schoolchildren. Addiction Research & Theory, **13**, 293-306. doi: 10.1080/16066350500053679

*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 & Health, **20**, 743-760. doi: 10.1080/14768320500183335

Raudenbush, S.W., & Bryk, A.S. (2002). Hierarchical linear models: Applications and data analysis methods. London: Sage.

Rhodes, R., Fiala, B., & Conner, M. (2010). A review and meta-analysis of affective judgments and physical activity in adult populations. Annals of Behavioral Medicine, **38**, 180-204. doi: 10.1007/s12160-009-9147-y

*Richetin, J., Sengupta, A., Perugini, M., Adjali, I., Hurling, R., Spence, M., & Greetham, D. (2010). A micro level simulation for the prediction of intention and behavior. Cognitive Systems Research, **11**, 181-193. doi: 10.1016/j.cogsys.2009.08.001

Rivis, A., Sheeran, P. & Armitage, C. J. (2009). Expanding the affective and normative components of the theory of planned behavior: A meta-analysis of anticipated affect and moral norms. Journal of Applied Social Psychology, **39**, 2985-3019.doi:10.1111/j.1559-1816.2009.00558.x

Rosenthal, R. (1984). Meta-analytic procedures for social research. Beverly Hill, CA: Sage.

Roysamb, E., Rise, J., & Kraft, P. (1997). On the structure and dimensionality of health-related behaviour in adolescents. Psychology & Health, 12, 437-452. doi: 10.1080/08870449708406721

Russell, J.T. (2003). Core affect and the psychological construction of emotion. Psychological Review, **110**, 145–172. doi: 10.1037/0033-295X.110.1.145

Sandberg, T., & Conner, M. (2008). Anticipated regret as an additional predictor in the theory of planned behaviour: A meta-analysis. British Journal of Social Psychology, **47**, 589-606. doi: 10.1348/014466607X258704

*Sandberg, T., & Conner, M., (2011). Using self-generated validity to promote exercise behaviour. British Journal of Social Psychology, **50**, 769-783. doi: 10.1111/j.2044-8309.2010.02004.x

*Schutz, M., Godin, G., Kok, G., Vezina-Im, L-A, Naccache, H., Otis, J. et al. (2011). Determinants of condom use among HIV-positive men who have sex with men. International Journal of STD & AIDS, **22**, 391-397. doi: 10.1258/ijsa.2011.010205

Sheeran, P., Harris, P.R., & Epton, T. (2014). Does heightened risk appraisals change people's intentions and behaviour? A meta-analysis of experimental studies. Psychological Bulletin, **140**, 511-543. doi: 10.1037/a0033065.

Sniehotta, F.F., Presseau, J., & Araujo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, **8**, in press. doi: 10.1080/17437199.2013.869710.

Wardle, J., Williamson, S., Sutton, S., Biran, A., McCaffery, K., Cuzick, J., & Atkin, W. (2003). Psychological impact of colorectal cancer screening. Health Psychology, **22**, 54-59. doi: 10.1037/0278-6133.22.1.54

*Walsh, J. C. (2005). Increasing screening uptake for a cervical smear test: Predictors of attendance and the use of action plans in prior non-attenders. The Irish Journal of Psychology, **26**, 65-73. doi: 10.1080/03033910.2005.10446209

Weinstein, N.D. (2007). Misleading tests of health behavior theories. Annals of Behavioral Medicine, **33**, 1-10. doi: 10.1207/s15324796abm3301_1

Table 1.

Characteristics of Studies Included in the Meta-Analysis (Study 1).

				Behavior Measure	
Study	Behavior	*N*	Behavior category	Type	Delay (days)
Conner & Abraham (2001)	Exercise	123	Protection	Self-report	14
Conner et al. (2006)	Smoking initiation	672	Risk	Self-report	270
Conner et al. (2007) study 1	Speeding	315	Risk	Objective	1
Conner et al. (2007) study 2	Speeding	86	Risk	Objective	30[a]
Conner et al. (2013)	Blood donation	1108	Other	Objective	180
Elliot & Thompson (2010)	Speeding	1403	Risk	Self-report	180
Godin et al. (2008)	Organ donation consent	602	Other	Self-report	450
Jackson et al. (2003)	Physical activity	87	Protection	Self-report	56
Lechner et al. (2004)	Breast self-examination	364	Detection	Self-report	180
McMillan et al. (2005)	Smoking initiation	155	Risk	Self-report	90
Prestwich et al. (2005)	Breast self-examination	149	Detection	Self-report	30
Richetin et al. (2010) study 1	Drinking fizzy drinks	105	Risk	Self-report	7
Richetin et al. (2010) study 2	Physical activity	132	Protection	Self-report	7
Sandberg & Conner (2011)	Exercise	427	Protection	Objective	60
Schutz et al. (2011)	Condom use	237	Protection	Self-report	180
Walsh (2005)	Cervical screening	156	Detection	Self-report	90

k = 16, total N = 6121. a Study used design where behavior measured before cognitions (not included in analysis of delay as moderator).

Table 2.

General Test of Model Relationships in Meta-Analysis (Study 1): Mean frequency-weighted correlation (r_+), standard deviation (in brackets), heterogeneity (Q statistic), percentage variance explained by statistical artefacts (I^2), and fail-safe number (FSN).

	Behavior	BI	IA	AA	AAR	SN	PBC
Intention (BI)	.431 (.196) Q=313.0*** I^2=95.2 FSN=4438	-					
Instrumental Attitude (IA)	.183 (.228) Q=300.9*** I^2=95.0 FSN=964	.410 (.161) Q=198.3*** I^2=92.4 FSN=4297	-				
Affective Attitude (AA)	.274 (.108) Q=65.7*** I^2=77.2 FSN=1713	.403[a] (.149) Q=165.7*** I^2=90.9 FSN=4026	.510 (.170) Q=283.7*** I^2=94.7 FSN=6305	-			
Anticipated Affective Reaction (AAR)	.228 (.203) Q=245.6*** I^2=93.9 FSN=1336	.474 (.175) Q=272.1*** I^2=94.5 FSN=5694	.352 (.187) Q=243.5*** I^2=93.8 FSN=3325	.289[a] (.235) Q=358.6*** I^2=95.8 FSN=2428	-		
Subjective Norm (SN)	.141[b] (.152) Q=123.4*** I^2=87.8 FSN=513	.315 (.127) Q=99.7*** I^2=85.0 FSN=2334	.310 (.157) Q=156.5*** I^2=90.4 FSN=2321	.231 (.157) Q=142.0*** I^2=89.4 FSN=1503	.293 (.166) Q=172.8*** I^2=91.3 FSN=2052	-	
Perceived Behavioral Control (PBC)	.326 (.187) Q=233.3*** I^2=93.6 FSN=2603	.557[d] (.133) Q=197.0*** I^2=92.4 FSN=8339	.335 (.152) Q=151.9*** I^2=90.1 FSN=3056	.307 (.141) Q=124.1*** I^2=87.9 FSN=2454	.316 (.197) Q=256.4*** I^2=94.1 FSN=3139	.259 (.141) Q=115.7*** I^2=87.0 FSN=1782	-

k = 16, N = 6121 for all analyses. *** $p < .001$.

Significant differences in point estimate (based on non-overlapping 95%CIs): a Risk > Detection behaviors; b Risk > Protection behaviors; c Protection > Risk behaviors.

Table 3.

Regressions of Intentions and Behavior onto TPB Variables from Meta-Analysis Data (Study 1, N = 6121).

	Predicting Intentions			Predicting Behavior		
Predictors	B	SE	β	B	SE	β
Step 1						
Intentions	-	-	-	.365	.015	.365***
Instrumental attitude	.219	.011	.219***	-.008	.013	-.008
Subjective norms	.131	.011	.131***	-.004	.012	-.004
Perceived Behavioral Control	.450	.011	.450***	.126	.014	.126***
Step 2						
Intentions	-	-	-	.338	.015	.338***
Instrumental attitude	.141	.012	.141***	-.081	.014	-.081***
Subjective norms	.120	.011	.120***	-.025	.012	-.025
Perceived Behavioral Control	.424	.011	.424***	.101	.014	.101***
Affective Attitude	.171	.012	.171***	.124	.014	.124***
Anticipated Affective Reaction	.005	.011	.005	.104	.013	.104***

*** $p < .001$. For *predicting intentions* using linear regression: Step 1, $\Delta R^2 = .381$, $\Delta F(3,6117) = 1257.3$, $p < .001$; Step 2, $\Delta R^2 = .021$, $\Delta F(2,6115) = 108.5$, $p < .001$. For *predicting behavior* using linear regression: Step 1, $\Delta R^2 = .197$, $\Delta F(4,6116) = 374.0$, $p < .001$; Step 2, $\Delta R^2 = .021$, $\Delta F(2,6114) = 82.5$, $p < .001$.

Table 4.

Descriptives (Mean and SD) and Partial Correlations (controlling for $N_{participants}$ - 1 dummy coded variables) for Measured Variables Across Behaviors for Study 2 (N of participants = 376; N of observations = 5571).

	B	BI	IA	AA	AAR	SN	PBC	Mean (SD)
Behavior (B)	-							0.67 (0.47)
Behavioral Intention (BI)	.413	-						4.93 (2.04)
Instrumental Attitude (IA)	.369	.467	-					6.26 (1.17)
Affective Attitude (AA)	.409	.424	.369	-				4.53 (1.77)
Anticipated Affective Reaction (AAR)	.302	.605	.442	.369	-			4.87 (2.13)
Subjective Norm (SN)	.275	.619	.446	.329	.558	-		5.19 (1.51)
Perceived Behavioral Control (PBC)	.399	.468	.410	.352	.303	.320	-	5.57 (1.88)
Past Behavior (PB)	.413	.793	.424	.431	.586	.615	.461	4.64 (2.30)

All *r*s, $p < .001$.

Table 5.

Hierarchical Multi-Level Regressions of Intentions and Behavior onto TPB Variables from Study 2 (N of participants = 376; N of observations = 5571).

	Predicting Intentions			Predicting Behavior		
Predictors	B	SE	β	B	SE	Odds Ratio
Step 1						
Intercept (γ_{00})	4.930	.038		0.840	.040	2.315***
Behavioral Intention (γ_{10})	-	-	-	0.270	.023	1.311***
Instrumental Attitudes (γ_{20})	0.268	.027	.154***	0.377	.036	1.458**
Subjective Norm (γ_{30})	0.620	.019	.459***	-0.032	.030	0.969
Perceived Behavioral Control (γ_{40})	0.313	.021	.288***	0.302	.021	1.352***
Step 2						
Intercept (γ_{00})	4.930	.038		0.883	.041	2.418***
Behavioral Intention (γ_{10})	-	-	-	0.190	.025	1.209***
Instrumental Attitudes (γ_{20})	0.113	.023	.065***	0.270	.037	1.310***
Subjective Norm (γ_{30})	0.422	.020	.312***	-0.052	.031	0.949
Perceived Behavioral Control (γ_{40})	0.261	.017	.241***	0.246	.022	1.279***
Affective Attitude (γ_{50})	0.111	.013	.096***	0.365	.024	1.441***
Anticipated Affective Reaction (γ_{60})	0.289	.016	.302***	0.032	.022	1.033
Step 3						
Intercept (γ_{00})	4.930	.038		0.777	.040	2.175***
Behavioral Intention (γ_{10})	-	-	-	0.077	.024	1.080**
Instrumental attitude (γ_{20})	0.114	.019	.099***	0.279	.040	1.322***
Subjective norm (γ_{30})	0.192	.017	.142***	-0.077	.032	0.926
Perceived Behavioral Control (γ_{40})	0.118	.012	.109***	0.209	.023	1.232***
Affective Attitude (γ_{50})	0.041	.011	.036***	0.308	.024	1.360***
Anticipated Affective Reaction (γ_{60})	0.150	.013	.157***	0.015	.022	1.015
Past Behavior (γ_{70})	0.442	.013	.498***	0.109	.024	1.115***

* $p < .05$; ** $p < .01$; *** $p < .001$. Note. B = unstandardized coefficient; β = standardized coefficient. For *predicting intentions* using multilevel modelling with random effects: Intercept only model at Step 0, Deviance = 23609.9; Step 1, Deviance = 19881.8; Step 2, Deviance = 19079.3; Step 3, Deviance = 17347.4. For *predicting behavior* using multilevel modelling with random effects (Bernoulli model): Intercept only model at Step 0, -2LL = 7891.1; Step 1, -2LL = 7748.6; Step 2, -2LL = 7403.5; Step 3, -2LL = 6960.5.