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Perceived Behavioral Control Moderating Effects in the Theory of Planned Behavior: A Meta-Analysis

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Abstract

Objective. According to the theory of planned behavior, individuals are more likely to act on their behavioral intentions, and report intentions aligned with their attitudes and subjective norm, when their perceived behavioral control (PBC) is high. We tested these predictions meta-analytically by estimating the moderating effect of PBC on the attitude-intention, subjective norm-intention, and the intention-behavior relations in studies applying the theory in the health behavior domain.

Methods. We conducted a pre-registered secondary analysis of studies ($k=39$; total $N=13,121$) from two programs of research. Each study measured participants' attitude, subjective norms, PBC, and intentions in relation to health behaviors, and most ($k=36$) measured health behavior at follow-up. Data were analyzed using meta-analytic structural equation modeling. Behavior type, scale score coverage, sample age, and publication states were included as moderators of model effects.

Results. PBC moderated the intention-behavior relation but not the attitude-intention and subjective norm-intention relations. All moderation effects exhibited significant heterogeneity. Analysis of moderators indicated that the PBC moderation effects on intention varied according to scale score coverage but not by the other moderator variables tested.

Conclusions. Results support moderation of the intention-behavior relation by PBC in health behaviors. However, substantial unresolved heterogeneity in the effect across studies remained. Further, these effects may not generalize to other populations and moderator analyses were confined to broad categories. More research that tests these moderation effects in health behavior contexts and reports sufficient data necessary for conducting a meta-analysis is needed to enable moderator analyses with greater fidelity.

Keywords: health behavior, social cognition, intention, perceived control, meta-analytic structural equation modeling.

Perceived Behavioral Control Moderating Effects in the Theory of Planned Behavior: A Meta-Analysis

Epidemiological research has indicated that regular participation in health behaviors (e.g., physical activity, healthy eating, not smoking, drinking alcohol only in moderation) is associated with reduced risk of non-communicable chronic disease and substantial delay in all-cause mortality (Ford et al., 2012). Government health departments and health organizations have promulgated guidelines on the levels of participation in these behaviors necessary to promote optimal health (Byers et al., 2002), and have commissioned the development and implementation of behavioral interventions to promote population-level participation in these behaviors (Yang et al., 2011). Development of efficacious behavioral interventions, however, necessitates identification of modifiable determinants of health behavior engagement, and the processes by which they relate to behavior (Hagger et al., 2020a). These determinants can serve as targets for change in interventions and play a critical role in informing their development. Reasoned action theories, with their focus on attitudinal and social determinants of behavior, have been at the forefront of research seeking to identify health behavior determinants (Fishbein & Ajzen, 2010; Hagger et al., 2020b).

Prominent among these theories is the theory of planned behavior (TPB; Ajzen, 1991, 2012), which has been applied extensively to predict, explain, and modify health behavior (for reviews see Ajzen & Schmidt, 2020; McEachan et al., 2011; Rich et al., 2015; Steinmetz et al., 2016). Central to the theory is the premise that intention is the immediate antecedent of the target health behavior of interest; the stronger an individual's intention, the more likely it is that the behavior will follow (see Figure 1). Consistent with the notion of reasoned action (Fishbein & Ajzen, 2010), intention is assumed to be guided by some degree of deliberation, whereby novel behaviors and important decisions receive more thorough contemplation than less important or

routine behaviors (Ajzen & Sexton, 1999). Three kinds of considerations influence intention formation: beliefs about the likely consequences and experiences resulting from performance of the behavior (behavioral beliefs), which, in their aggregate, result in the formation of an *attitude* toward the behavior; beliefs about the expectations and behaviors of significant social referents (normative beliefs), which produce perceived social pressure on whether or not to engage in the behavior, or *subjective norm*; and beliefs about factors that may facilitate or impede performance of the behavior (control beliefs), which result in *perceived behavioral control* (PBC) or a sense of self-efficacy with respect to the behavior (Bandura, 1986).

While attitude and subjective norm are conceptualized as direct determinants of intention in the TPB, PBC was not originally conceptualized as a direct determinant of intention (see Ajzen, 1985). Individuals are unlikely to form an intention to engage in a target behavior merely because they believe that they are capable of doing so (cf., Eagly & Chaiken, 1993). Instead, PBC was designated a moderator of the attitude-intention and subjective norm-intention relations in the original theory (Ajzen, 1985, 2002; La Barbera & Ajzen, 2020), such that individuals are more likely to form a behavioral intention when they perceive high control over the target behavior. However, because researchers tended to find mostly main effects, later formulations (e.g., Ajzen, 1991; Ajzen, 2012) and most empirical applications of the theory (e.g., Armitage & Conner, 2001; McEachan et al., 2011; Rich et al., 2015) have treated PBC as a direct determinant of intention with a status equal to that of attitude and subjective norm.

Similarly, PBC was not originally conceptualized as a determinant of behavior, either directly or indirectly mediated by intention. Rather, it was proposed to moderate the intention-behavior relation. Unanticipated events; insufficient time, money, or resources; lack of requisite skills; and a multitude of other factors may prevent people from acting on their intentions. The degree to which people have control over the behavior depends on their ability to overcome

barriers of this kind, and on the presence of facilitating factors such as past experience and assistance provided by others. Therefore, the greater individuals' actual control over the behavior, the more likely they will carry out their intention (see Yang-Wallentin et al., 2004 for a review). Because measuring the factors that determine individuals' actual control over a given behavior is difficult, most studies rely on PBC as a proxy for actual control. This reliance is based on the assumption that control perceptions are veridical, that is, they reflect actual control reasonably well. To the extent that PBC reflects actual control, it should serve to moderate the intention-behavior relation such that it is stronger when PBC is high rather than low. However, as in the case of intention prediction, research has tended to reveal direct effects of PBC on behavior, and, in most applications of the theory, PBC been treated as a direct predictor of behavior alongside intention rather than as a moderator of the intention-behavior relation (for reviews see Armitage & Conner, 2001; McEachan et al., 2011).

The TPB has been applied extensively to the prediction of a diverse range of health behaviors in multiple populations and contexts (e.g., Ajzen, 2011; Brown et al., 2018; Chatzisarantis et al., 2006; Hamilton et al., 2013; McEachan et al., 2011). Syntheses of TPB research have generally supported its predictions with PBC as an additional predictor of intention. Specifically, PBC has been shown to predict health behaviors indirectly by its effect on intentions, alongside attitudes and subjective norms, with small-to-medium sized effects, and to predict behavior directly with small effect sizes (e.g., McEachan et al., 2011; Rich et al., 2015).

The proposed moderating effects of PBC on theory relationships are rarely tested. In most studies, no mention is made of these moderating effects, with research particularly sparse in the health domain. For example, Armitage and Conner (2001) reported that fewer than 30% of the studies in their meta-analysis tested for the moderation of the relation between intention and behavior by PBC. Instead, studies typically report direct effects of PBC on intention and

behavior. As a consequence, there is little clear consensus on whether or not these moderating effects are supported in the extant research literature. It is not clear whether investigators are unaware that the TPB postulates interaction effects, test for moderation effects but fail to report the results, or have concluded that such effects are not of sufficient magnitude or importance to be explored.

The few studies that have tested moderation effects in the TPB report inconsistent findings. For example, some studies testing the moderating effect of PBC on the intention-behavior relation have reported statistically significant moderating effects (e.g., Conner & McMillan, 1999; Schifter & Ajzen, 1985; Steinmetz et al., 2011; White et al., 1994), while others have reported non-significant effects (e.g., Devellis et al., 1990; Dzewaltowski et al., 1990; Hukkelberg et al., 2014). Even fewer studies have tested moderation of the attitude-intention and subjective norm-intention relations by PBC. These studies have also reported inconsistent results. A small number of studies reported that PBC moderated the effects of attitude (e.g., Conner & McMillan, 1999; Earle et al., 2020; Hukkelberg et al., 2014; La Barbera & Ajzen, 2020; Umeh & Patel, 2004) and subjective norm (e.g., La Barbera & Ajzen, 2020; Yzer & van den Putte, 2014) on intention in health behavior contexts, but others have reported non-significant findings (e.g., Earle et al., 2020; Umeh & Patel, 2004). Some research has even indicated that the moderating effect of PBC on the subjective norm-intention relation is negative in sign (e.g., La Barbera & Ajzen, 2020), suggesting that individuals are less likely to be subject to normative influences when they have high perceived control.

The observed inconsistencies in moderation effects in TPB research may be attributed, in part, to methodological artifacts across studies. For example, Yang-Wallentin et al. (2004) suggested that measurement error in constructs may contribute to modest interaction effects and recommended the use of structural equation modeling to correct this error and use a non-linear

approach to test for interactions. Another reason for the difficulty in detecting interaction effects may be because studies do not have sufficient statistical power to test them. Research syntheses may help resolve the lack of statistical power by examining cumulative evidence for moderation effects across studies. However, existing syntheses have relied on ‘vote count’ procedures (Yang-Wallentin et al., 2004), which may indicate trends across studies, but are likely biased due to their reliance on statistical significance (Hunter & Schmidt, 2004). Meta-analysis may offer a solution by focusing on synthesizing effect sizes and correcting for bias, but to date, no study has applied meta-analytic techniques to examine TPB interaction effects across available research on the theory.

Study Overview and Hypotheses

In the present pre-registered study, we aimed to advance knowledge of the moderating effects of PBC in the TPB by conducting a meta-analysis of research testing these effects in the health domain. The analysis may assist in resolving the observed inconsistencies in the effects across studies by addressing the issue of low statistical power, and provide overall estimates of each effect and their true variability. A meta-analysis may also assist in identifying the conditions in which the effects are likely to be observed through an analysis of possible moderating factors.

An important issue when testing moderating effects using meta-analysis is that access to the zero-order effects of the interaction terms used in analyses is required. Such data are seldom presented in reports of research testing interaction effects. The meta-analyst would, therefore, require access to the raw data for these studies in order to compute the required interaction terms. Gaining access to these datasets through requests to the original authors would likely yield only a small sample of studies relative to the number of tests, and would likely be insufficient to conduct the analysis. Our solution in the present study was to meta-analyze tests of these effects in a large number of datasets applying the TPB in health behaviors sourced from the programs of

research conducted by two co-authors of the current study, Martin S. Hagger (University of California, Merced, USA; www.sharpplab.com) and Kyra Hamilton (Griffith University, Australia, www.hapiresearchlab.com). This approach enabled us to compute averaged point and variability estimates for each interaction effect corrected for sampling error across the datasets using meta-analytic structural equation modeling. Our approach also enabled us to test whether the proposed effects varied according to candidate moderator variables including behavior type and whether scores on the variables involved in the interaction terms tended to cover both or only one side of the scale.

Specifically, the hypothesized TPB moderation effects are summarized in the model presented in Figure 1. We predicted larger effects of intention on behavior, and larger effects of attitude and subjective norm on intention, when PBC was high, and smaller effects when PBC was low. Alongside these key hypotheses, we also predicted direct effects of attitude, subjective norm, and PBC on intention, and intention and PBC on behavior, as well as indirect effects of attitude, subjective norm, and PBC on behavior through intention, consistent with the TPB.

We also tested whether the hypothesized moderation effects are conditional on behavior type. Based on previous meta-analytic research, we predicted that the effects would depend on the target behavior. Specifically, we made a distinction between behaviors that offer protection from illness or chronic disease, labelled ‘health protective behaviors’ (e.g., physical activity participation, healthy eating), and behaviors that may undermine health (e.g., alcohol consumption, smoking), labelled ‘health risk behaviors’ (see McEachan et al., 2011). This distinction was based on the assumption that many behaviors classified as ‘risky’ for health, such as smoking, alcohol consumption, and snacking, are highly rewarding and often require substantive resources to overcome the biological reinforcement or dependency. Health ‘protective’ behaviors, on the other hand, tend not to be subject to these reinforcing

contingencies. These contingencies, therefore, may present increased perceptions of lack of control for ‘risky behaviors’, and intention enactment may be more subject to moderation by PBC. Furthermore, we sought to compare the moderation effects on groups of studies targeting specific behaviors that had been frequently studied. While we expected the pattern of effects to be consistent across moderator groups, that is, we expected the TPB predictions to hold regardless of behavior, we did not rule out possible variations in the magnitude of the effects across behavior type, although we made no specific directional hypotheses for this moderator.

In addition, we conducted exploratory analyses to examine whether the hypothesized TPB moderating effects were conditional on the extent to which scores on the attitude, subjective norm, PBC, and intention variables tended to exhibit high coverage of the response scale or tended to only cover one side of the scale. Moderator effects are less likely to be detected if scores on the variables that make up the interaction term, the moderator and independent variable, are concentrated on one side of the scale. In contrast, there is more scope for interaction effects to be observed when the scores on the scales involved in the interaction cover a greater proportion of the scale. As an illustration, a simulation study in the context of the TPB demonstrated that moderation of the effects of behavioral beliefs on attitude by outcome evaluation were more likely to be present when scores on measures of the belief and evaluation variables covered more of the scale rather than when they tended to cover only one side of the scale (Ajzen & Fishbein, 2008). Consistent with these considerations, we predicted that the proposed moderation effects of PBC are more likely when scores on the variables that comprise the interaction terms cover more of the scale compared to when they do not.

To explore these effects at the study level in the current analysis, we coded studies into those in which scores on the attitude, subjective norm, and PBC constructs had a higher percentage of scores above the scale hypothetical mid-point, coded ‘low coverage’, and those in

which scores on both constructs had a higher percentage of scale scores below the scale mid-point, coded ‘high coverage’. This classification method was used because average scores on these scales in the current sample of studies was above the scale mid-point with relatively low proportions of scores falling below the mid-point. We predicted that the proposed moderation effects would be smaller if scores on scales of one or both of the constructs involved in the moderation effect had lower coverage.

Finally, we tested some additional exploratory moderator analyses of the proposed TPB moderation effects. Specifically, we investigated whether the effects varied according to sample age and publication status. We expected no variation in the proposed effects by sample age, consistent with prior research examining age as a moderator of TPB effects (McEachan et al., 2011). Whether or not study findings have been published has been shown to bias research findings (Polanin et al., 2016), so we investigated whether the proposed effects varied in groups of the included studies defined by their publication status.

Method

Design, Participants, and Procedure

The present study involved secondary analysis of datasets on health behaviors ($k = 39$) from the Hagger and Hamilton labs. Study hypotheses and analysis protocol were pre-registered in advance: <https://osf.io/bqz4m>. The datasets represented all available studies from these labs to the date of analysis (November 2020), published ($k = 31$, 79.5%) and unpublished ($k = 8$, 20.5%), that included independent samples of participants that completed measures of the TPB constructs for a target health behavior with or without a follow-up measure of the target health behavior. While the sets of studies were selective in that they are confined to those conducted in two researchers’ labs, they were inclusive in that no study with the requisite measures from either lab was omitted. This means there is no ‘file drawer’ of studies excluded from the analysis

(Rosenthal, 1994). The datasets comprised samples of university students ($k = 13$), university students and staff ($k = 3$), elementary/high school students ($k = 14$), people in community settings (corporate employees, $k = 1$; older adults, $k = 1$; long-haul truck drivers, $k = 1$; parents of young children, $k = 5$), and patients in clinical settings (pregnant women, $k = 1$). Data were collected in multiple countries or regions: Australia, Estonia, Finland, Greece, Hong Kong, Hungary, Poland, Singapore, and the United Kingdom. Samples were convenience samples of participants who were neither recruited at random nor systematically stratified by demographic variables. Details of participant recruitment and data collection procedures and IRB approvals for each dataset are provided in Appendix A (supplemental materials).

All datasets were from studies that were correlational in design, with the majority ($k = 36$) adopting a prospective design in which measures of the TPB constructs (attitude, subjective norm, PBC, and intention) were administered at an initial time point with a subsequent behavioral follow-up. The remaining datasets ($k = 3$) adopted a cross-sectional design in which theory constructs were measured at a single time point. The majority of the samples ($k = 33$) focused on one target behavior, while a number of samples ($k = 8$) included measures of theory constructs and behavior for more than one target behavior. Characteristics of current datasets including time lag to behavioral follow-up, target behavior(s), and previously published research using the datasets are summarized in Table 1 and presented in full in Appendix B (supplemental materials).

Measures

Participants were presented with a brief introductory passage to each section of the survey, which included instructions on completing each set of items. The full set of items for theory constructs and behavioral measures are presented in Appendix C (supplemental materials).

Theory of planned behavior constructs. All measures of the intention, attitude, subjective norm, and PBC constructs from the TPB were developed according to standardized

guidelines (Ajzen, 2002). Details of the procedures used to develop the current measures can be found online: <https://people.umass.edu/aizen/pdf/tpb.measurement.pdf>. Consistent with the guidelines, each item was designed to make reference to the target behavior(s) and correspond to the behavioral measure(s) in terms of the target of the behavior, the action to be performed, the context in which the behavior was to be performed, and the time frame over which the behavior was to be performed. Confirmatory factor analytic research on TPB measures developed according to these guidelines has supported the factorial and discriminant validity of the measures as indicators of their requisite constructs, and they demonstrate adequate composite reliability (Hagger & Chatzisarantis, 2005; Rhodes et al., 2006).

Behavior. Studies mainly adopted multi-item measures of behavior and complied with Ajzen's (1991) guidelines for correspondence between the theory constructs and behavior.

Moderator Coding

Behavior type is a key moderator of proposed interaction effects involving PBC. We coded two behavior type moderator variables. First, consistent with previous research (McEachan et al., 2011), we segregated studies into those targeting behaviors that were classified as health protective (e.g., physical activity, eating fruit and vegetables; $k = 32$), health risk (e.g., alcohol consumption, consumption of high-sugar beverages; $k = 4$), or a mix of both health protective and health risk behaviors ($k = 3$). Second, we coded a moderator for specific behaviors tested with sufficient regularity to form moderator groups of appropriate size for a meaningful analysis. In the current set of studies two behaviors were tested with requisite frequency: physical activity ($k = 19$) and dietary behaviors (e.g., eating sufficient fruit and vegetables, restricting consumption of sugar-sweetened beverages, dieting; $k = 6$). We therefore classified studies into physical activity and dietary behavior categories, with the remaining studies classified into a separate

category representing an eclectic mix of health behaviors (e.g., parent-for-child toothbrushing; alcohol consumption; $k = 8$).

We also explored the effect of score coverage of the variables involved in the interaction terms on the proposed moderation effects. We did this by coding studies according to the degree to which the scores on the variables involved in the interaction effects covered the scale. Studies in which one or both variables involved in the interaction term had a higher percentage of scores ($>60\%$) above the hypothetical scale mid-point were coded as having low scale score coverage, while those in which both variables had a lower percentage ($\leq 60\%$) of scores above the mid-point were coded as having high coverage.

Finally, we explored whether the TPB moderation effects varied by sample age by estimating our model in groups of studies on adult (classified as ‘older’) or lower- or high-school student (classified as ‘younger’) participants. We also explored effects of publication status by estimating the model in groups of studies that had been previously published and those that remained unpublished. Details on moderator coding is summarized in Table 1 and presented in full in Appendix B (supplemental materials).

Data analysis¹

Data were analyzed using one-stage meta-analytic structural equation modeling (OSMASEM; Jak & Cheung, 2020) with metaSEM package in R (Cheung, 2015). The proposed structural equation models were fit to the pooled correlation matrices from each sample weighted according to their precision (inverse of the sampling covariance matrices) using random effects meta-analysis. The matrices included mean-centered interaction terms computed for the interaction of PBC with attitude, subjective norm, and intention prior to pooling using meta-

¹Data files, analysis scripts, and data analysis output files can be accessed online: <https://osf.io/3w2k7/>

analysis. These terms were used to estimate the PBC moderation effects in the proposed model. Some samples included multiple measures of theory constructs and behaviors, so we accounted for this dependency by conducting a within-sample meta-analysis of effects with a simple average across behaviors and generated a within-sample pooled correlation matrix that was used for that study in subsequent analyses. The models specifying theory predictions including the hypothesized moderation effects of PBC were then estimated using the pooled correlation matrix and their model fit evaluated.

Effect sizes of the proposed effects in the models were evaluated using standardized parameter estimates and their 95% Wald confidence intervals. Overall model heterogeneity was evaluated using the I^2 statistic, and heterogeneity of each model parameter estimate evaluated using the tau squared statistic (τ^2). The I^2 statistic indicates the percentage of variation that can be explained by the studies. The I^2 statistic is a relative measure of heterogeneity because it is affected by the sample sizes of the included studies, so we also reported the τ^2 statistic, an absolute measure of heterogeneity, as recommended (Borenstein et al., 2017). Overall fit of the proposed model with its respective pooled correlation matrix was evaluated using multiple goodness-of-fit criteria: the goodness-of-fit chi-square, the comparative fit index (CFI), the root mean square error of approximation (RMSEA) and its 95% confidence intervals, and the standardized root mean square of the residuals (SRMSR). Exact model fit was supported if the chi-square statistic was non-significant, whereas approximate model fit was indicated by the CFI, which should approach or exceed .950, the RMSEA, which should be equal to or less than .05 with confidence intervals including .05 or less, and the SRMSR, which should be .08 or less for a well-fitting model. Analysis of effects of the behavior type, scale coverage, sample age, and publication status moderator variables was performed by creating categorical moderators that compared model effects across samples with one moderator group as the reference sample. This

enabled model fit to be compared for the model that included and did not include the moderators with a formal test provided using the likelihood ratio statistic. Differences in specific model parameters across moderator groups were tested by comparing the parameter estimates of each model across moderator groups. Further details of the use of OSMASEM procedure with interaction effects are provided in Appendix D (supplemental materials).

Results

Preliminary Analyses

Reliability estimates for theory constructs and behavior measures used in each sample and for each behavior approached or exceeded recommended cut-off values ($>.70$), with the exception of the inter-item correlation for the subjective norm construct in dataset for the study on physical activity in patients with familial hypercholesterolemia. Descriptive statistics and reliability estimates for the theory constructs and behavior measures for studies on single behaviors and studies on multiple behaviors are presented in Appendices E and F, respectively.

Meta-Analytic Structural Equation Models

Parameter estimates of the proposed meta-analytic structural equation model of the TPB with moderation effects are presented in Table 2 and Figure 1, with full model estimates including correlations among residuals presented in Appendix G (supplemental materials). The model exhibited acceptable fit with the data according to the multiple criteria adopted, $\chi^2(5) = 9.722, p = .084$, CFI = 0.995, RMSEA = 0.008, RMSEA 95% CI [0, 0.018]. The model accounted for substantive variance in the intention ($R^2 = .452$) and behavior ($R^2 = .265$). Consistent with previous research and theory predictions, results revealed statistically significant small-to-medium sized averaged effects of attitude ($\beta = .386, p < .001$, 95% CI [.319, .452]), subjective norm ($\beta = .162, p < .001$, 95% CI [.100, .225]), and PBC ($\beta = .314, p < .001$, 95% CI [.240, .388]) on intention, and intention on behavior ($\beta = .489, p < .001$, 95% CI [.384, .594]).

There were also significant small-sized indirect effects of attitude ($\beta = .189, p < .001, 95\% \text{ CI } [.141, .237]$), subjective norm ($\beta = .079, p < .001, 95\% \text{ CI } [.045, .113]$), and PBC ($\beta = .154, p < .001, 95\% \text{ CI } [.099, .209]$) on behavior via intention. With respect to the hypothesized moderator effects, we found a significant small-sized effect of the interaction of PBC and intention on behavior ($\beta = .066, z = 3.119, p = .002, 95\% \text{ CI } [.025, .107]$). We probed this interaction using simple slope analysis, estimating the intention-behavior relation at three levels of PBC, the mean, and at one standard deviation above and below the mean. The interaction effect is illustrated in Figure 2. The intention-behavior relation was stronger at one standard deviation above the mean value for PBC ($\beta = .555, z = 10.558, p < .001, 95\% \text{ CI } [.452, .658]$) than at the mean value ($\beta = .489, z = 9.126, p < .001, 95\% \text{ CI } [.384, .594]$) and at one standard deviation below the mean value ($\beta = .423, z = 6.798, p < .001, 95\% \text{ CI } [.301, .545]$). Although we observed small-sized interaction effects of PBC and attitude ($\beta = -.050, z = -1.011, p = .312, 95\% \text{ CI } [-.148, .047]$) and PBC and subjective norm ($\beta = .075, z = 1.639, p = .101, 95\% \text{ CI } [-.015, .164]$) on intention, these effects were not statistically significant.

Analysis of Moderators

Behavior type. We tested the effect of type of target behavior as a moderator of the interaction effects of PBC on model relations. Our first analysis compared model effects across studies with health protective behavior, health risk behavior, and both health promoting and health risk behaviors as the target behavior. Although the analysis revealed overall differences in model fit when the moderator was included ($\Delta\chi^2 = 75.934, \Delta df = 8, p < .001$), we found no statistically significant differences in the size of the moderating effects of PBC on the attitude-intention, subjective norm-intention, and intention-behavior relations at any level of the moderator.

Our second analysis compared model effects in studies focusing on physical activity and dietary behaviors as the target behaviors, the two most frequently targeted behaviors in the sample of studies, with a third category accounting for the remaining studies targeting an eclectic mix of behaviors (e.g., sun safety behaviors, alcohol consumption, parent-for-child health behaviors). Although the analysis revealed overall differences in model fit when the moderators were included ($\Delta\chi^2 = 35.220$, $\Delta df = 16$, $p = .004$), there were no differences in the individual parameter estimates for the TPB moderation effects of interest.

Scale score coverage. We explored whether moderation effects of PBC on the intention-behavior, attitude-intention, and subjective-norm intention relations were moderated by whether scores on the variables involved in the interaction terms covered more of the scale. The analyses revealed significant differences in overall model fit for the attitude and PBC ($\Delta\chi^2 = 16.498$, $\Delta df = 8$, $p = .036$) and intention and PBC ($\Delta\chi^2 = 49.535$, $\Delta df = 8$, $p < .001$) scale coverage moderator analyses, but no differences in model fit for the subjective norm and PBC scale coverage moderator ($\Delta\chi^2 = 12.775$, $\Delta df = 8$, $p = .120$). We subsequently examined the slopes of the two significant moderation effects². As predicted, we found a small-sized significant positive effect of intention on behavior with increasing values of PBC when the PBC and intention variables had high scale score coverage ($\beta = .101$, $p < .001$, 95% CI [.043, .158]), but not when these variables had low coverage ($\beta = -.006$, $p = .867$, 95% CI [-.068, .057]). Although we also observed a small-sized negative effect of attitude on intention with increasing values of PBC when the attitude or PBC variables had high scale score coverage ($\beta = -.075$, $p = .147$, 95% CI [-.175, .026]), and a small-sized positive effect when these variables had low coverage ($\beta = .067$, $p = .299$, 95% CI [-

²Only slopes (without intercepts) at each level of the moderator were available in this analysis, so we did not plot the simple slopes as such plots require both intercepts and slopes at each level of the moderator. These analyses are similar to a meta-regression or mixed-effects meta-analysis.

.058, .192]), neither effect was statistically significant. This indicated that this moderator did not contribute substantively to differences in model fit.

Sample age and publication status. We found significant overall differences in model fit for the sample age (younger vs. older samples; $\Delta\chi^2 = 33.703$, $\Delta df = 8$, $p < .001$), but not the publication status (published vs. unpublished; $\Delta\chi^2 = 8.707$, $\Delta df = 8$, $p = .368$), moderators. However, we found no differences in the TPB moderator effects for the sample age moderator; differences in model fit were the result of variation in the main effects of the TPB variables across moderator groups.

Full results of the moderator analyses with comparisons of parameter estimates are presented in Appendix H (supplemental materials).

Discussion

While the TPB has been applied widely to predict behavior in health contexts, and many of its predictions have been supported in meta-analyses of extant research on multiple health behaviors (e.g., McEachan et al., 2011), relatively few studies have tested the moderating effects of PBC on the attitude-intention, subjective norm-intention, and intention-behavior relations, particularly in health behavior contexts. Furthermore, tests of these moderation effects in health behavior contexts have generally provided inconclusive support. In the current study we aimed to extend knowledge on the role of PBC as a moderator in the TPB by estimating of the average size and variability of the proposed moderation effects in the theory in health behavior studies using meta-analysis. To do so, we tested these effects in a sample of studies ($k = 39$) from two programs of research applying the TPB in multiple health behavior domains. These datasets enabled us to compute the mean-centered interaction terms necessary to test the proposed moderation effects using meta-analytic structural equation modeling. We also conducted a series

of moderator analyses testing the effects of behavior type, scale score coverage, sample age, and publication status on the proposed TPB moderation effects.

Results revealed support for the moderating effect of PBC on the intention-behavior relation, such that this relation was stronger at higher values of PBC. However, we found small-sized effects for the moderation of the effects of attitude and subjective norm on intention by PBC, which did not differ significantly from zero. The significant heterogeneity observed in effects among theory constructs, including the moderator effects, across studies, justified a search for moderators. Analyses of the behavior type moderator revealed no differences in the proposed moderation effects in groups of studies targeting health protective, health risk, and both types of behavior as the target behavior, and in groups of studies targeting physical activity, dietary, and ‘other’ health behaviors as the target behavior. Analysis of scale score coverage revealed that the moderating effect of PBC on the intention-behavior relation was larger in groups of studies in which both variables involved in the interaction term had higher scale score coverage, consistent with predictions. Finally, we found no differences in the proposed TPB moderation effects in groups of studies on younger and older samples, and published and unpublished studies.

Moderation of the Intention-Behavior Relation

The current research provides the first synthesis of evidence demonstrating that individuals reporting higher levels of perceived control over a given health behavior are more likely to act on their intention to perform the behavior. Providing cumulative evidence for this moderation effect across multiple studies makes an important theory contribution by lending support for a key prediction of the TPB that is seldom tested. Our findings suggest that when perceived control over a behavior is compromised, individuals are less likely to act on their intention. There are two possible reasons for this pattern of effects. First, when PBC is low, individuals with a favorable intention may be less likely to persevere in the face of difficulties encountered while trying to

carry out their intention. For example, individuals who intend to adhere to a low-fat diet and attempt to do so may give up easily when they encounter impediments if they doubt their ability to forego high-fat foods, while individuals with beliefs in their ability to do so will be more likely to persevere. Second, PBC is predicted to moderate the intention-behavior relation when it is assumed to act as a proxy for actual control. Low PBC may thus reflect objective internal or external factors that can interfere with successful implementation of the target behavior. Strictly speaking, when actual and perceived behavior control are at their maximum, the size of the intention-behavior relation is at its highest potential value or strength, such that control is no longer an ‘issue’ and the TPB reverts to the theory of reasoned action. The current research, therefore, serves to provide confirmation based on cumulative evidence for a fundamental prediction of the TPB in health behavior contexts.

From a practical perspective, evidence for moderation of the intention-behavior relation by PBC suggests that intervention strategies that maximize perceived control over the target health behavior are likely to increase individuals’ likelihood of acting on their intention. Such interventions need to target control beliefs by addressing perceived barriers and highlighting solutions or skills to overcome or manage them (Ajzen & Schmidt, 2020). Research has provided support for this line of reasoning, indicating that interventions targeting control beliefs are effective in changing intention and behavior in health contexts (Steinmetz et al., 2016).

Moderation of the Attitude-Intention and Subjective-Norm Intention Relations

The current analysis revealed little evidence for the moderation effects of PBC on the attitude-intention and subjective norm-intention relations. These effects were small in size and not significantly different from zero. The theoretical basis for these moderation effects, which are not routinely tested in studies applying the TPB in health contexts, is that individuals with greater perceived control over their behavior are more likely to align their intention to perform a target

health behavior with their attitude and subjective norm. Taken at face value, evidence from the current meta-analysis suggests that the theory-based processes represented by these moderation effects are relatively trivial. Such an interpretation is, however, inconsistent with some previous research that has supported these effects in health behavior contexts (e.g., Conner & McMillan, 1999; Earle et al., 2020; Hukkelberg et al., 2014; La Barbera & Ajzen, 2020; Umeh & Patel, 2004; Yzer & van den Putte, 2014). It is also important to note the substantial heterogeneity in these moderation effects across studies in our analysis, suggesting the presence of moderator variables. It is, therefore, possible that the TPB moderation effects may be subject to the effects of other extraneous variables. In the current analysis we explored effects of a number of candidate moderators, foremost among them the type of target and coverage of scale scores of the variables contributing to the moderator effects. We summarize the extent to which these moderator variables affected the proposed moderation effects in the next section.

Analysis of Moderators

Behavior type as a moderator. Our analysis of the behavior type moderator revealed no significant differences in moderator effects across studies on health protective and health risk behaviors, or physical activity and dietary behaviors. These findings provide preliminary evidence to suggest that the moderator effects may be consistent across behaviors. This would be in keeping with assumptions that patterns of effects of social cognition constructs on behavior should be invariant across behaviors. However, it is important to emphasize that we cannot unequivocally rule out possibility of behavior type as a moderator of the proposed effects. This is because our moderator coding had to be relatively broad in order to retain sufficient numbers of studies to estimate the proposed model. It is possible that a more fine-grained analysis may have revealed differences. For example, segregating studies according to specific behavior characteristics, such as behaviors requiring impulse control or behaviors with an ‘addictive’

component. However, the number of studies available for analysis was too small to estimate the model moderator groups at this level of fidelity.

Scale score coverage as a moderator. As predicted, when scores on the variables involved in the proposed moderation effects had high coverage of the scale, the moderation of the intention-behavior relationship by PBC was observed. These findings suggest that researchers should consider the coverage of scores on the PBC and intention scales when testing TPB moderation effects. It should also be noted that the effect size of the moderation effects of PBC on the intention-behavior relationship was small relative to, for example, the direct and indirect effects of PBC on behavior. From a practical perspective, this may imply that interventions targeting change in PBC may lead to behavior change by increasing the strength of the effects of PBC on intention and behavior, rather than by bolstering the intention-behavior relation. However, it should be noted that strategies aimed at changing PBC but may also lead to stronger moderation effects. For instance, if PBC scores were originally distributed on one side of the scale prior to the intervention, only trivial moderation effects would likely be observed. However, an intervention may move PBC for some of the participants and not others, resulting in PBC scores with greater scale coverage. Following the intervention, we would therefore observe much stronger interaction effect. However, to date, no study has experimentally tested the effect of PBC change strategies on the intention-behavior relation and we look to future studies to explicitly test this effect to support this hypothesis.

Scale score coverage did not affect the moderating effects of PBC on the attitude-intention and subjective norm-intention relations. This was not unexpected given these moderating effects were not observed in the overall analysis. However, it is important to note that our analysis of the scale score coverage moderator was not preregistered and should be considered exploratory.

These findings are in need of further corroboration in future primary studies and research syntheses.

Strengths, Limitations and Avenues for Future Research

The current study has a number of strengths: It used a set of studies derived from two programs of research to conduct the first meta-analytic test of PBC moderation effects in the TPB applied to health behaviors; it adopted a meta-analytic structural equation modeling analytic approach that permitted simultaneous tests of the PBC moderation effects alongside other theory predictions, corrected for sampling error; and it tested behavior type and scale score coverage as salient moderators of the hypothesized moderation effects.

It is, nevertheless, important to consider some limitations that should be taken into account when interpreting current findings. Foremost among these is the selective sample of studies used in the current analysis. The sample of studies was comprehensive as it comprised all studies from Hagger's and Hamilton's programs of research applying the TPB in health contexts with no useable data were left in our 'file drawer' (Rosenthal, 1994). Nevertheless, the sample should not be taken as representative of the 'universe' of available studies applying the TPB in health contexts. Furthermore, none of the samples of participants in the included datasets were recruited using randomly-selected stratified sampling methods. Taken together, these selective sampling practices place limits on the extent to which current findings can be generalized to the broader population.

However, it should also be stressed that these selectivity and sampling issues do not mean these data lack value. The TPB, and reasoned action theories more broadly (Ajzen, 1991; Conner & Norman, 2015), are proposed as generalized models of behavior and decision making consistent with the social cognition approach. This assumption means that the pattern of relations among theory constructs is expected to hold and differ from zero in each test of the theory even if

the actual size of the effects vary according to contextual, behavioral, and population attributes. In other words, effect sizes for the relations among theory constructs may vary in magnitude, but the overall pattern of effects should still be consistent with theory predictions. As a consequence, the current data have value in providing preliminary in-principle support for the tenability of the proposed effects, particularly the moderating effect of PBC in terms of the intention-behavior relation.

Another limitation is the relatively small number of studies available in the sample for additional moderator analyses. Although the number of studies and total sample size was sufficient to conduct the main analysis and the broad behavior type and scale coverage moderator analyses, it precluded testing of more fine-grained moderator analyses given the relative complexity of the proposed models. For example, it would have been informative to test the current models in groups of studies on other specific health behaviors beyond physical activity and dietary behaviors. It may also have been useful to identify groups of studies targeting behaviors that are determined by impulsive or appetitive desires (e.g., drinking alcohol, sugar consumption) with which individuals are likely to experience problems of behavioral control.

It is also important to note that all of the studies in the current analysis adopted self-report measures of behavior. Such measures are subject to measurement error caused by socially-desirable responding and affirmation bias. The development of measures of theory constructs that exhibited good correspondence with the behavioral measures according to published guidelines (Ajzen, 2002) with good internal consistency statistics may mitigate such bias. Nevertheless, replication of the PBC moderator effects in samples of studies adopting more ‘objective’ measures of health behavior should be conducted for comparison. In addition, the studies included in the current analysis were exclusively correlational in design, so directional and causal effects among model variables are to be inferred from theory alone, not the data. Research

adopting panel, experimental, and intervention designs should be considered in future studies to resolve this limitation.

We should also acknowledge the limitations of methods used to evaluate the moderation effects in the current analysis. Although testing moderation effects using interaction or product terms is used extensively in social science research, this method suffers from several limitations: (a) it only tests linear-by-linear interaction effects and does not, therefore, model non-linear interactions, that is, the interaction effect doubles when the value of the moderator doubles; (b) it assumes that the residuals of the outcome variable are homoscedastic across the values of the predictors, that is, there is equality in their variances, an assumption that is often violated (e.g., Aguinis, 1995); (c) it assumes that the predictor and moderator are measured without measurement error; and (d) the tests often have low statistical power. The use of a meta-analytic approach in the current research helps to address the issue of low statistical power by combining multiple studies; however, the current analyses cannot resolve issues (a) through (c). Other approaches to moderation are available, but these too have limitations. For example, dividing the sample according to cut points on a continuous moderator (e.g., median split) and testing the effect of interest separately in samples above and below the cut points. Although there are advocates of such practices (Iacobucci et al., 2015), this approach is generally not recommended as it loses information (MacCallum et al., 2002).

Finally, although the sample of studies included in the current analysis covered all studies drawn from two programs of research, which provided some control over publication bias, the studies on which the analysis was based represent a highly selective sample. This selectivity limits the generalizability of the findings. For example, the samples in the included studies were largely from homogenous groups with little diversity: participants were predominantly White Caucasian, with relatively low numbers from minority ethnic and racial groups, and were

relatively affluent and highly educated. Although we tested for effects of sample age, lack of diversity in the included samples precluded moderator analyses in groups of studies defined by a broader range of demographic characteristics. The onus is on researchers to routinely test the moderating effects of PBC within the TPB in research applying the theory in multiple populations, contexts, and behaviors. In particular, given research demonstrating the general lack of diversity in samples in psychological research (Henrich et al., 2010), and the moderating effects of socio-structural variables on TPB effects (Hagger & Hamilton, 2021), researchers should consider testing the moderation effects in samples drawn from ethnic and racial minority populations and those from lower socio-economic backgrounds. Furthermore, we implore researchers to make data from their studies openly available, which would enable interaction effects to be calculated and permit their inclusion in future meta-analyses of TPB moderation effects.

Researchers should also consider conducting more research comparing PBC moderation effects for specific behaviors with different levels of perceived and actual control. Research adopting experimental or intervention designs where participants' control over the behavior is systematically varied is also advocated. In such studies, differences in control across the behaviors should be verified by comparing levels of PBC across the manipulations, followed by comparisons of the size of the attitude-intention, subjective norm-intention, and intention-behavior relations.

Conclusion

The current study provides the first meta-analytic test of the moderating effects of PBC in the TPB in a sample of studies from two programs of research in the health behavior domain. Results lend consistent support for the moderating effect of PBC on the intention-behavior relation across studies, such that the intention-behavior relation is larger at higher values of PBC.

Data provide little support for the moderation effects of PBC on the attitude-intention and subjective norm-intention relations. All moderation effects were highly variable across samples.

Moderator analyses indicated that the moderating effect of PBC on the intention-behavior relation was more likely when scores on the variables involved in the interaction had high coverage of the scale. Moderator analyses for behavior type, as well as sample age and publication status did not moderate these effects or resolve the heterogeneity in the effect sizes.

Overall, findings provide consistent support for the moderation of the intention-behavior relation by PBC. Researchers are advised to routinely test this effect in studies applying the TPB to health behaviors, and account for the distribution of the scales involved in the interaction. Future research should systematically test these moderation effects in different health behaviors, populations, and contexts, and report sufficient data to conduct behavior type moderator analyses with greater fidelity.

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Table 2

Characteristics of Studies Included in the Meta-Analysis and Moderator Variable Coding

| Dataset | Sample | N | Design | Behavior | Moderator variable coding | | | | | | |
|---|---------|------|--------|----------|---------------------------|---------------|--------|----------------------|------------|--------------|------------------|
| | | | | | Pub. status | Behavior type | | Scale score coverage | | | Age ^a |
| | | | | | | Mod. 1 | Mod. 2 | Att./ PBC | SN/ PBC | Int./ PBC | |
| 1. Caudwell & Hagger (2015) | UST | 280 | PRO | AL | PUB | HR | OTH | 1 | 1 | 1 | 0 |
| 2. Hagger & Chatzisarantis (2005) | UST/STA | 523 | PRO | DB | PUB | HP | DB | 1 | 0 | 1 | 0 |
| 3. Hagger & Chatzisarantis (2005) | UST/STA | 596 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 0 |
| 4. Hagger et al. (2017) | UST | 90 | PRO | DB | PUB | HR | DB | 0 | 0 | 0 | 0 |
| 5. Hagger & Armitage (2004) | LSST | 1198 | CS | PA | PUB | HP | PA | 0 | 0 | 0 | 1 |
| 6. Hagger et al. (2012) | EMP | 661 | PRO | AL | PUB | HR | OTH | 1 | 1 | 1 | 0 |
| 7. Hagger et al. (2003) | HSST | 222 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 1 |
| 7. Hagger et al. (2007) | HSST | 432 | PRO | PA | PUB | HP | PA | 1 | 1 | 0 | 1 |
| 8. Hagger et al. (2007) | HSST | 268 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 1 |
| 10. Hagger et al. (2007) | HSST | 235 | PRO | PA | PUB | HP | PA | 1 | 1 | 0 | 1 |
| 11. Hagger et al. (2001) | HSST | 1238 | CS | PA | PUB | HP | PA | 1 | 1 | 1 | 1 |
| 12. Hagger (unpublished) ^b | HSST | 497 | CS | PA | UPUB | HP | PA | 1 | 1 | 1 | 1 |
| 13. Hagger et al.(2009) | HSST | 127 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 1 |
| 14. Hagger et al. (2006) | UST | 250 | PRO | DB | PUB | HP | DB | 0 | 0 | 0 | 0 |
| 15. Hagger et al. (2006) | UST | 261 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 0 |
| 16. Hagger (unpublished) ^b | UST | 263 | PRO | MULT | UPUB | MIX | OTH | - | - | - | 0 |
| 17. McLachlan & Hagger (2011) | UST/EMP | 185 | PRO | PA | PUB | HP | PA | 1 | 0 | 0 | 0 |
| 18. Hagger et al. (2007) | UST | 525 | PRO | DB/AL/PA | PUB | MIX | OTH | - | - | - | 0 |
| 19. Hagger et al. (2005) | HSST | 93 | PRO | PA | PUB | HP | PA | 1 | 0 | 0 | 1 |
| 20. Hagger et al. (2005) | HSST | 103 | PRO | PA | PUB | HP | PA | 1 | 0 | 1 | 1 |
| 21. Hagger et al. (2005) | HSST | 133 | PRO | PA | PUB | HP | PA | 0 | 0 | 0 | 1 |
| 22. Hamilton & White (2008) | HSST | 423 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 1 |
| 23. Hamilton (unpublished) ^b | HSST | 230 | PRO | PA | UPUB | HP | PA | 1 | 0 | 1 | 1 |
| 24. Hamilton (unpublished) ^b | UST | 626 | PRO | OTH | UPUB | HP | OTH | 1 | 0 | 0 | 0 |
| 25. Arnautovska et al. (2019) | GP | 213 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 0 |
| 26. Hamilton et al. (2017) | GP | 373 | PRO | OTH | PUB | HP | OTH | 1 | 1 | 1 | 0 |
| 27. Hamilton (unpublished) ^b | GP | 281 | PRO | OTH | UPUB | HP | OTH | 1 | 1 | 1 | 0 |
| 28. Hamilton et al. (2012) | GP | 580 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 0 |
| 29. Hamilton et al. (2021) | UST | 201 | PRO | OTH | PUB | HP | OTH | 1 | 1 | 1 | 0 |
| 30. Hamilton, Gibbs et al. (2020) | UST | 204 | PRO | AL | PUB | HR | OTH | 0 | 0 | 0 | 0 |
| 31. Hamilton et al. (2021) | UST | 161 | PRO | OTH | PUB | HP | OTH | 0 | 0 | 0 | 0 |
| 32. Allom et al. (2016) | UST | 188 | PRO | PA | PUB | HP | PA | 1 | 1 | 1 | 0 |
| 33. Phipps et al. (2020) | UST | 233 | PRO | DB | PUB | HP | DB | 1 | 1 | 1 | 0 |
| 34. Hamilton (unpublished) ^b | HSST | 266 | PRO | DB | UPUB | HP | DB | - | - | - | 1 |
| 35. Spinks and Hamilton (2016) | GP | 196 | PRO | DB | PUB | HP | DB | - | - | - | 0 |
| 36. Hamilton et al. (2016) | GP | 208 | PRO | DB/OTH | PUB | HP | OTH | - | - | - | 0 |
| 37. Hamilton et al. (2019) | GP | 207 | PRO | PA/DB | PUB | HP | OTH | - | - | - | 0 |

| | | | | | | | | | | | |
|---|-----|-----|-----|-------|------|----|-----|---|---|---|---|
| 38. Hamilton (unpublished) ^b | GP | 84 | PRO | PA/DB | UPUB | HP | DB | - | - | - | 0 |
| 39. Hamilton (unpublished) ^b | UST | 267 | PRO | AL | UPUB | HP | OTH | - | - | - | 0 |

Note. Mod. 1 = Moderator 1 – Studies classified as targeting a health risk, health protective, or a mix of both health protective and risk behaviors; Mod. 2 = Moderator 2 – Studies classified as targeting physical activity, dietary behaviors, or other behaviors; Pub. status = Publication status; Att. = Attitude; SN = Subjective norm; PBC = Perceived behavioral control; Int. = Intention; UST = University student; STA = University staff; LSST = Lower school students; EMP = Company employees; HSST = High school students; GP = General population; PRO = Prospective study design; CS = Cross-sectional study design; AL = Alcohol; DB = Dietary behavior; PA = Physical activity behavior; MULT = Multiple behaviors; OTH = Other behavior; PUB = Published dataset; UPUB = Unpublished dataset; HR = Health risk behavior; HP = Health protective behavior; MIX = Mix of health protective and risk behaviors. ^aAge moderator variable coded as 1 = older samples and 0 = younger samples. ^bDescription of unpublished data sets is provided in Appendix A (supplemental materials) and the datasets are available online: <https://osf.io/3w2k7/>.

Table 2

Standardized Path Coefficients for Direct and Indirect Effects and Correlations for the Meta-Analytic Structural Equation Models of the Theory of Planned Behavior with Interaction Effects

| Effect | β | Wald CI ₉₅ | |
|---------------------------------------|-----------|-----------------------|--------|
| | | LL | UL |
| Direct effects | | | |
| Intention→Behavior | 0.489*** | 0.384 | 0.594 |
| Attitude→Intention | 0.386*** | 0.319 | 0.452 |
| Subjective norm→Intention | 0.162*** | 0.100 | 0.225 |
| PBC→Intention | 0.314*** | 0.240 | 0.388 |
| PBC→Behavior | 0.065 | -0.054 | 0.184 |
| Interaction effects | | | |
| Attitude x PBC→Intention | -0.050 | -0.148 | 0.047 |
| Subjective norm x PBC→Intention | 0.075 | -0.015 | 0.164 |
| Intention x PBC→Behavior | 0.066** | 0.025 | 0.107 |
| Indirect effects | | | |
| Attitude→Intention→Behavior | 0.189*** | 0.141 | 0.237 |
| Subjective norm→Intention→Behavior | 0.079*** | 0.045 | 0.113 |
| PBC→Intention→Behavior | 0.154*** | 0.099 | 0.209 |
| Correlations | | | |
| Attitude↔Subjective norm | 0.346*** | 0.302 | 0.391 |
| Attitude↔PBC | 0.401*** | 0.359 | 0.444 |
| Attitude↔Attitude x PBC | -0.274*** | -0.345 | -0.204 |
| Attitude↔Subjective norm x PBC | -0.075*** | -0.115 | -0.036 |
| Attitude↔Intention x PBC | -0.170*** | -0.225 | -0.115 |
| Subjective norm↔PBC | 0.317*** | 0.269 | 0.364 |
| Subjective norm↔Attitude x PBC | -0.076*** | -0.116 | -0.036 |
| Subjective norm↔Subjective norm x PBC | -0.178*** | -0.251 | -0.104 |
| Subjective norm↔Intention x PBC | -0.090*** | -0.130 | -0.051 |
| PBC↔Attitude x PBC | -0.226*** | -0.289 | -0.162 |
| PBC↔Subjective norm x PBC | -0.187*** | -0.254 | -0.120 |
| PBC↔Intention x PBC | -0.343*** | -0.405 | -0.281 |
| Attitude x PBC↔Subjective norm x PBC | 0.558*** | 0.426 | 0.689 |
| Attitude x PBC↔Intention x PBC | 0.931*** | 0.775 | 1.087 |
| Subjective norm x PBC↔Intention x PBC | 0.631*** | 0.503 | 0.760 |

Note. β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; CI₉₅ = Conventional 95% confidence interval; β_{diff} = Difference in standardized path coefficient; PBC = Perceived behavioral control.

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

Figure 1. Diagrammatic representation of the theory of planned behavior with interaction effects. Coefficients are standardized parameter estimates.

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

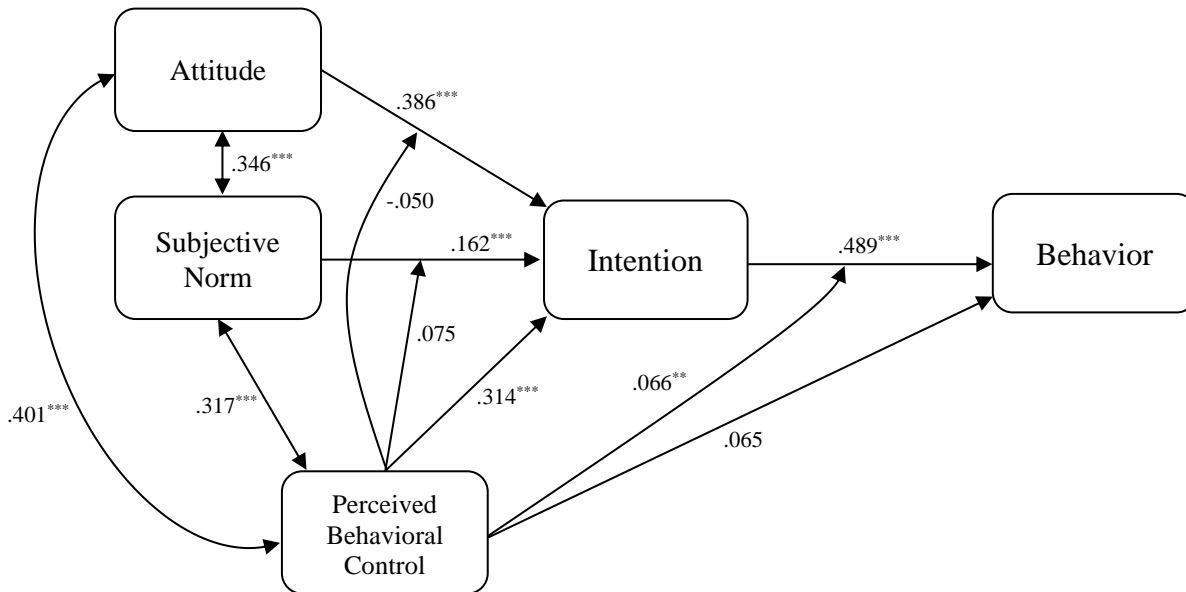
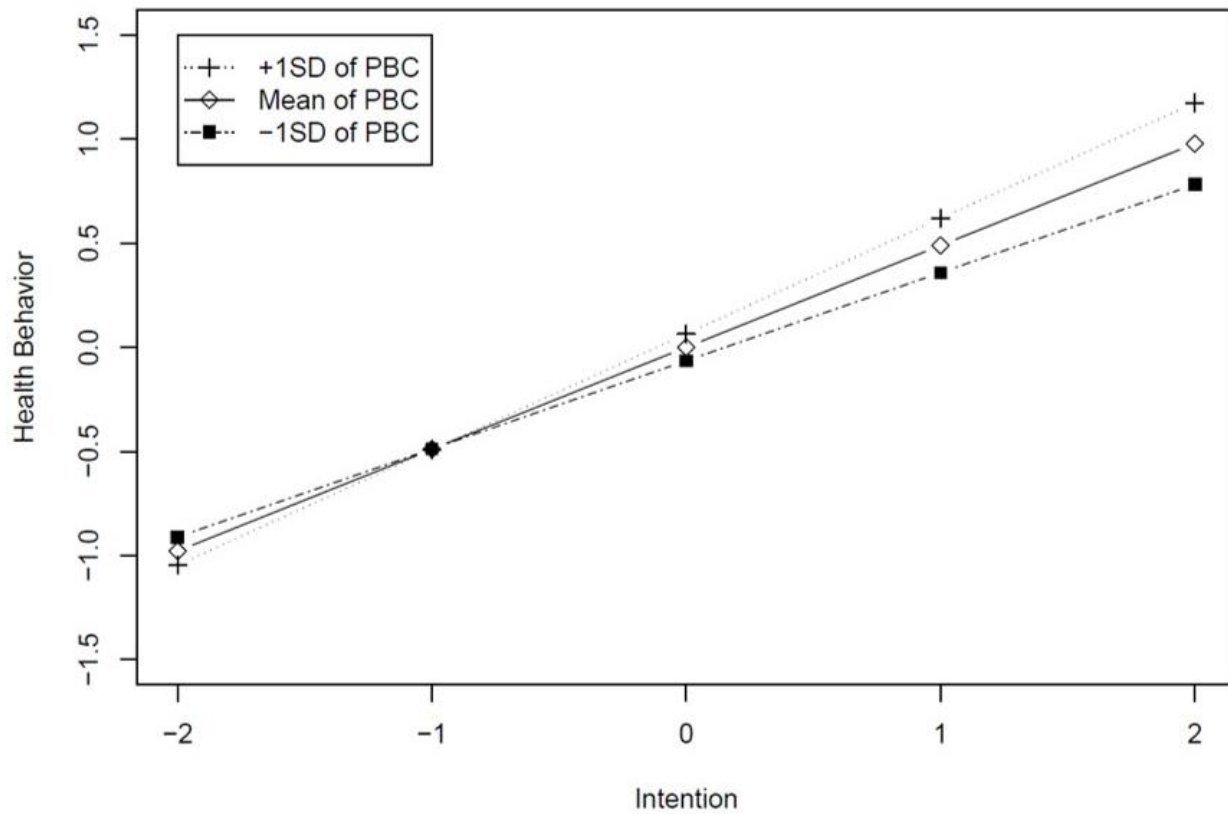


Figure 2. Results of the simple slopes analysis plotting the intention-health behavior relationship at the mean level of the moderator, perceived behavioral control (PBC), and at one standard deviation above and below the mean.



Appendix A

*Details of Participant Recruitment and Data Collection Procedures and Institutional Review Board Approvals for the Samples in Each Dataset Included in the Meta-Analysis***Dataset 1 (Caudwell & Hagger, 2015; Student alcohol pre-drinking)**

Participants were undergraduate students recruited via social media and posters placed on noticeboards and prominent locations around university campus locations in Western Australia. Participation was incentivized through entry into a prize draw or by offering course credit. Participants were eligible for inclusion in the study if they were aged 18 years or older and enrolled in a full-time course at a Western Australian university. Participants ($N = 508$) completed a baseline online questionnaire comprising theory of planned behavior (TPB) measures and past behavior at an initial data collection occasion (Time 1). Four weeks later, at a second data collection occasion (Time 2) participants ($N = 341$ (retention rate = 67.1%)) completed a follow-up measure of behavior. Of these participants, 55 reported not engaging in pre-drinking in the previous four weeks and a further 6 participants' data had a high proportion of missing data, resulting in a final sample of 280 (M age = 21.41 years $SD = 4.21$ years; 90 men, 190 women). The majority (79.2%) self-identified as Caucasian in ethnicity. Data on education level and income were not collected. Ethical approval was secured from the Curtin University Human Research Ethics Committee in advance of data collection. These data were previously published (Caudwell & Hagger, 2015).

Datasets 2 and 3 (Hagger & Chatzisarantis, 2005; University student and staff dieting and exercise)

Participants were undergraduate university students and university employees. Participants were required to completed self-report measures of TPB constructs referring to either dieting behavior or leisure-time exercise behavior at an initial data collection occasion. Participants in the dieting behavior sample ($N = 523$; 322 women, 201 men; M age = 21.13, $SD =$

3.72) were provided with instructions that they were participating in a ‘survey’ on behaviours relating to ‘watching your diet’. A standardized set of instructions defined the target behaviour of ‘watching your diet’ as “cutting down on sugary foods (e.g. sweets, soft drinks, chocolate), cutting down on fatty foods (e.g. butter, bacon, potato chips), avoiding snacks between meals, decreasing food intake in general by eating lighter meals, not having seconds and not overeating, taking diet pills or liquid diet formula to control weight, eating diet foods (e.g. reduced calorie salad dressing, diet soft drinks), and fasting i.e. purposefully skipping one or more meals. It does not necessarily imply being on a specific diet or dietary programme”. For the exercise sample ($N = 596$; 344 women, 252 men; M age = 26.81, $SD = 10.71$), the target behavior was defined as “vigorous physical activities such as sports and active pastimes that raise your heart rate/pulse and make you breathe deeply for 20 minutes at a time”. Two weeks after the initial occasion, participants were completed a follow-up self-report measure of their dieting behavior or vigorous physical activity over the previous fortnight. Data on education level, income, ethnicity, and race were not collected. The study was approved by the research ethics committee of the University of Essex. These data were previously published (Hagger & Chatzisarantis, 2005).

Dataset 4 (Hagger et al., 2017; Student consumption of high-sugar foods and beverages)

Participants were undergraduate students studying at two universities in Australia. Students were recruited via online psychology participant pools of research study participants. Participants received either course credit or an opportunity to enter a prize draw to win department store vouchers in return for their participation. The study received approval from the institutional review boards of each university (Curtin University and Griffith University). A prospective correlational design was used with participants ($N = 111$, 77 women, 34 men; M age = 22.86, $SD = 7.92$) completing self-report measures of the TPB variables at an initial laboratory visit (T1). Participants ($N = 90$, 61 women, 29 men; M age = 23.12, $SD = 7.87$; attrition rate = 18.92%,)

completed a follow-up survey containing behavioral measures at a second point in time (T2), two weeks later. Participants in the final sample were highly educated, all were studying for an undergraduate or postgraduate degree. The majority of participants identified as White Caucasian (85.55%) with small minorities identifying as Asian (12.22%), African (3.33%), and Indigenous/Torres-Strait Islander (1.11%) and Middle Eastern or Arabic (2.22%). Data on income were not collected. These data have been previously published (Hagger et al., 2017).

Dataset 5 (Hagger & Armitage, 2004; Primary/elementary school students' physical activity)

The participants were school students recruited from 10 schools in the East Midlands region of the United Kingdom. Consent was obtained from the schoolteachers and the parents of the participants prior to data collection. The sample comprised 1198 adolescents (girls $n = 580$, M age = 13.45, $SD = 0.78$; boys $n = 618$, M age = 13.47, $SD = 0.82$). Data on the ethnicity and race of the students, and on the education level and income of their caregivers, were not collected. Department of Education reports on the demographic characteristics of the school catchment areas indicated that the schools were in low-to-middle income regions of the East Midlands region. Consent from parents, teachers and the children was obtained prior to data collection. Studies were reviewed and approved by the school headteachers prior to data collection. The children were told they were participating in a survey on their opinions about their physical activities outside of school. Prior to administration and at frequent intervals during administration, the participants were reminded that the target behavior was leisure-time physical activities and not activity in school-time physical education. Physical activities were defined as vigorous pastimes that “make your heart beat faster” or “make you out of breath” for at least 20 minutes at a time. Study measures were collected at a single time point only with no follow up

measures. Findings from this study have been previously published (Hagger, Chatzisarantis, & Biddle, 2002).

Dataset 6 (Hagger et al., 2012; Company employees binge drinking)

Participants ($N = 661$, men = 296, women = 365; M age = 30.99, $SD = 8.89$, range = 46) were employees from seven companies in Estonia ($n = 189$, men = 121, women = 68; M age = 29.97, $SD = 5.88$, range = 27), 14 companies in Finland ($n = 184$, men = 63, women = 121; M age = 28.46, $SD = 3.58$, range = 27), 10 companies in Sweden ($n = 73$, men = 25, women = 48; M age = 25.46, $SD = 3.83$, range = 16), and three companies in the UK ($n = 215$, men = 87, women = 128; M age = 35.95, $SD = 12.51$, range = 46) who agreed to participate in a 'health survey'. Participants completed TPB measures and past behavior with respect to binge drinking (heavy episodic drinking) at an initial data collection point, and then completed a follow-up measure of binge drinking behavior at a second time point one month later. Attrition across the time points due to absences, inaccessibility, and missing data resulted in a final sample size of 486 participants (men = 225, women = 261; M age = 30.41, $SD = 8.31$; range = 46; attrition rate = 25.87%). This was made up of 131 participants in the UK sample (men = 54, women = 77; M age = 35.56, $SD = 12.56$, range = 46; attrition rate = 39.10%), 154 participants in the Estonian sample (men = 94, women = 60; M age = 29.76, $SD = 5.63$, range = 26; attrition rate = 16.90%; missing cases, $n = 3$), 136 participants in the Finnish sample (men = 55, women = 81; M age = 28.38, $SD = 3.60$, range = 17; attrition rate = 26.10%), and 65 participants in the Swedish sample (men = 22, women = 43; M age = 25.80, $SD = 3.67$, range = 16; attrition rate = 9.6%, missing cases, $n = 1$).

The companies that consented to participate in the study were largely based in the managerial, caring profession, and clerical work sectors with employees mainly engaged in office work. Contact with employees was made through senior members of staff such as company

directors or managers who advertised the opportunity to participate in the study to their employees. Companies were sourced from these national groups because survey data has shown elevated levels of heavy alcohol drinking patterns in these nations relative to other European nations, particularly among young people. The companies were selected as they were large employers in the region providing the opportunity to recruit a substantive sample of employees from middle-income backgrounds. Data from employer records indicated that participants ranged in job status from senior management to entry-level office worker (e.g., secretary, clerical worker). This indicates that the majority of employees could be classified as white collar workers and of a middle socio-economic background based on figures from the relevant governmental agencies in the participating countries. Specific data on ethnicity and race were not collected. These data were previously published (Hagger et al., 2012).

Dataset 7 (Hagger et al., 2003; High school students' physical activity)

Participants were high school students ($N = 295$; boys = 132, girls = 163; M age = 14.50 years, $SD = 1.35$) recruited from three state high schools. School principals and students' parents granted consent for data to be collected in their schools, and participating students signed informed consent forms. The students were recruited at the schools' convenience during lessons with their homeroom teacher and during study periods. Students from three classes in the 8th, 9th, or 10th grades in each school were recruited to the study. Students were informed that they were taking part in a survey on young people. Students completed TPB and past behavior measures at an initial data collection occasion. Five weeks later, students self-reported their physical activity participation. Data on the ethnicity and race of the students, and on the education level and income of their caregivers, were not collected. Attrition across the three waves of data collection due to absences and inaccessibility resulted in final sample sizes of 222 participants in the British sample (118 girls, 104 boys; M age = 14.68 years, $SD = 1.47$). Two

researchers conducted the data collection in quiet classroom conditions. Children were separated such that they could not copy or discuss responses. All of measures were completed anonymously to preserve confidentiality. Prospective responses were matched with baseline responses by using birth date and gender. These data were previously published (Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003).

Datasets 8-10 (Hagger et al., 2007; High school students' physical activity)

Participants were high school students recruited from schools in Great Britain, Estonia, and Hungary. British participants ($N = 699$) were recruited from two government-run high schools in southeastern England. School statistics indicated that the majority of the pupils in each school were of white European ethnicity, with less than 10% from other ethnic minority groups. Students from the catchment areas of the schools were matched the socioeconomic status (SES) distribution of British schools according to data from the National Office for Standards in Education based the child's eligibility for free school meals. Participants in the Estonian sample ($N = 361$) were recruited from three state-run high schools. Details on the SES of the participants were given by the school principal. Students were from districts characterized as middle class, and the school population matched the distribution of SES levels among urban-dwelling school children in Estonia. The majority of the pupils were Estonian nationals, although a significant minority were children of Estonian-born Russian immigrants. Hungarian participants ($N = 286$) were recruited from three state-run secondary schools in a Hungarian city. The local government register indicated that the catchment area of the school encompassed communities of low and middle SES, but no data on ethnicity were available.

Participants completed standard measures of TPB constructs and past physical activity participants at an initial time point, and completed follow-up measures of physical activity participation five weeks later. Measures were translated into participants' native language using

standard back-translation techniques. Consent for the school pupils' participation in the study was obtained from students' parents and the school principals prior to data collection. Pupils were informed that they were participating in a survey on young people and signed an informed consent form. Students completed measures in quiet classroom conditions and were isolated from each other so that they could not copy or discuss responses. All the questionnaires were completed anonymously to preserve confidentiality, and questionnaires across the two waves were matched using birth date and gender to preserve anonymity.

Attrition across the two waves of data collection due to missing data, absences, and inaccessibility resulted in final sample sizes of 432 participants in the British sample (boys = 198, girls = 234; M age = 13.96, SD = 1.51), 268 participants in the Estonian sample (boys = 117, girls = 151; M age = 15.04, SD = .91), and 235 participants in the Hungarian sample (boys = 114, girls = 121; M age = 14.01, SD = .99). We did not directly collect data on the ethnicity and race of the students, or on the education level and income of their caregivers. These data were previously published (Hagger et al., 2007).

Dataset 11 (Hagger, Chatzisarantis, & Biddle, 2001; High school students' physical activity)

Participants were high school students (N = 1238, boys = 607, girls = 630, M age = 13.50, SD = 0.70) were recruited from twenty government-run schools. Schools were contacted by telephone from the local education authority lists covering the counties of Cheshire, Leicestershire, Nottinghamshire and Staffordshire. School principals from eleven schools agreed to participate and provided written consent. The principals and class teachers reviewed and approved the study protocol and measures. Children's parents gave consent for their children to participate in the study and students signed an informed consent form prior to participating. Students completed measures of the TPB constructs and past behavior in small groups (maximum 100 participants per group) in a quiet classroom conditions. The questionnaires were completed

together as a class with the researcher reading each item aloud and then providing adequate time for the class to ask questions and provide their responses. Study measures were collected at a single time point only with no follow up measures. Data on the ethnicity and race of the students, and on the education level and income of their caregivers, were not collected. These data were previously published (Hagger, Chatzisarantis, & Biddle, 2001).

Dataset 12 (Hagger, Chatzisarantis, & Biddle, 1998, unpublished; High school students' physical activity)

Participants were high school students ($N = 497$, boys = 211, girls = 286) aged 12 to 14 years recruited from high schools in the midlands of the United Kingdom. Consent from the school principals and lesson teachers whose classes were nominated to participate in the study. We also obtained parental consent for children in these classes and participating children also signed consent forms. Participants completed measures of TPB constructs and past behavior under quiet classroom conditions and in the presence of the class teacher. Participants were informed they were participating in a study on activities they did in their free time. The target behaviour, physical activity, was defined for the participants as “activities which make you out of breath or huff and puff for at least 20 minutes at a time”. The children were reminded throughout the administration period of the type, intensity and duration of the physical activity behaviour under scrutiny and that free-time physical activity was the behavior of interest. All the items were read aloud and then time was given for the participants to ask any questions and make their responses. Data on the ethnicity and race of the students, and on the education level and income of their caregivers, were not collected. These data have not been previously published, but used methods similar to a published study (Hagger, Chatzisarantis, Biddle, & Orbell, 2001).

Dataset 13 (Hagger et al., 2009, Finnish high school students' physical activity)

Participants were high school students ($N = 158$) recruited from three co-educational high schools in the Jyväskylä region of central Finland. Participants were of lower-middle class socioeconomic status according to the national school registry. Details on ethnicity were not available. Participants completed TPB and past behavior measures at an initial time point, and then completed follow up measures of behavior at a follow-up time point five weeks later. Permission from school principals and parental consent was obtained prior to data collection. Pupils were told that they were participating in a survey on young people's physical activity. Data were collected in quiet classroom conditions and pupils were isolated so that they could not discuss responses. Questionnaires were completed anonymously to preserve confidentiality and were matched using birth date and gender. Attrition across the data collection occasions due to absences and inaccessibility resulted in final sample size of 127 participants (boys = 55, girls = 72; M age = 14.30, $SD = 0.49$; attrition rate = 19.62%). These data were previously published as part of a multi-national study (Hagger et al., 2009), with the remaining datasets published elsewhere (Hagger et al., 2007).

Datasets 14 and 15 (Hagger, Chatzisarantis, & Harris, 2006; University students' physical activity and dieting)

Participants were university undergraduate and graduate students (total $N = 511$) recruited from classes across undergraduate and graduate programs of study. Participants were assigned to receive measures referring to leisure-time exercise or dieting as the target behavior on an arbitrary basis. Participants in the exercise behavior sample ($N = 261$; women = 166, men 95 men; M age = 25.43, $SD = 10.26$) were informed they were taking part in a survey on exercise habits. Participants in the dieting behavior sample ($N = 250$; women = 141, men = 109; M age = 24.64, $SD = 6.39$) were notified they were participating in a survey on watching your diet. Participants were required to complete measures of TPB and past behavior on an initial data

collection occasion, and two weeks later reported their leisure time physical activity or dieting behaviors using self-report measures. Data were collected by three research assistants in quiet class conditions. Questionnaires were completed anonymously to preserve confidentiality and prospective responses were matched with baseline responses by using birth date and gender. The research was reviewed and passed by the University of Essex research ethics committee. Data on the income and ethnicity/race of the students were not collected, although their level of education was assumed to be high as they were all enrolled on an undergraduate or postgraduate University degree program. These data were previously published (Hagger, Chatzisarantis, & Harris, 2006).

Dataset 16 (Hagger & Chatzisarantis, 2006, unpublished; University students' multiple health behaviors)

Participants were undergraduate and graduate students ($N = 263$; men = 99; women = 164; M age = 22.40, $SD = 4.33$) enrolled in a UK university. In the first wave of data collection, participants were presented with standardized two-item measures of the TPB variables for 20 health-related behaviors salient to the student sample: regular exercise, eating a portion of vegetables twice every day, taking multi-vitamin tablets, brushing and flossing twice per day, sleeping 7 hours per night, eating five portions of fresh fruit and vegetables regularly, avoiding smoking, drinking 4 pints of water every day, going to the pub, using a condom when having sex, avoiding eating 'junk' food, avoiding taking caffeine and other legal stimulants, hand washing after visiting the toilet, wearing a seatbelt when in a car, avoiding getting drunk, avoiding taking illegal drugs, sitting with the correct posture when using a computer, seeking medical care when ill, studying in good light, and avoiding making long calls on a mobile phone (>10 minutes). Measures were taken in quiet class conditions, with participants given an enforced 60-second break every ten minutes to allay fatigue and non-attentive responding. Participants completed single-item measures of their participation in each of the target behaviors at a second wave of

data collection two weeks later. Participants completing questionnaires on the first data collection occasion but did not complete follow-up measures at the allotted class time on the second data collection occasion were contacted by telephone, resulting in no attrition across data collection occasions. Questionnaires were de-anonymized by the researchers that collected the data and the questionnaires matched across time points by a unique code comprising their date of birth, gender, and mother's maiden name that they specified on the first data occasion. Ethical clearance for the study protocol was secured from the university research ethics committee. Data on the income and ethnicity and race of the students were not collected, although their level of education was assumed to be high as they were all enrolled on an undergraduate University degree program. These data have not been previously published, but the methods used are similar to a previously published study (Hagger & Chatzisarantis, 2006).

Dataset 17 (McLachlan & Hagger, 2010; University students and staff and company employees' physical activity)

Participants ($N = 259$) were staff and students recruited from a UK University and staff from several private companies in South East UK. Participants completed standardized measures of the TPB constructs and past behavior at an initial data collection occasion, and then completed a follow-up self-report measure of physical activity behavior three weeks later. Participants were informed that they were participating in a survey on physical activity. The participants were presented with a definition of leisure-time active sports and/or vigorous physical activities prior to completing the measures. Attrition between the first and second of data collection occasions resulted in a final sample of 185 adults (men = 56, women = 129; M age = 30.83, $SD = 13.21$; attrition rate = 33.59%). Data on the income and ethnicity and race of the participants were not collected. These data were previously published (McLachlan & Hagger, 2010).

Dataset 18 (Hagger, Anderson, Kyriakaki, & Darkings, 2007; University students' health behaviors)

Participants were undergraduate students from two Universities in the United Kingdom ($N = 525$; women = 325, men = 200; M age = 22.84, $SD = 6.50$). Participants completed TPB and past behavior measures for two health-related behaviors: dieting and binge drinking and a sub-sample ($N = 202$; women = 99 women, men = 103 men; M age = 21.49, $SD = 2.14$) completed measures for exercise behavior. Participants were informed they were taking part in a survey on 'health habits' prior to completing the study measures. For each set of measures, the target behavior was defined for the participants and given a standardized set of instructions. Two weeks after completing the initial measures, participants self-reported their dieting, binge drinking behavior, and exercise behavior. Data on the income and ethnicity and race of the students were not collected, although their level of education was assumed to be high as they were all studying for an undergraduate or postgraduate degree. These data have been previously published (Hagger, Anderson, Kyriakaki, & Darkings, 2007).

Datasets 19-21 (Hagger et al., 2005; School students' physical activity)

Participants were high school students recruited from government schools in Greece, Poland, and Singapore. Participants in the Greek sample ($N = 183$) were recruited from a single suburban school in Thessaloniki, Greece. Only 121 participants provided usable data. The school draws its students from a catchment area characterized as 'middle-class' and the school's principal indicated that school population matched the demographic profile of school children in mainland Greece. The majority of the pupils were Greek nationals with a small minority of children from Greek-born immigrants with Greek as their native language. Participants in the Polish sample ($N = 120$) were recruited from three government-run high schools in Bytom, a town close to Katowice, Poland. Two of the schools are based around suburban housing projects

and one was close to the town centre. Details on ethnicity were not available, but the local government regional data suggested that the population of the catchment area of the schools were of lower socio-economic status. Participants in the Singaporean sample ($N = 217$) were recruited from one junior college in the Nanyang district of Singapore, with 170 useable cases. The majority of the participants were of Chinese ethnicity (78%), while the remainder were of Malay (15%) and Indian (7%) ethnicity. According to the college principal, the student body was highly representative of the national average in terms of socioeconomic status. Data on the ethnicity and race of the students, or on the education level and income of their caregivers, were not collected directly. School principals granted consent for data to be collected in their schools and received and approved the study measures and protocol. The students were recruited from lessons in which there was no specific syllabus content to be fulfilled. Parental consent for the students' participation was obtained prior to data collection and students completed informed consent forms.

Participants completed standard measures of TPB constructs and a self-report measure of past behavior at an initial data collection occasion, with a follow-up measure of behavior taken on a second occasion five weeks later. Researchers conducted the data collection in quiet classroom conditions. Participants were informed that they would be taking part in a survey on young people. Participants were separated so that they could not copy or discuss responses. All of the questionnaires were completed anonymously to preserve confidentiality. Measures across time-points were matched using birth date and gender.

Attrition across the three waves of data collection due to missing data, absences, and inaccessibility resulted in final sample sizes of 93 participants in the Greek sample (girls = 57, boys = 36 boys; M age = 13.99, $SD = .80$; attrition rate = 49.18%), 103 participants in the Polish sample (girls = 56, boys = 47; M age = 16.32, $SD = 1.12$; attrition rate = 14.17%), and 133

participants in the Singaporean sample (girls = 67, boys = 66; M age = 13.32, SD = .47; attrition rate = 38.71%). These data have been published previously (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005).

Dataset 22 (Hamilton & White, 2008; High school students' physical activity)

Participants were 423 grade nine students, 251 (59%) girls and 172 (41%) boys, ranging in age from 12 to 16 years (M = 13.47, SD = 0.56), with 97.4% aged between 13 and 14 years. A majority of the participants reported coming from an English speaking background (87%) and not having a disability that interferes with them doing physical activity (91%). Participants were recruited from 10 schools across South East Queensland, Australia. School participation was determined by convenience and availability although attempts were made to provide a representation of students from a range of socio-demographic backgrounds. Data on the ethnicity and race of the students, or on the education level and income of their caregivers, were not collected. Of the participants who completed the main questionnaire, 395 completed the follow-up questionnaire 1 week later.

The study used a prospective design with two waves of data collection 1 week apart. The main questionnaire assessed the standard theory of planned behavior predictors (i.e., attitude, subjective norm, perceived behavioral control, and intention), along with past behavior and other additional measures. The second wave of data collection assessed participants' self-reported physical activity during the previous week. Both parental and child written consent were required for participation. Following the return of signed consent forms, questionnaire distribution commenced. In all cases, participants completed the questionnaires at their own pace and in selected class times. A code identifier was used to enable matching of the questionnaires, and to maintain confidentiality and anonymity of participants. All participants received a water bottle or

pen as a thank you gift for participating. The university ethics committee and relevant school educational authorities approved the study. Full details of participant characteristics and procedures are provided elsewhere (Hamilton & White, 2008).

Dataset 23 (Hamilton et al., 2018, unpublished; High school students' physical activity)

Participants included a total of 230 students (102 boys and 127 girls) recruited from one co-educational non-government school in Brisbane, Queensland, Australia. The age of participants ranged between 11 and 15 years, with an average age of 12.88 years. The school grade levels included middle school grades composed of grades seven, eight, and nine. General demographic information was obtained from the My School website (<http://www.myschool.edu.au/>). Majority of students were born in Australia and 63% of students' parents earn an income in the top quarter. A scale of socio-educational advantage that is computed for schools across Australia, the index of community socio-educational advantage (ICSEA), showed that this school had an ICSEA value above the National Average at the time of data collection. Data on the ethnicity and race of the students, or on the education level and income of their caregivers, were not collected. Of the participants who completed the main questionnaire, 185 completed the final follow-up 4 weeks later.

The study used a prospective design with two waves of data collection 4 weeks apart. The main questionnaire assessed the standard theory of planned behavior predictors (i.e., attitude, subjective norm, perceived behavioral control, and intention), along with past behavior and other additional measures. The second wave of data collection assessed participants' self-reported physical activity during the previous 4 weeks. Both parental and child written consent were required for participation. Following the return of signed consent forms, questionnaire distribution commenced. In all cases, participants completed the questionnaires at their own pace and in selected class times. A code identifier was used to enable matching of the questionnaires,

and to maintain confidentiality and anonymity of participants. Verbal and written instructions were given to participants for both waves of data collection. The university ethics committee and relevant school educational authorities approved the study. No previous manuscripts have been published using these data.

Dataset 24 (Hamilton et al., 2017, unpublished; University students' dental flossing)

Participants were university students recruited from a major university in Queensland, Australia. Participants were recruited via three methods: face-to-face at the university, online through email and social media (i.e., Facebook), and posters advertising the study displayed in common areas at the university. A prospective design was used. Participants ($N = 629$) completed a baseline paper-based questionnaire at an initial point in time. Three participants were removed due to incomplete data on all theory of planned behavior measures, making a final sample at Time 1 of $N = 626$ in the current study. At the follow-up, participants ($N = 254$; 79.4% women; M age = 22.23, $SD = 6.40$) completed a behavioral follow-up survey over the phone. An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were offered the opportunity to enter a prize draw to win one of four AU\$25 gift voucher or receive course credit if they were eligible. Participants in the final sample were highly educated, all were studying for an undergraduate degree. The majority of participants identified as White Caucasian (79.1%). Data on family income varied: AU\$0-18,200 (27%), AU\$18,201-\$37,000 (20%), AU\$37,001-80,000 (23%), \$80,001-\$180,000 (20%), AU\$>180,000 (10%). The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. No previous manuscripts have been published using these data. These data are unpublished, but methods used are similar to a previously published study (Hamilton, Bonham, Bishara, Kroon, & Schwarzer, 2017).

Dataset 25 (Arnautovska et al., 2019; Older adults' physical activity)

Participants were older adults aged 65 years and older, who resided independently in a community-dwelling, and were able to engage in physical activity of at least moderate intensity. Participants were recruited through a variety of methods including advertisements in local community newsletters, face-to-face presentations at community events, and word of mouth. Participants ($N = 213$) completed an online or paper-based questionnaire at Time 1. Two weeks later, at Time 2, participants ($N = 163$, 64.8% women; M age = 73.8, $SD = 7.0$, range = 65–95) completed a behavioral follow-up survey over the phone. Participants in the final sample were majority lower education status (university educated = 35.4%, non-university education = 64.6%), of middle-income socio-economic status, as determined by the average gross weekly income (up to \$1,000 = 68%, over \$1,000 = 32%), and predominantly Australian in nationality (Australian-born = 63.4%). About half of the participants were married or in a de-facto relationship (49.7%) and most were retired (87.3%). An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were offered the opportunity to enter a prize draw to win one of five AU\$20 gift vouchers. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant recruitment and study procedures are provided elsewhere (Arnautovska, Fleig, O'Callaghan, & Hamilton, 2019).

Dataset 26 (Hamilton et al., 2017; Parent-for-child sun safety behaviors)

Participants 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. 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.

Participants ($N = 373$) completed an online questionnaire at Time 1. Two weeks later, at Time 2, participants ($N = 273$; 87.1% women; M age = 34.83, $SD = 5.19$) completed a behavioral follow-up survey online. An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were offered the opportunity to enter a prize draw to win one of three double pass movie vouchers. In the final sample, participants were highly educated, with the majority reporting having obtained a university degree (59.23%) and a substantive minority obtaining a high school certificate or a vocational qualification (37.36%). The majority of participants identified as White Caucasian (92.67%) with small minorities identifying as Asian (0.73%), African (2.56%), and Indigenous/Torres-Strait Islander/Pacific Islander (2.93%). A large majority of the participants were full-time or part-time employed (76.19%), and participants were from middle-to-high income backgrounds, with a large majority reporting an annual income over AU\$80,001 (72.16%). The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Hamilton, Kirkpatrick, Rebar, & Hagger, 2017).

Dataset 27 (Hamilton et al., 2017, unpublished; Parent-for-child tooth brushing)

Participants were parents with 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. Participants were recruited face-to-face at locations in the Greater Brisbane, Australia area where parents congregate (e.g., swim schools, sporting clubs). A prospective design was used. Participants ($N = 281$) completed a paper-based

questionnaire at an initial point in time. At the follow-up, participants ($N = 219$; 72.8% women; M age = 37.15, $SD = 4.81$) completed a behavioral follow-up survey online or over the phone. In the final sample, participants were highly educated, with the majority reporting having obtained a university degree (76.3%). The majority of participants identified as White Caucasian (78.1%) and married (85.8%). A large majority of the participants were full-time or part-time employed (79.5%), and participants were from middle-to-high income backgrounds, with a large majority reporting an annual income over AU\$80,001 (85.2%). An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were given a thank you package that included a children's toothbrush, sample toothpaste, and information on child tooth brushing procedures. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. No previous manuscripts have been published using these data. These data are unpublished, but methods used are similar to a previously published study (Hamilton, Cornish, Kirkpatrick, Kroon, & Schwarzer, 2018).

Dataset 28 (Hamilton, Cox, & White, 2012; Parents' physical activity)

Participants were parents of at least one child younger than 5 years of age who usually resided in the same household as the parent. Parents were independent, with only one partner from each couple completing the questionnaire. Parents were recruited via various networks (e.g., parenting groups, swim schools, child play centres, playgroup and day care associations, online parenting forums, and the University Alumni association). At Time 1, parents ($N = 580$) completed the main questionnaire either on-line or paper-based. At Time 2, 1 week later, parents ($N = 458$, 55.0% women; M age = 35.54, $SD = 5.40$; range = 21–53 years), via telephone follow-up, self-reported their PA behavior in the previous week. A large majority of the parents were in a partnered relationship (96%) and indicated they were Australian in nationality (76%). A

majority of participants were university educated (53%) and engaged in full-time (49%) or part-time (23%) work. Half of the sample reported having one child, while the remainder reported having one (25%) or three or more children (25%). An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. A prize draw of a chance to win one of five AU\$150 sporting store gift vouchers was offered as an incentive for participation. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant recruitment and characteristics are provided elsewhere (Hamilton, Cox, & White, 2012).

Dataset 29 (Hamilton et al., 2020; University student sleep hygiene, Australia sample)

Participants were Australian undergraduate university students. The study used a prospective-correlational design with a four-week behavioral follow-up. At Time 1, students ($N = 329$) completed an online survey assessing social psychological constructs of attitude, subjective norm, perceived behavioral control, intention, and past behavior regarding their sleep hygiene behavior. Demographic variables were also collected. At Time 2, four weeks later, 201 students (M age = 22.82, $SD = 8.89$; men = 36, women = 165) completed an online behavioral follow-up regarding their sleep hygiene behavior over the previous 4 weeks. Participants were highly educated, each was enrolled in a full-time or part-time university degree program, and the vast majority were never married (85%). Data on ethnicity and race and income were not collected. Consent was gained through the completion of the Time 1 questionnaire, and consent to contact participants for the Time 2 follow-up was given through the provision of contact details. On completion of the study, eligible students were awarded course credit, no other incentives were offered. The study was approved by the Griffith University Human Research Ethics Committees

prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Hamilton, Ng, Zhang, Phipps, & Zhang, 2020).

Dataset 30 (Hamilton et al., 2020; University students' heavy episodic drinking)

Participants were university students aged between 18 and 25 years recruited from a major university in Queensland, Australia using a combination of face-to-face and online methods. Face-to-face recruitment involved direct approach by a member of the research team, with the potential participant being given a flyer containing the study URL. Online recruitment included notices sent in broadcast emails to all students at the university, notices posted on Facebook, and a notice posted on the school subject/participant pool. Participants ($N = 204$) completed a baseline online questionnaire in the lab at Time 1. Four weeks later, at Time 2, participants ($N = 161$, M age = 20.03, $SD = 2.15$; men = 53, women = 108) completed a behavioral follow-up survey online or over the phone. Participants were educated, with the majority reporting having completed high school (67.7%) and a small minority reported having already obtained a university degree (17.4%) or a vocational qualification (14.3%). The majority of participants identified as White Caucasian (81.4%) with small minorities identifying as Asian (9.3%), African (0.6%), and Indigenous/Torres-Strait Islander/Pacific Islander (2.4%). The majority of participants reported that their family was in the middle (average annual income between AU\$37,001 and AU\$80,000; 26.1%) and high (average annual income above AU\$80,000; 35.4%) income categories. The majority of participants reported being never married (96.9%). An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were offered the opportunity to enter a prize draw to win one of four AU\$25 gift voucher or receive course credit if they were eligible. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data

collection. Full details of participant recruitment and characteristics are provided elsewhere (Hamilton, Gibbs, Keech, & Hagger, 2020). The final sample in the latter published study ($N = 121$) was smaller than the final sample used in the present analysis because the research included an implicit association test for which there were fewer cases available for analysis.

Dataset 31 (Hamilton et al., 2020; University student sleep hygiene, Hong Kong sample)

Participants were Hong Kong undergraduate university students. The study used a prospective-correlational design with a four-week behavioral follow-up. At Time 1, students ($N = 285$) completed a paper-based survey assessing social psychological constructs of attitude, subjective norm, perceived behavioral control, intention, and past behavior regarding their sleep hygiene behavior. Demographic variables were also collected. At Time 2, four weeks later, 161 students (M age = 20.47, $SD = 7.80$; men = 77, women = 84) completed a paper-based behavioral follow-up regarding their sleep hygiene behavior over the previous 4 weeks. Participants were highly educated, each was enrolled in a full-time university degree program, and all reported never being married. Data on ethnicity and race and income were not collected. Consent was gained through the completion of the Time 1 questionnaire, and consent to contact participants for the Time 2 follow-up was given through the provision of contact details. The study was approved by the Hong Kong Baptist University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Hamilton, Ng, Zhang, Phipps, & Zhang, 2020).

Dataset 32 (Allom et al., 2016; University student physical activity)

Participants were 188 first generation college students, ranging in age from 17 to 54 years, M age = 19.60; $SD = 4.88$, from a public university in a metropolitan area of South East Queensland, Australia, of which 45% of the total commencing students in the year of data collection were first-generation. Inclusion criteria included: 1) commencing a university degree

for the first time that semester; 2) aged 17 years and older, and 3) first generation within their family to attend college. Students were excluded from participation if they identified having a physical disability perceived to interfere with doing regular physical activity. The study used a prospective design with two stages of data collection occurring one week apart. The study was conducted within the first semester of enrolment within the degree, across a 2-month time period, which did not span an examination period in order to ensure that the physical activity of participants reflected their typical behavior. Participants were recruited using convenience sampling, the university's participant pool, advertisement on social media, and in lectures. At Time 1, participants ($N = 188$) completed an online questionnaire, and one week later, at Time 2 ($N = 101$; 82.2% women; M age = 20.12, $SD = 5.79$) participants completed a follow-up survey assessing their physical activity behavior during the previous week. A large majority of participants were full time students (94.1%) and had completed high school within 3 years of commencing their university studies (85.6%). Most participants reported coming from an English-speaking background (80.3%), and were currently engaged in employment (70.2%). No data on race/ethnicity or income were collected. A code identifier was used to match the results of the questionnaires, and to maintain confidentiality and anonymity. Participants enrolled in the relevant psychology course received credit for participation (51%), while all other participants did not receive incentives for participation. The study was approved by the University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Allom, Mullan, Cowie, & Hamilton, 2016).

Dataset 33 (Phipps et al., 2020; Limiting sugar consumption)

The study adopted a two-occasion prospective survey design. Participants ($N = 233$) completed an online survey assessing self-report measures of social psychological constructs

regarding free sugar limiting behavior, and demographic variables at an initial data collection occasion (Time 1). Two weeks later, at Time 2, participants ($N = 205$, 46 men, 159 women; M age = 22.20, $SD = 7.92$) completed a follow-up measure of free sugar limiting behavior.

Participants were highly educated, each was enrolled in a full-time or part-time university degree program, and the vast majority were born in Australia (78.04%). Data on income were not collected. Participants were eligible for inclusion in the study if they were part of the targeted undergraduate cohort, and completed a consent form agreeing to participate in the study and stating availability to be contacted at a later time for follow-up data collection. Eligible participants were granted course credit in return for their participation. The study was approved by the University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Phipps, Hagger, & Hamilton, 2020).

Dataset 34 (Hamilton et al., 2018, unpublished; High school students' restricting sugary drinks and eating fruits and vegetables)

Participants were Year 7 and Year 8 students between 11 and 14 years of age. Participants were recruited from two co-educational schools in South East Queensland, Australia of which one was a public school and the other was a private school. General characteristics of the schools were obtained from each school's profile on the My School website (<http://www.myschool.edu.au>). The index of community and socio-educational advantage (ICSEA), a scale calculated for each school across Australia using data such as parent occupation and education, indicated that the private school was above the national average, while the public school was slightly below the national average. Data on the ethnicity and race of the students, or on the education level and income of their caregivers, were not collected. No incentives were offered to the schools or students for participation in the study.

A prospective survey design was adopted whereby participants ($N = 266$) completed measures of the target psychological variables at Time 1 and measures of the target behavioural variables at Time 2 ($N = 198$, 46.4% women; M age = 12.60, $SD = 0.61$) one week later. Schools were recruited via an email which provided information about the research and an invitation to participate. Following approval from school principals, study procedures and resources were organised with the relevant school staff. Both child and parent/guardian consent was required to participate. A combination of online and paper-based surveys, with identical content, were used in the study. Participants completed the surveys in class time for both time points. Data was matched using a unique code identifier provided by participants. Consent forms were also matched to each participant in the data set to confirm each had received parent/guardian consent to participate in the study. The study was approved by the Griffith University Human Research Ethics Committee as well as the relevant school authority as stated in the ethical guidelines from Education Queensland. No previous manuscripts have been published using these data.

Dataset 35 (Spinks & Hamilton, 2016; Parent-for-child limiting discretionary choices and healthy eating)

Participants were comprised of 197 Australian mothers ranging in age from 18 to 46 years, with at least one child aged 2 or 3 years. Of the mothers who completed the main questionnaire, 161 completed the follow-up questionnaire one-week later. The study adopted a prospective design with two phases of data collection. In phase one, paper-based and online versions were utilised for the main questionnaire. In the second phase, a follow-up phone call was conducted one-week later to assess behaviour from the previous week. Participants were recruited face-to-face via convenience sampling methods, access to childcare facilities, and one swim school; and on-line via social networking sites (e.g., Facebook; *Australia's Mothers Group*). Mothers completed the main questionnaire in either paper-based ($N = 151$, 76.6%) or online

formats ($N = 46$, 23.4%). Participants were educated, with the majority reporting having gained an undergraduate or postgraduate degree (57.4%) or a technical or vocational qualification (26.4%). Nearly half of the participants were in part-time or full-time work (47.7%) with a substantive minority on leave or care duties (35.5%). Nearly all were in partnered relationships (95.4%). No data were collected on ethnicity/race or income were collected. As an incentive to participate, individuals were provided the opportunity to go into a prize draw to win one of three double-pass movie vouchers (valued at AU\$36 each). The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Spinks & Hamilton, 2016).

Dataset 36 (Hamilton et al., 2016; Parent-for-child screen time and physical activity)

The sample comprised 207 Australian parents, 138 mothers ($M = 36.43$ years; $SD = 5.04$, 66.7%) and 69 fathers ($M = 36.33$ years; $SD = 6.5$) who had at least one child aged between 2 and 5 years who usually resided in the same household as the parent. When responding to questionnaire items, parents were instructed to consider the oldest child aged between 2 and 5 years. Parents were independent, with only one partner from each couple completing the questionnaire. Almost all parents were married (96%), and just over half were employed full-time (52.4%). Data on parent ethnicity/race and income were not collected. One week later, 152 parents (64.5% mothers, M age = 36.34 years; $SD = 5.40$) responded to the follow-up questionnaire (attrition rate = 73.4%). Participants were recruited via online sources (e.g., parenting websites), face-to-face (e.g., swim schools), and through their child's day care facility (long day care, kindergarten). A prize draw was offered (to win one of three AU\$150 supermarket gift cards) upon completion of both questionnaires. The study adopted a prospective correlational design with a 1-week follow-up. Parents completed the main questionnaire either

online or paper-based, and 1 week later completed the behavioral follow-up via telephone. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Hamilton, Spinks, White, Kavanagh, & Walsh, 2016).

Dataset 37 (Hamilton et al., 2019; Pregnant women physical activity and dieting)

Participants were pregnant women aged 18 years and older and recruited in Australia, with the majority residing in the states of Queensland and New South Wales ($N = 171$, 66%). Women were eligible to participate if they had not been diagnosed with a medical condition preventing them from engaging in physical activity in the antenatal period. Participants were recruited via face-to-face contact at mother/baby groups and general practice surgeries, along with advertisements at antenatal classes, childcare centers, and on social media. Participants ($N = 207$) completed an online or paper-based questionnaire at Time 1. One week later, at Time 2, participants ($N = 117$; M age = 30.53, $SD = 4.42$) completed a behavioral follow-up survey online or over the phone. The majority of participants were highly educated, with a large majority reporting having gained an undergraduate or postgraduate degree (61.6%) or a technical or vocational qualification (23.9%). The majority of participants were in part-time or full-time work (75.2%) with a substantive minority on leave or care duties (24.8%). The majority of participants identified as White Caucasian (96.5%) with small minorities identifying as Indigenous/Torres-Strait Islander (0.9%) or other ethnicities (2.6%). The majority of participants reported that their family was in the middle (average annual income between AU\$37,001 and AU\$80,000; 27.3%) and high (average annual income above AU\$80,000; 65.0%) income categories. An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participant, individuals were offered the opportunity to enter a prize draw to win one of three double pass movie vouchers (each valued at

AU\$50). The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. Full details of participant characteristics and procedures are provided elsewhere (Hamilton, Fleig, Henderson, & Hagger, 2019).

Dataset 38 (Hamilton et al., 2018, unpublished; Long-haul heavy goods vehicle drivers' fruit and vegetable consumption and limiting discretionary choices)

Participants were male, long-haul heavy HGV drivers, who drove a ≥ 12 -tonne HGV, travelled at least 200km in one work period, and spent most of their work time driving (weekly driving hours, $M = 67.20$, $SD = 15.08$). Drivers were recruited face-to-face at HGV events/locations (e.g., HGV stops, HGV charity events) and through social media (e.g., Facebook groups) and offered the opportunity to enter into a draw to win one of three AU\$100 gift vouchers as an incentive to participate. The study received approval from the Institution Human Research Ethics Committee. A prospective-correlational design was used. At Time 1, participants ($N = 148$) completed a survey either face-to-face or online. One week later, at Time 2, participants ($N = 84$; M age = 45.94, $SD = 12.07$) completed a behavioural follow-up survey. Participants in the final sample were majority lower education status (university educated = 5.95%, vocational training = 34.52%, high school or less = 59.53). The majority of participants identified as White Caucasian (89.295%) with small minorities identifying as Indigenous/Torres-Strait Islander (3.57%), Māori (1.19%), Indian (1.19%), or other ethnicities (7.14%). Data on income were not collected. Participant data across the time points was anonymized and matched using a unique code identifier created by the participant. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. No previous manuscripts have been published using these data. These data are

unpublished, but methods used are similar to a previously published study (Brown, Hagger, Morrissey, & Hamilton, K., 2018).

Dataset 39 (Hamilton et al., 2018, unpublished; Student alcohol consumption safe limits and physical activity)

Participants were university students recruited from a major university in Queensland, Australia using a combination of face-to-face and online methods. Participants ($N = 267$) completed a baseline paper-based or online questionnaire at Time 1. Four weeks later, participants ($N = 166$, 71.7% women; M age = 20.73, $SD = 3.99$) completed a behavioral follow-up survey online or over the phone. Participants were highly educated, each was enrolled in a full-time or part-time university degree program, and the vast majority identified as White Caucasian (79.40%) with small minorities identifying as Indigenous/Torres-Strait Islander (2.4%), Asian (7.9%), Pacific Islander (1.2%), African (1.8%), or other ethnicities (7.3%). Data on family income varied: AU\$0-18,200 (18.1%), AU\$18,201-\$37,000 (17.5%), AU\$37,001-80,000 (31.9%), \$80,001-\$180,000 (24.7%), AU\$>180,000 (7.8%). An information sheet outlining the details of the study was provided to all participants and informed consent was assumed by completion of the survey. As an incentive to participate, individuals were offered the opportunity to enter a prize draw to win one of four AU\$25 gift voucher or receive course credit if they were eligible. The study was approved by the Griffith University Human Research Ethics Committees prior to participant recruitment and data collection. No previous manuscripts have been published using these data.

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young people in a physical activity context. *Journal of Sport and Exercise Psychology*, 29, 2-20. <https://doi.org/10.1123/jsep.29.1.2>

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Appendix B

Characteristics of Datasets Used in the Current Meta-Analysis and Moderator Coding

| Dataset | Sample | N | Behavior | Design | Publication status | Behavior type moderator | | Scale score coverage moderator | | | Age ¹ | Previous studies using dataset |
|---------|------------------------------------|------|---|--------|--------------------|-------------------------|--------|--------------------------------|------------|-------------------|------------------|--|
| | | | | | | Mod. 1 | Mod. 2 | Attitude/ PBC | SN/ PBC | Intention/ PBC | | |
| 1 | University students | 280 | Alcohol pre-drinking | PRO | PUB | HR | OTH | 1 | 1 | 1 | 0 | Caudwell, K. M., & Hagger, M. S. (2015). Predicting alcohol pre-drinking in Australian undergraduate students using an integrated theoretical model. <i>Applied Psychology: Health and Well-Being</i> , 7, 188–213. https://doi.org/10.1111/aphw.12044 |
| 2 | University students and staff | 523 | Dieting | PRO | PUB | HP | DB | 1 | 0 | 1 | 0 | Hagger, M. S., & Chatzisarantis, N. L. D. (2005). First- and higher-order models of attitudes, normative influence, and perceived behavioural control in the Theory of Planned Behaviour. <i>British Journal of Social Psychology</i> , 44, 513-535. https://doi.org/10.1348/014466604X16219 |
| 3 | University students and staff | 596 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 0 | Hagger, M. S., & Chatzisarantis, N. L. D. (2005). First- and higher-order models of attitudes, normative influence, and perceived behavioural control in the Theory of Planned Behaviour. <i>British Journal of Social Psychology</i> , 44, 513-535. https://doi.org/10.1348/014466604X16219 |
| 4 | University students | 90 | Consumption of high-sugar foods and beverages | PRO | PUB | HR | DB | 0 | 0 | 0 | 0 | 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. <i>Appetite</i> , 116, 147-156. https://doi.org/10.1016/j.appet.2017.04.032 |
| 5 | Primary/elementary school students | 1198 | Physical activity | CS | PUB | HP | PA | 0 | 0 | 0 | 1 | Hagger, M. S., & Armitage, C. (2004). The influence of perceived loci of control and causality in the theory of planned behavior in a leisure-time exercise context. <i>Journal of Applied Biobehavioral Research</i> , 9, 45-64. |

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|----|--------------------------------|-----|-------------------|-----|-----|----|-----|---|---|---|---|---|
| 6 | Company employees | 661 | Binge drinking | PRO | PUB | HR | OTH | 1 | 1 | 1 | 0 | https://doi.org/10.1111/j.1751-9861.2004.tb00091.x Hagger, M. S., Lonsdale, A., Hein, V., Koka, A., Lintunen, T., Pasi, H. J., . . . Chatzisarantis, N. L. D. (2012). Predicting alcohol consumption and binge drinking in company employees: An application of planned behaviour and self-determination theories. <i>British Journal of Health Psychology</i> , 17, 379-407. https://doi.org/10.1111/j.2044-8287.2011.02043.x |
| 7 | High school students | 222 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Culverhouse, T., & Biddle, S. J. H. (2003). The processes by which perceived autonomy support in physical education promotes leisure-time physical activity intentions and behavior: A trans-contextual model. <i>Journal of Educational Psychology</i> , 95, 784–795. https://doi.org/10.1037/0022-0663.95.4.784 |
| 8 | High school students – British | 432 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 0 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., Hein, V., Pihu, M., . . . Karsai, I. (2007). Cross-cultural generalizability of the Theory of Planned Behavior among young people in a physical activity context. <i>Journal of Sport and Exercise Psychology</i> , 29, 2-20. https://doi.org/10.1123/jsep.29.1.2 |
| 9 | High school students – Estonia | 268 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., Hein, V., Pihu, M., . . . Karsai, I. (2007). Cross-cultural generalizability of the Theory of Planned Behavior among young people in a physical activity context. <i>Journal of Sport and Exercise Psychology</i> , 29, 2-20. https://doi.org/10.1123/jsep.29.1.2 |
| 10 | High school students - Hungary | 235 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 0 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., Hein, V., Pihu, M., . . . Karsai, I. (2007). Cross-cultural generalizability of the Theory of Planned |

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|----|----------------------|------|--|-----|------|-----|-----|---|---|---|---|--|
| 11 | High school students | 1238 | Physical activity | CS | PUB | HP | PA | 1 | 1 | 1 | 1 | Behavior among young people in a physical activity context. <i>Journal of Sport and Exercise Psychology</i> , 29, 2-20. https://doi.org/10.1123/jsep.29.1.2 |
| 12 | High school students | 497 | Physical activity | CS | UPUB | HP | PA | 1 | 1 | 1 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., & Biddle, S. J. H. (2001). The influence of self-efficacy and past behaviour on the physical activity intentions of young people. <i>Journal of Sports Sciences</i> , 19, 711-725. https://doi.org/10.1080/02640410152475847 |
| 13 | High school students | 127 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 1 | No previous manuscripts have been published using these data. |
| 14 | University students | 250 | Dieting | PRO | PUB | HP | DB | 0 | 0 | 0 | 0 | Hagger, M. S., Chatzisarantis, N. L. D., Hein, V., Pihu, M., Soós, I., Karsai, I., . . . Leemans, S. (2009). Teacher, peer, and parent autonomy support in physical education and leisure-time physical activity: A trans-contextual model of motivation in four cultures. <i>Psychology and Health</i> , 24, 689-711. https://doi.org/10.1080/08870440801956192 |
| 15 | University students | 261 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 0 | Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. <i>Personality and Social Psychology Bulletin</i> , 32, 131-138. https://doi.org/10.1177/0146167205279905 |
| 16 | University students | 263 | Multiple health behaviors ^a | PRO | UPUB | MIX | OTH | - | - | - | 0 | Hagger, M. S., Chatzisarantis, N. L. D., & Harris, J. (2006). From psychological need satisfaction to intentional behavior: Testing a motivational sequence in two behavioral contexts. <i>Personality and Social Psychology Bulletin</i> , 32, 131-138. https://doi.org/10.1177/0146167205279905 No previous manuscripts have been published using these data. |

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|----|---|-----|---|-----|-----|-----|-----|---|---|---|---|--|
| 17 | University students and staff and company employees | 185 | Physical activity | PRO | PUB | HP | PA | 1 | 0 | 0 | 0 | McLachlan, S., & Hagger, M. S. (2011). The influence of chronically-accessible autonomous and controlling motives on physical activity within an extended theory of planned behaviour. <i>Journal of Applied Social Psychology</i> , 41, 445-470. https://doi.org/10.1111/j.1559-1816.2010.00721.x |
| 18 | University students | 525 | Dieting, alcohol consumption, physical activity | PRO | PUB | MIX | OTH | - | - | - | 0 | Hagger, M. S., Anderson, M., Kyriakaki, M., & Darkings, S. (2007). Aspects of identity and their influence on intentional behaviour: Comparing effects for three health behaviours. <i>Personality and Individual Differences</i> , 42, 355-367. https://doi.org/10.1016/j.paid.2006.07.017 |
| 19 | High school students – Greece | 93 | Physical activity | PRO | PUB | HP | PA | 1 | 0 | 0 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. <i>Journal of Educational Psychology</i> , 97, 376-390. https://doi.org/10.1037/0022-0663.97.3.376 |
| 20 | High school students – Poland | 103 | Physical activity | PRO | PUB | HP | PA | 1 | 0 | 1 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. <i>Journal of Educational Psychology</i> , 97, 376-390. https://doi.org/10.1037/0022-0663.97.3.376 |
| 21 | High school students - Singapore | 133 | Physical activity | PRO | PUB | HP | PA | 0 | 0 | 0 | 1 | Hagger, M. S., Chatzisarantis, N. L. D., Barkoukis, V., Wang, C. K. J., & Baranowski, J. (2005). Perceived autonomy support in physical education and leisure-time physical activity: A cross-cultural evaluation of the trans-contextual model. <i>Journal of Educational Psychology</i> , 97, 376-390. https://doi.org/10.1037/0022-0663.97.3.376 |

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|----|----------------------|-----|---------------------------------------|-----|------|----|-----|---|---|---|---|---|
| 22 | High school students | 423 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 1 | Hamilton, K., & White, K.M. (2008). Extending the Theory of Planned Behavior: The role of self and social influences in predicting adolescent regular moderate-to-vigorous physical activity. <i>Journal of Sport & Exercise Psychology</i> , 30, 56-74. |
| 23 | High school students | 230 | Physical activity | PRO | UPUB | HP | PA | 1 | 0 | 1 | 1 | No previous manuscripts have been published using these data. |
| 24 | University Students | 626 | Dental flossing | PRO | UPUB | HP | OTH | 1 | 0 | 0 | 0 | No previous manuscripts have been published using these data. |
| 25 | Older adults | 213 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 0 | Arnautovska, U., Fleig, L., O'Callaghan, F., & Hamilton, K. (2019). Older adults' physical activity: The integration of autonomous motivation and theory of planned behaviour constructs. <i>Australian Psychologist</i> , 54, 46-54. https://doi.org/10.1111/ap.12346 . |
| 26 | Parents | 373 | Parent-for-child sun safety behaviors | PRO | PUB | HP | OTH | 1 | 1 | 1 | 0 | Hamilton, K., Kirkpatrick, A., Rebar, A., & Hagger, M.S. (2017). Child sun safety: Application of an integrated behavior change model. <i>Health Psychology</i> , 36, 916-926. https://doi.org/10.1037/hea0000533 . |
| 27 | Parents | 281 | Parent-for-child tooth brushing | PRO | UPUB | HP | OTH | 1 | 1 | 1 | 0 | No previous manuscripts have been published using these data. |
| 28 | Parents | 580 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 0 | 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. <i>Journal of Sport & Exercise Psychology</i> , 34, 124-145. |
| 29 | University students | 201 | Sleep hygiene | PRO | PUB | HP | OTH | 1 | 1 | 1 | 0 | Hamilton, K., Ng, H. T. H., Zhang, C.-Q., Phipps, D. J., & Zhang, R. (2021). Social psychological predictors of sleep hygiene behaviors in Australian and Hong Kong university students. <i>International Journal of</i> |

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|----|----------------------|-----|--|-----|------|----|-----|---|---|---|---|---|
| 30 | University students | 204 | Heavy episodic drinking | PRO | PUB | HR | OTH | 0 | 0 | 0 | 0 | <i>Behavioral Medicine</i> , 28(2), 214-226. https://doi.org/10.1007/s12529-020-09859-8 Hamilton, K., Gibbs, I., Keech, J. J., & Hagger, M. S. (2020). Reasoned and implicit processes in heavy episodic drinking: An integrated dual process model. <i>British Journal of Health Psychology</i> , 25, 189-209. https://doi.org/10.1111/BJHP.12401 |
| 31 | University students | 161 | Sleep hygiene | PRO | PUB | HP | OTH | 0 | 0 | 0 | 0 | Hamilton, K., Ng, H. T. H., Zhang, C.-Q., Phipps, D. J., & Zhang, R. (2021). Social psychological predictors of sleep hygiene behaviors in Australian and Hong Kong university students. <i>International Journal of Behavioral Medicine</i> , 28(2), 214-226. https://doi.org/10.1007/s12529-020-09859-8 |
| 32 | University students | 188 | Physical activity | PRO | PUB | HP | PA | 1 | 1 | 1 | 0 | Allom, V., Mullan, B., Cowie, E., & Hamilton, K. (2016). Physical activity and transitioning to college: The importance of intentions and habits. <i>American Journal of Health Behavior</i> , 40, 280-290. https://doi.org/10.5993/AJHB.40.2.13 |
| 33 | University students | 233 | Limiting free sugar | PRO | PUB | HP | DB | 1 | 1 | 1 | 0 | Phipps, D., Hagger, M. S., & Hamilton K. (2020). Predicting limiting 'free sugar' consumption using an integrated model of behavior. <i>Appetite</i> . https://doi.org/10.1016/j.appet.2020.104668 |
| 34 | High school students | 266 | Restricting sugary drinks and eating fruits and vegetables | PRO | UPUB | HP | DB | - | - | - | 1 | No previous manuscripts have been published using these data |
| 35 | Parents | 196 | Parent-for-child limiting discretionary choices and healthy eating | PRO | PUB | HP | DB | - | - | - | 0 | Spinks, T., & Hamilton, K. (2016). Investigating mothers' decisions to give their 2-3 year old a nutritionally balanced diet. <i>Journal of Nutrition Education and Behavior</i> , 48, 250-257. https://doi.org/10.1016/j.jneb.2016.02.002 |

| | | | | | | | | | | | | |
|----|---------------------------------------|-----|--|-----|------|----|-----|---|---|---|---|--|
| 36 | Parents | 208 | Parent-for-child screen time and physical activity | PRO | PUB | HP | OTH | - | - | - | 0 | 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. <i>British Journal of Health Psychology</i> , 21(2), 285-301. https://doi.org/10.1111/bjhp.12168 . |
| 37 | Pregnant women | 207 | Physical activity and fruit and vegetable consumption | PRO | PUB | HP | OTH | - | - | - | 0 | Hamilton, K., Fleig, L., Henderson, J., & Hagger, M. S. (2019). Being active in pregnancy: Theory-based predictors of physical activity among pregnant women. <i>Women & Health</i> , 9, 213-228. https://doi.org/10.1080/03630242.2018.1452835 |
| 38 | Long-haul heavy goods vehicle drivers | 84 | Fruit and vegetable consumption and limiting discretionary choices | PRO | UPUB | HP | DB | - | - | - | 0 | No previous manuscripts have been published using these data. |
| 39 | University students | 267 | Drinking alcohol within safe limits and physical activity | PRO | UPUB | HP | OTH | - | - | - | 0 | No previous manuscripts have been published using these data. |

Note. ¹Sample age moderator variable coded as 1 = older samples comprising adult samples and 0 = younger samples comprising lower- and high-school students. Mod. 1 = Moderator 1 – Studies classified as targeting a behavior that is health risk (e.g., alcohol consumption, consumption of high-sugar beverages), health protective (e.g., physical activity, eating fruit and vegetables), or a mix of both health protective and health risk behaviors; Mod. 2 = Moderator 2 – Studies classified as targeting physical activity, dietary behaviors, or other (e.g., parent-for-child toothbrushing; alcohol consumption); SN = Subjective norm; PBC = Perceived behavioral control; Attitude/PBC = Studies in which both the attitude and PBC variables were classified as having a high percentage of scores (>60%) above the scale midpoint (low coverage, coded 1), or studies in which one or both variables had a low percentage of scores (≤60%) above the scale midpoint (high coverage, coded 0); SN/PBC = Studies in which both the subjective norm and PBC variables were classified as having a high percentage of scores (>60%) above the scale midpoint (low coverage, coded 1), or studies in which one or both variables had a low percentage of scores (≤60%) above the scale midpoint

(high coverage, coded 0); Intention/PBC = Studies in which both the intention and PBC variables were classified as having a high percentage of scores ($>60\%$) above the scale midpoint (low coverage, coded 1), or studies in which one or both variables had a low percentage of scores ($\leq 60\%$) above the scale midpoint (high coverage, coded 0); HP = Health promoting behavior; HR = Health risk behavior; PA = Physical activity behavior; DB = Dietary behavior (e.g., eating sufficient fruit and vegetables, restricting consumption of sugar-sweetened beverages; dieting); OTH = Health behaviors other than physical activity and dietary behaviors; PRO = Prospective design studies; CS = Cross-sectional design studies. ^aMultiple behaviors were: regular exercise, eating a portion of vegetables twice every day, taking multi-vitamin tablets, brushing and flossing twice per day, sleeping 7 hours per night, eating five portions of fresh fruit and vegetables regularly, avoiding smoking, drinking 4 pints of water every day, going to the pub, using a condom when having sex, avoiding eating junk food, avoiding taking caffeine and other legal stimulants, hand washing after visiting the toilet, wearing a seatbelt when in a car, avoiding getting drunk, avoiding taking illegal drugs, sitting with the correct posture when using a computer, seeking medical care when ill, studying in good light, and avoiding making long calls on a mobile phone (>10 minutes).

Appendix C

Items and Response Scales for Measures Used in Studies Included in the Meta-Analysis

| Dataset | Sample | Behavior | Variable | Item(s)/measure | Scale |
|---------|-------------------------------|----------------------|------------------------------|---|--|
| 1 | University students | Alcohol pre-drinking | Attitude | For me, pre-drinking over the next four weeks is... | 1 = unimportant, 6 = important 1 = not worthwhile, 6 = worthwhile 1 = unenjoyable, 6 = enjoyable 1 = harmful, 6 = beneficial 1 = bad, 6 = good |
| | | | Subjective norm | People who are important to me would approve of my decision to pre-drink over the next four weeks Most people who are important to me would want me to pre-drink sessions over the next four weeks Most people whose opinions I value would approve of me pre-drinking over the next four weeks | 1 = strongly disagree, 6 = strongly agree |
| | | | Perceived behavioral control | How much personal control do you have over pre-drinking over the next four weeks? It is mostly up to me whether or not I pre-drink over the next four weeks If I wanted to, I could pre-drink over the next four weeks | 1 = no control at all, 6 = complete control 1 = strongly disagree, 6 = strongly agree |
| | | | Intention | I intend to pre-drink over the next four weeks I plan to pre-drink over the next four weeks I will try to pre-drink over the next four weeks. | 1 = extremely unlikely, 6 = extremely likely |
| | | | Past behavior/behavior | I consumed alcoholic beverages at my home or someone else's house before I went out on each individual occasion over the past four weeks with the following regularity. How many drinking sessions would you have had in total over the past four weeks? | 1 = never, 7 = everyday |
| | | | | | |
| 2 | University students and staff | Dieting | Attitude | For me, watching my diet in the next fortnight is... | 1 = of no use, 6 = useful 1 = unimportant, 6 = important 1 = not worthwhile, 6 = worthwhile 1 = worthless, 6 = valuable 1 = sad, 6 = happy 1 = unsatisfying, 6 = satisfying 1 = unenjoyable, 6 = enjoyable 1 = unpleasant, 6 = pleasant |
| | | | Subjective norm | Most people who are important to me would want me to watch my diet in the next fortnight. Most people I know would approve of me watching my diet in the next fortnight | 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly |

| | | | | | |
|---|-------------------------------|-------------------|------------------------------|--|---|
| 3 | University students and staff | Physical activity | | People who are important to me would...[approve/disapprove]...of me watching my diet in the next fortnight. Most people close to me expect me to watch my diet in the next fortnight. | 1 = very strongly disapprove, 6 = very strongly approve 1 = extremely unlikely, 6 = extremely likely |
| | | | Perceived behavioral control | For me to watching my diet in the next fortnight would be... How much personal control do you have over watching your diet in the next fortnight? There is a lot I can do to make sure I watch my diet in the next fortnight. I am in complete control over watching my diet in the next fortnight. Overall, how much control do you have over watching your diet in the next fortnight? | 1 = extremely difficult, 6 = extremely easy 1 = no control at all, 6 = complete control 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly 1 = low control, 6 = high control 1 = disagree very strongly, 6 = agree very strongly |
| | | | Intention | I intend to watch my diet in the next two weeks. I plan to watch my diet in the next two weeks. I will watch my diet in the next two weeks. I want to watch my diet in the next two weeks. I expect to watch my diet in the next two weeks. | |
| | | | Past behavior/behavior | In the course of the past two weeks, how often have you watched your diet? I watched my diet over the past two weeks with the following regularity. | 1 = almost never, 6 = every day 1 = never, 6 = every day |
| | | | Attitude | For me, doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight is... | 1 = of no use, 6 = useful 1 = unimportant, 6 = important 1 = not worthwhile, 6 = worthwhile 1 = worthless, 6 = valuable 1 = sad, 6 = happy 1 = unsatisfying, 6 = satisfying 1 = unenjoyable, 6 = enjoyable 1 = unpleasant, 6 = pleasant 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly 1 = very strongly disapprove, 6 = very strongly approve 1 = extremely unlikely, 6 = extremely likely |
| | | | Subjective norm | Most people who are important to me would want me to do vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight. Most people I know would approve of me doing vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight. People who are important to me would...[approve/disapprove]...of me doing in vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight. | |

| | | | | | |
|---|---------------------|--|------------------------------|--|--|
| 4 | University students | Consuming high-sugar foods and beverages | Perceived behavioral control | <p>Most people close to me expect me to do vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight.</p> <p>For me to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight would be...</p> <p>How much personal control do you have in doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight?</p> <p>There is a lot I can do to make sure I do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight.</p> <p>I am in complete control over my doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight.</p> <p>Overall, how much control do you have over doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight?</p> | <p>1 = extremely difficult, 6 = extremely easy</p> <p>1 = no control at all, 6 = complete control</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = low control, 6 = high control</p> |
| | | | Intention | <p>I intend to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight</p> <p>I plan to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight</p> <p>I will do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight</p> <p>I want to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> |
| | | | Past behavior/behavior | <p>In the course of the past two weeks, how often have you participated in vigorous physical activity for 20 minutes at a time?</p> <p>I engaged in vigorous physical activity for 20 minutes at a time the following number of times per week in the past two weeks.</p> | <p>1 = almost never, 6 = every day</p> <p>1 = never, 6 = every day</p> |
| | | | Attitude | <p>For me, avoiding consuming foods and beverages that are high in sugar in the next week is...</p> | <p>1 = of no use, 7 = useful</p> <p>1 = unimportant, 7 = important</p> <p>1 = unenjoyable, 7 = enjoyable</p> <p>1 = unpleasant, 7 = pleasant</p> |
| | | | Subjective norm | <p>Most people who are important to me would want me to avoid consuming foods and beverages that are high in sugar.</p> <p>Most people I know would approve of me avoiding consuming foods and beverages that are high in sugar.</p> <p>People who are important to me would...[approve/disapprove]...of me avoiding consuming foods and beverages that are high in sugar.</p> | <p>1 = strongly disagree, 7 = strongly agree</p> <p>1 = strongly disagree, 7 = strongly agree</p> <p>1 = disapprove very strongly, 7 = approve very strongly</p> |

| | | | | | |
|---|--|-------------------|------------------------------------|--|--|
| 5 | Primary/ elementary school children | Physical activity | Perceived behavioral control | Most people close to me expect me to avoid consuming foods and beverages that are high in sugar. | 1 = extremely unlikely, 7 = extremely likely |
| | | | | How much personal control do you have in avoiding consuming foods and beverages that are high in sugar? | 1 = no control, 7 = complete control |
| | | | | I am confident I can completely avoid consuming foods and beverages that are high in sugar. | 1 = extremely unconfident, 7 = extremely confident |
| | | | | I am in complete control over avoiding consuming foods and beverages that are high in sugar. | 1 = strongly disagree, 7 = strongly agree |
| | | | Intention | I believe I have the ability to avoid consuming foods and beverages that are high in sugar. | 1 = strongly disagree, 7 = strongly agree |
| | | | | I try hard to avoid consuming foods and beverages that are high in sugar. | 1 = completely disagree, 4 = completely agree. |
| | | | Past behavior/ behavior | In the course of the past two weeks, how often have you consumed foods or beverages that are high in sugar? | 1 = “almost never, 7 = “every day” |
| | | | | I consumed foods and beverages that are high in sugar the following number of times in the past two weeks. | 1 = “0-5 times”, 6 = “21+ times” |
| | | | Attitude | My doing physical activities at least three times in my own time in the next week is... | 1 = unpleasant, 6 = fun |
| | | | | | 1 = boring, 6 = exciting |
| | | | Subjective norm | Most people important to me think I should do physical activities at least three times in my own time in the next week. | 1 = bad, 6 = good |
| | | | | | |
| | | | Perceived behavioral control | Do you think it would be easy or difficult to do physical activities which make you out of breath at least three times in your own time in the next week? | 1 = unlikely, 7 = likely |
| | | | | How much control do you have over your ability to participate in physical activities which make you out of breath at least three times in your own time in the next week? | 1 = difficult, 7 = easy |
| | | | | Whether or not I participate in physical activities that will make me out of breath at least three or more times in your own time in the next week is entirely up to me. | 1 = very little control, 7 = complete control |
| | | | | It is mostly up to me whether I do physical activities that make me out of breath at least three or more times in my own time in the next week, measured with true± false scale end-points | 1 = strongly disagree, 7 = strongly agree |
| | | | | How much personal control do you feel you have over participating in physical activities that will make you out of breath at least three or more times in your own time in the next week? | 1 = true, 7 = false |
| | | | | | 1 = very little control, 7 = complete control |
| | | | Intention | I plan to do physical activities that make my heart beat faster or make me out of breath at least three times in my own time during the next week. | 1 = unlikely, 7 = likely |
| | | | | | |

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|---|-------------------|----------------|------------------------------|--|--|
| 6 | Company employees | Binge drinking | Past behavior | <p>I intend to do physical activities that make my heart beat faster or make me out of breath at least three times in my own time during the next week.</p> <p>I will do physical activities that make my heart beat faster or make me out of breath at least three times in my own time during the next week.</p> <p>How often have you performed physical activities which make you out of breath at least three times per week in the past six months?</p> | 1 = never, 6 = every day |
| | | | Attitude | <p>For me, keeping my alcohol drinking to within safe limits on each individual occasion or session over the next three months is...</p> | <p>1 = of no use, 6 = useful</p> <p>1 = unimportant, 6 = important</p> <p>1 = not worthwhile, 6 = worthwhile</p> <p>1 = bad, 6 = good</p> <p>1 = unenjoyable, 6 = enjoyable</p> |
| | | | Subjective norm | <p>Most people who are important to me (e.g., friends, family, etc.) would want me to keep my alcohol drinking to within safe limits on each individual occasion or session over the next three months.</p> <p>Most people I know would approve of me keeping my alcohol drinking to within safe limits on each individual occasion or session over the next three months.</p> <p>People who are important to me would...[approve/disapprove]...of me keeping my alcohol drinking to within safe limits on each individual occasion or session over the next three months.</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = very strongly disapprove, 7 = very strongly approve</p> |
| | | | Perceived behavioral control | <p>How much personal control do you have over keeping your alcohol drinking to within safe limits on each individual occasion or session over the next three months?</p> <p>How confident are you that you can keep your alcohol drinking to within safe limits on each individual occasion or session over the next three months?</p> <p>Overall, how much control do you think you have over keeping your alcohol drinking to within safe limits on each individual occasion or session over the next three months?</p> | <p>1 = no control at all, 6 = complete control</p> <p>1 = extremely unconfident, 6 = extremely confident</p> <p>1 = low control, 6 = high control</p> |
| | | | Intention | <p>I intend to keep my alcohol drinking to within safe limits on each individual occasion or session over the next three months.</p> <p>I plan to keep my alcohol drinking to within safe limits on each individual occasion or session over the next three months</p> <p>I will keep my alcohol drinking to within safe limits on each individual occasion or session over the next three months</p> | <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> |
| | | | Past behavior/behavior | <p>Frequency of binge-drinking occasions in the previous 4 weeks.</p> <p>Participants were required to write down how many occasions they exceeded 10 [alcohol] 'units' for men or seven 'units' for women each week over the previous 4 weeks. Separate response boxes were provided</p> | — |

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| 7 | High school students | Physical activity | Attitude | for each week and responses were summed to give the total number of binge-drinking occasions for the previous 4 weeks. Participating in active sports and/or vigorous physical activities during my leisure-time in the next 5 weeks is... | 1 = useless, 7 = useful 1 = harmful, 7 = beneficial 1 = bad, 7 = good 1 = unenjoyable, 7 = enjoyable 1 = unimportant, 7 = important 1 = strongly disagree, 7 = strongly agree |
| | | | Subjective norms | Most people who are important to me think that I should do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during my leisure time over the next 5 weeks. Most people who are important to me pressure me to do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during my leisure time over the next 5 weeks. | |
| | | | Perceived behavioral control | How much control do you have over doing active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during your leisure time over the next 5 weeks. If I wanted to I could do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during your leisure time over the next 5 weeks. I feel in complete control over whether I will do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during your leisure time over the next 5 weeks. | 1 = very little control, 7 = complete control 1 = strongly disagree, 7 = strongly agree 1 = completely false, 7 = completely true |
| | | | Intention | I intend to do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during my leisure time, over the next 5 weeks. I intend to do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during my leisure time, over the next 5 weeks with the following regularity. I intend to do active sports and/or vigorous physical activities for at least 30 minutes, _____ days per week, during my leisure time over the next 5 weeks. | 1 = unlikely, 7 = likely 1 = not at all, 7 = every day |
| | | | Past behavior | During the last six months, I have been doing active sports, and/or vigorous physical activities.... | 1 = not at all, 6 = most days of the week |
| | | | Behavior | How many times per week have you participated in active sports/vigorous physical activities for at least 30 minutes at a time in the last 5 weeks? | 0 = not at all, 8 = most days of the week |
| 8-10 | High school students | Physical activity | Attitude | For me, doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks is... | 1 = of no use, 6 = useful 1 = unimportant, 6 = important 1 = unpleasant, 6 = pleasant 1 = unsatisfying, 6 = satisfying |

| | | | | | |
|----|----------------------|-------------------|------------------------------|--|---|
| 11 | High school students | Physical activity | Subjective norms | <p>Most people who are important to me would want me to do vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks.</p> <p>People who are important to me would approve of me doing vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks.</p> <p>Most people who are important to me pressure me to do vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks.^a</p> <p>Most people who are important to me would want me to do vigorous physical activities for at least 20 minutes at a time at least three times per week in the next five weeks.^a</p> | <p>1 = unenjoyable, 6 = enjoyable</p> <p>1 = disagree, 6 = agree</p> |
| | | | Perceived behavioral control | <p>For me doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks would be . . .</p> <p>How much personal control do you think you have in doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks?</p> <p>How much do you feel doing vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks is beyond your control?</p> | <p>1 = very difficult, 6 = very easy</p> <p>1 = no control at all, 6 = complete control</p> <p>1 = not at all, 6 = very much so</p> |
| | | | Intention | <p>I intend to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks.</p> <p>I plan to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks.</p> <p>How often do you expect to be able to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next five weeks?</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = very unlikely, 6 = very likely</p> |
| | | | Past behavior | How often have you participated in vigorous physical activities for 20 minutes at a time in the past six months? | 1 = never, 6 = every day |
| | | | Behavior | <p>In the course of the past five weeks, how often have you participated in vigorous physical activities for 20 minutes at a time?</p> <p>I engaged in vigorous physical activity for 20 minutes at a time with the following regularity...</p> | <p>1 = almost never, 6 = every day</p> <p>1 = never, 6 = every day</p> |
| | | | Attitude | My doing physical activities that make me out of breath at least three or more times in the next week is... | <p>1 = unpleasant, 6 = fun</p> <p>1 = boring, 6 = exciting</p> <p>1 = bad, 6 = good</p> |

| | | | | | |
|----|----------------------|-------------------|------------------------------|--|--|
| 12 | High school students | Physical activity | Subjective norm | Most people important to me think I should do physical activities that make me out of breath at least three or more times in the next week. | 1 = unlikely, 7 = likely |
| | | | Perceived behavioral control | Whether or not I participate in physical activities that will make me out of breath at least three or more times in the next week is entirely up to me. It is mostly up to me whether I do physical activities that make me out of breath at least three or more times in the next week. How much personal control do you have over participating in physical activities which make you out of breath at least three or more times in the next week? Do you think it would be easy or difficult to do physical activities which make you out of breath at least three or more times in the next week? | 1 = disagree very strongly, 7 = agree very strongly 1 = false, 7 = true 1 = very little control, 7 = complete control 1 = difficult, 7 = easy |
| | | | Intention | I plan to do physical activities that make me out of breath at least three or more times during my free time the next week. I intend to do physical activities that make me out of breath at least three or more times during my free time the next week. I will do physical activities that make me out of breath at least three or more times during my free time the next week. | 1 = unlikely, 7 = likely |
| | | | Past behavior | How often have you performed physical activities which make you out of breath in the past six months? | 1 = hardly ever, 7 = very often |
| | | | Attitude | My doing physical activities at least three or more times in the next week is... | 1 = unpleasant, 7 = fun 1 = boring, 7 = exciting 1 = bad, 7 = good 1 = unlikely, 7 = likely |
| | | | Subjective norm | Most people important to me think I should do physical activities at least three or more times in the next week. | |
| | | | Perceived behavioral control | Do you think it will be easy or difficult for you to participate in physical activities which make you out of breath three or more times in the next week? It is mostly up to me whether I do physical activities that make me out of breath at least three or more times in the next week. If I wanted to I could do physical activities three or more times in the next week. There is very little I can do to make sure I do three or more physical activities in the next week. | 1 = difficult, 7 = easy 1 = false, 7 = true 1 = false, 7 = true 1 = disagree, 7 = agree |
| | | | Intention | I plan to do physical activities at least three or more times during my free time in the next week. I intend to do physical activities at least three or more times during my free time in the next week. I will do physical activities at least three or more times during my free time in the next week. | 1 = unlikely, 7 = likely |

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|----|----------------------|-------------------|------------------------------|---|--|
| 13 | High school students | Physical activity | Past behavior | How often have you performed physical activities that make you out of breath in the past six months? | 1 = never, 7 = at least seven times per week |
| | | | Attitude | Participating in active sports and/or vigorous physical activities during my leisure time in the next 5 weeks is... | 1 = useless, 7 = useful 1 = bad, 7 = good 1 = harmful, 7 = beneficial 1 = boring, 7 = interesting 1 = unenjoyable, 7 = enjoyable |
| | | | Subjective norms | People important to me think that I should do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. People who are important to me would approve of me doing active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. Most people who are important to me pressure me to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. Most people who are important to me would want me to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. | 1 = disagree, 7 = agree |
| | | | Perceived behavioral control | I feel in complete control over whether I do active sports and/or vigorous physical activities in my leisure time in the next 5 weeks. How much control do you have over doing active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during your leisure time over the next 5 weeks. If I wanted to I could do active sports and/or vigorous physical activities for at least 30 minutes, 3 days per week during your leisure time over the next 5 weeks. | 1 = no control, 7 = complete control 1 = strongly disagree, 7 = strongly agree 1 = completely false, 7 = completely true |
| | | | Intention | I intend to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. I plan to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. I will do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. | 1 = strongly disagree, 7 = strongly agree |
| | | | Past behavior | In the course of the past 6 months, how often, on average, have you participated in vigorous physical activities for 20 min at a time? | 1 = not at all, 6 = most days per week |
| | | | Behavior | In the course of the past five weeks, how often have you participated in vigorous physical activities for 20 minutes at a time? I engaged in vigorous physical activity for 20 minutes at a time with the following regularity... | 1 = almost never, 6 = every day 1 = never, 6 = every day |

| | | | | | |
|----|---------------------|---------|------------------------------|---|--|
| 14 | University students | Dieting | Attitude | For me, watching my diet in the next fortnight is... | 1 = of no use, 6 = useful 1 = unimportant, 6 = important 1 = not worthwhile, 6 = worthwhile 1 = worthless, 6 = valuable 1 = unfavorable, 6 = favorable 1 = unsatisfying, 6 = satisfying 1 = unenjoyable, 6 = enjoyable 1 = unpleasant, 6 = pleasant 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly 1 = very strongly disapprove, 6 = very strongly approve 1 = extremely unlikely, 6 = extremely likely 1 = extremely difficult, 6 = extremely easy 1 = no control at all, 6 = complete control 1 = disagree very strongly, 6 = agree very strongly 1 = extremely unconfident, 6 = extremely confident 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly 1 = disagree very strongly, 6 = agree very strongly 1 = extremely low control, 6 = extremely high control 1 = disagree very strongly, 6 = agree very strongly 1 = extremely unlikely, 6 = extremely likely 1 = extremely difficult, 6 = extremely easy |
| | | | Subjective norms | Most people who are important to me would want me to watch my diet in the next fortnight. Most people I know would approve of me watching my diet in the next fortnight. People who are important to me would... [approve/disapprove] ...of me watching my diet in the next fortnight. Most people close to me expect me to watch my diet in the next fortnight. | |
| | | | Perceived behavioral control | For me to watch my diet in the next fortnight would be... How much personal control do you have over watching your diet in the next fortnight? If I wanted to I could watch my diet in the next fortnight. I am confident I could watch my diet in the next fortnight. There is a lot I can do to make sure I watch my diet in the next fortnight. I am in complete control over my watching my diet in the next fortnight. I believe I have the ability to watch my diet in the next fortnight. Overall, how much control do you have over watching your diet in the next fortnight? There are likely to be plenty of opportunities for me to watch my diet in the next fortnight. What is the likelihood that if you tried you could watch your diet in the next fortnight? For me to watch my diet in the next fortnight would be... | |

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| 15 | University students | Physical activity | Intention | <p>I intend to watch my diet in the next fortnight.</p> <p>My will to watch my diet in the next fortnight is...</p> <p>I will watch my diet in the next fortnight.</p> <p>I want to watch my diet in the next fortnight.</p> <p>I will try to watch my diet in the next fortnight</p> | <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = no will, 6 = very strong will</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = extremely unlikely, 6 = extremely likely</p> |
| | | | Past behavior | <p>In the course of the past four weeks, how often have you to watched your diet?</p> <p>I engaged in watching my diet the following number of times in the past four weeks.</p> | <p>1 = almost never, 6 = every day</p> <p>1 = never, 6 = every day</p> |
| | | | Behavior | <p>In the course of the past fortnight, how often have you watched your diet?</p> <p>I engaged in watching my diet the following number of times in the past fortnight.</p> | <p>1 = almost never, 6 = every day</p> <p>1 = never, 6 = every day</p> |
| | | | Attitude | <p>For me, doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight is...</p> | <p>1 = of no use, 6 = useful</p> <p>1 = unimportant, 6 = important</p> <p>1 = not worthwhile, 6 = worthwhile</p> <p>1 = worthless, 6 = valuable</p> <p>1 = unfavorable, 6 = favorable</p> <p>1 = unsatisfying, 6 = satisfying</p> <p>1 = unenjoyable, 6 = enjoyable</p> <p>1 = unpleasant, 6 = pleasant</p> |
| | | | Subjective norms | <p>Most people who are important to me would want me to do vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight.</p> <p>Most people I know would approve of me doing vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight.</p> <p>People who are important to me would... [approve/disapprove] ...of me doing in vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight.</p> <p>Most people close to me expect me to do vigorous physical activities for 20 minutes per day at least three times per week in the next fortnight.</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = very strongly disapprove, 6 = very strongly approve</p> <p>1 = extremely unlikely, 6 = extremely likely</p> |

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| Perceived behavioral control | For me to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight would be... | 1 = extremely difficult, 6 = extremely easy |
| | How much personal control do you have over doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight? | 1 = no control at all, 6 = complete control |
| | For me to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight would be... | 1 = disagree very strongly, 6 = agree very strongly |
| | How much personal control do you have over doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight? | 1 = extremely unconfident, 6 = extremely confident |
| | If I wanted to I could do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = disagree very strongly, 6 = agree very strongly |
| | I am confident I could do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = disagree very strongly, 6 = agree very strongly |
| | There is a lot I can do to make sure I do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = extremely low control, 6 = extremely high control |
| | I am in complete control over my doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = disagree very strongly, 6 = agree very strongly |
| | I believe I have the ability to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = extremely unlikely, 6 = extremely likely |
| | Overall, how much control do you have over doing vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight? | 1 = extremely difficult, 6 = extremely easy |
| | There are likely to be plenty of opportunities for me to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | |
| | What is the likelihood that if you tried you could do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight? | |
| | For me to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight would be... | |
| | I intend to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = extremely unlikely, 6 = extremely likely |
| Intention | My will to participate in vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight is... | 1 = no will, 6 = very strong will |
| | I will do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight | 1 = disagree very strongly, 6 = agree very strongly |
| | I want to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = extremely unlikely, 6 = extremely likely |
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| | | | | I will try to do vigorous physical activities for 20 minutes at a time at least three times per week in the next fortnight. | 1 = extremely unlikely, 6 = extremely likely |
| | | | Past behavior | In the course of the past four weeks, how often have you participated in vigorous physical activities for 20 minutes at a time? I engaged in vigorous physical activity for 20 minutes at a time the following number of times per week in the past four weeks. | 1 = almost never, 6 = every day 1 = never, 6 = every day |
| | | | Behavior | In the course of the past fortnight, how often have you participated in vigorous physical activity for 20 minutes at a time? I engaged in vigorous physical activity for 20 minutes at a time the following number of times per week in the past fortnight. | 1 = almost never, 6 = every day 1 = never, 6 = every day |
| 16 | University students | Multiple health behaviors ^b | Attitude | For me, to do [health behavior] in the next fortnight is... | 1 = useless, 6 = useless 1 = unsatisfying, 6 = satisfying |
| | | | Subjective norm | Most people who are important to me would want me to [health behavior] in the next fortnight. Most people I know would approve of me [health behavior] in the next fortnight. | 1 = disagree very strongly, 6 = agree very strongly |
| | | | Perceived behavioral control | For me to [health behavior] in the next fortnight would be... If I wanted to I could do [health behavior] in the next fortnight. | 1 = extremely difficult, 6 = extremely easy 1 = disagree very strongly, 6 = agree very strongly |
| | | | Intention | I intend to [health behavior] in the next fortnight... I want to [health behavior] in the next fortnight | 1 = extremely unlikely, 6 = extremely likely |
| | | | Behavior | In the course of the past two weeks, how often have you [health behavior]? | 1 = never, 6 = almost everyday |
| 17 | University staff and students and company employees | Physical activity | Attitude | For me, doing active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks is... | 1 = useless, 7 = useless 1 = unsatisfying, 7 = satisfying 1 = unimportant, 7 = important |
| | | | Subjective norms | Most people who are important to me would want me to do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks. People important to me think that I should do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks. | 1 = strongly disagree, 7 = strongly agree |

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| 18 | University students | Dieting, alcohol consumption, physical activity | Perceived behavioral control | <p>People who are important to me would approve of me doing active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>Most people who are important to me pressure me to do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>I am confident I can do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>How much control do you have over doing active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>If I wanted to I could do active sports and/or vigorous physical activities, for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> | <p>1 = very unlikely, 7 = very likely</p> <p>1 = strongly disagree, 7 = strongly agree</p> <p>1 = strongly disagree, 7 = strongly agree</p> |
| | | | Intention | <p>I intend to do active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>I plan to do active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> <p>I will do active sports and/or vigorous physical activities for at least 40 minutes, 4 days per week during my leisure-time, over the next 3 weeks.</p> | <p>1 = strongly disagree, 7 = strongly agree</p> |
| | | | Past behavior/behavior | <p>In the last 3 weeks, I participated in active sports and/or vigorous physical activities for at least 40 minutes during my leisure time...</p> <p>In the course of the past three weeks, how often have you participated in active sports and/or vigorous physical activities for at least 40 minutes during my leisure time?</p> | <p>1 = not at all, 7 = most days of the week</p> <p>1 = never, 7 = very often</p> |
| | | | Attitude | <p>For me, [watching my diet/participating in binge drinking sessions/doing in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight is...</p> | <p>1 = of no use, 6 = useful</p> <p>1 = unimportant, 6 = important</p> <p>1 = not worthwhile, 6 = worthwhile</p> <p>1 = worthless, 6 = valuable</p> <p>1 = unfavorable, 6 = favorable</p> <p>1 = unsatisfying, 6 = satisfying</p> <p>1 = unenjoyable, 6 = enjoyable</p> <p>1 = unpleasant, 6 = pleasant</p> <p>1 = bad, 6 = good</p> |
| | | | Subjective norm | <p>Most people who are important to me would want me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> |

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| | <p>activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>Most people I know would approve of me [watching my diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>People who are important to me would... [approve/disapprove]...of me [watching my diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight/.</p> <p>Most people close to me expect me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>For me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight would be....</p> <p>How much personal control do you think you have over [watching your diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight?</p> <p>If I wanted to I could [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I am confident I can [watch my diet/avoid participating in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>There is a lot I can do to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I am in complete control over [watching my diet/my participation in binge drinking sessions/my participation in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I believe I have the ability to [watch my diet/avoid participating in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>Overall, how much control do you have over [watching your diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight?</p> | <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = very strongly disapprove, 6 = very strongly approve</p> <p>1 = very unlikely, 6 = very likely</p> |
| Perceived behavioral control | <p>For me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight would be....</p> <p>How much personal control do you think you have over [watching your diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight?</p> <p>If I wanted to I could [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I am confident I can [watch my diet/avoid participating in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>There is a lot I can do to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I am in complete control over [watching my diet/my participation in binge drinking sessions/my participation in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I believe I have the ability to [watch my diet/avoid participating in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>Overall, how much control do you have over [watching your diet/participating in binge drinking sessions/participating in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight?</p> | <p>1 = extremely difficult, 6 = extremely easy</p> <p>1 = no control at all, 6 = complete control</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = extremely unconfident, 6 = extremely confident</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = extremely high control, 6 = extremely low control</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = extremely unlikely, 6 = very extremely</p> <p>1 = extremely difficult, 6 = extremely easy</p> |

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| 19-21 | High school students | Physical activity | Intention | <p>There are likely to be plenty of opportunities for me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>What is the likelihood that if you tried could [watch your diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight?</p> <p>For me to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight would be....</p> <p>I intend to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>My will to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight is...</p> <p>I will try to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I want to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> <p>I will try to [watch my diet/participate in binge drinking sessions/participate in vigorous physical activities for 20 minutes at a time at least three times per week] in the next fortnight.</p> | <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = no will, 6 = very strong will</p> <p>1 = disagree very strongly, 6 = agree very strongly</p> <p>1 = extremely unlikely, 6 = extremely likely</p> <p>1 = extremely unlikely, 6 = extremely likely</p> |
| | | | Past behavior/ behavior | <p>In the course of the past two weeks, how often have you [watched your diet/participated in binge drinking sessions/participated in vigorous physical activities for 20 minutes at a time at least three times per week]?</p> <p>I [engaged in binge drinking/participated in vigorous physical activities for 20 minutes at a time at least three times per week] with the following number of times per week in the past two weeks?/How many days have you watched your diet PER WEEK over the past two weeks?</p> | <p>1 = never, 7 = every day</p> <p>0 = 0, 7 = 6+</p> |
| | | | Attitude | <p>Participating in active sports and/or vigorous physical activities during my leisure time in the next 5 weeks is...</p> | <p>1 = useless, 7 = useful</p> <p>1 = bad, 7 = good</p> <p>1 = harmful, 7 = beneficial</p> <p>1 = boring, 7 = interesting</p> <p>1 = unenjoyable, 7 = enjoyable</p> |

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| 22 | Subjective norms | People important to me think that I should do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. People who are important to me would...[approve/disapprove]... of me doing active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. | 1 = strongly disagree, 7 = strongly agree 1 = strongly disapprove, 7 = strongly approve |
| | Perceived behavioral control | How much control do you have over doing active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. If I wanted to I could do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. ^c I feel in complete control over whether I do active sports and/or vigorous physical activities in my leisure time in the next 5 weeks. | 1 = very little control, 7 = complete control 1 = strongly disagree, 7 = strongly agree 1 = no control, 7 = complete control |
| | Intention | I intend to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. I plan to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. I expect I will be able to do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. I will do active sports and/or vigorous physical activities during my leisure time in the next 5 weeks. ^d | 1 = strongly disagree, 7 = strongly agree |
| | Past behavior | During the last six months, I have done active sports and/or vigorous physical activities for at least 20 minutes at a time during my leisure time with the following regularity.... | 1 = almost never, 6 = every day |
| | Behavior | I engaged in vigorous physical activity for 20 minutes at a time with the following regularity in the past five weeks. | 1 = not at all, 6 = every day |
| | Attitude | For me, to do moderate-to-vigorous physical activity on a regular basis in the next week would be... | 1 = unpleasant, 7 = pleasant 1 = bad, 7 = good 1 = harmful, 7 = beneficial 1 = boring, 7 = fun 1 = worthless, 7 = valuable |
| | Subjective norm | Those people who are important to me would want me to do moderate-to-vigorous physical activity on a regular basis in the next week. Most people who are important to me think that my doing moderate-to-vigorous physical activity on a regular basis would be: | 1 = strongly disagree, 7 = strongly agree 1 = undesirable, 7 = desirable |
| | Perceived behavioral control | I have complete control of whether I do moderate-to-vigorous physical activity on a regular basis in the next week. I am confident that I could do moderate-to-vigorous physical activity on a regular basis in the next week. | 1 = strongly disagree, 7 = strongly agree |

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| 23 | Intention | If I wanted to I could do moderate-to-vigorous physical activity on a regular basis in the next week. | |
| | | It would be easy for me to do moderate-to-vigorous physical activity on a regular basis in the next week. | |
| | | It is mostly up to me if I do moderate-to-vigorous physical activity on a regular basis in the next week. | |
| | | It is entirely up to me if I do moderate-to-vigorous physical activity on a regular basis in the next week. | |
| | Past behavior/behavior | I... to do moderate-to-vigorous physical activity on a regular basis in the next week. | 1 = do not intend, 7 = intend |
| | | I expect I will do moderate-to-vigorous physical activity on a regular basis in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | | I plan to do moderate-to-vigorous physical activity on a regular basis in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Attitude | In the course of the past week, how often have you done moderate-to-vigorous physical activity for at least 60 minutes. | 0 = 0 days, 5 = 5 days or more |
| | | Participating in active sports and/or vigorous physical activities during my leisure time in the next four weeks is... | 1 = useless, 7 = useful 1 = bad, 7 = good 1 = unenjoyable, 7 = enjoyable 1 = strongly disagree, 7 = strongly agree |
| | Subjective norm | Most people who are important to me think I should do active sports and/or vigorous physical activities during my leisure time for the next 4 weeks. | |
| | Perceived behavioral control | Most people important to me put pressure on me to do active sports and/or vigorous physical activities during my leisure time for the next 4 weeks. | |
| | | How much control do you have over doing active sports and/or vigorous physical activities in my leisure time in the next 4 weeks? | 1 = strongly disagree, 7 = strongly agree |
| | | I am confident I could do active sports and/or vigorous physical activities during my leisure time in the next 4 weeks. | |
| | Intention | I intend to do active sports and/or vigorous physical activities during my leisure time in the next 4 weeks. | 1 = strongly disagree, 7 = strongly agree |
| | | I plan to do active sports and/or vigorous physical activities during my leisure time in the next 4 weeks. | |
| | Past behavior/behavior | In the course of the past 4 weeks, how often on average, have you participated in vigorous physical activities during your leisure time for at least 20 minutes at a time? | 1 = not at all, 6 = every day 1 = never, 6 = all of the time |
| | | How frequently did you have you participated in vigorous physical activities during your leisure time in the course of the past 4 weeks for at least 20 minutes at a time? | |

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| 24 | University students | Dental flossing | Attitude | Flossing my teeth on a daily basis would be...? | 1 = unpleasant, 7 = pleasant 1 = bad, 7 = good 1 = worthless, 7 = valuable 1 = strongly disagree, 7 = strongly agree |
| | | | Subjective norm | In regards to flossing your teeth on a daily basis, do you agree that... Those people who are important to me would want me to floss? Most people who are important to me would approve of me flossing? | 1 = strongly disagree, 7 = strongly agree |
| | | | Perceived behavioral control | In regards to flossing your teeth on a daily basis, do you agree that... It is mostly up to me whether I floss? I have complete control over whether I floss? It would be easy for me to floss? I am confident that I could floss? | 1 = strongly disagree, 7 = strongly agree |
| | | | Intention | In regards to flossing your teeth on a daily basis, do you agree that... It is likely that I will floss? I intend to floss? I plan to floss? | 1 = strongly disagree, 7 = strongly agree |
| | | | Past behaviour/behavior | In the last week, how often did you floss? In the last week, to what extent did you floss? | 1 = never; 7; very often 1 = never; 7 = to a large extent |
| 25 | Older adults | Physical activity | Attitude | For me to do regular physical activity in the next week would be ...? | 1 = bad, 7 = good 1 = harmful, 7 = beneficial 1 = boring, 7 = interesting 1 = unenjoyable, 7 = enjoyable 1 = strongly disagree, 7 = strongly agree |
| | | | Subjective norm | In regards to doing regular physical activity in the next week, do you agree that... People who are important to me would want me to engage in regular physical activity? Most people who are important to me would approve of my engaging in regular physical activity? | 1 = strongly disagree, 7 = strongly agree |
| | | | Perceived behavioral control | In regards to doing regular physical activity in the next week, do you agree that... It is mostly up to me whether or not I engage in regular physical activity? I have complete control over whether I engage in regular physical activity? It would be easy for me to engage in regular physical activity? I am confident that I can engage in regular physical activity? | 1 = strongly disagree, 7 = strongly agree |
| | | | Intention | In regards to doing regular physical activity in the next week, do you agree that... It is likely that I will be regularly physically active? I intend to be regularly physically active? I expect that I will be regularly physically active? | 1 = strongly disagree, 7 = strongly agree |
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| | | | Past behaviour/behavior | On how many days in the past week (past 7 days) have you engaged in at least 30 minutes of at least moderate-intensity physical activity? In the previous week, how often did you engage in regular physical activity? In the previous week, to what extent did you engage in regular physical activity? | 0 days to 7 days 1 = never, 7 = always 1 = not at all, 7 = a great extent |
| 26 | Parents | Parent-for-child sun safety behaviors | Attitude | Performing sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks would be...? | 1 = unpleasant, 7 = pleasant 1 = bad, 7 = good 1 = unwise, 7 = wise 1 = awful, 7 = nice 1 = unfavourable, 7 = favourable |
| | | | Subjective norm | Those people who are important to me would want me to perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks? Other parents I know perform sun-protective behaviours. Most people who are important to me would approve of me performing sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks? Other parents I know think that performing sun-protective behaviour is a good thing to do for my child. Most people who are important to me think I should perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks? | 1 = strongly disagree; 7 = strongly agree |
| | | | Perceived behavioral control | I have complete control over whether my child's sun-protective behaviours are performed every time they go in the sun for more than 10 minutes in the next 2 weeks? It is mostly up to me whether my child's sun-protective behaviours are performed every time they go in the sun for more than 10 minutes in the next 2 weeks? If I wanted to it would be easy for me to perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes in the next 2 weeks? I am confident that I could perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes in the next 2 weeks? | 1 = strongly disagree, 7 = strongly agree |
| | | | Intention | I am willing to perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks? I intend to perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks? | 1 = strongly disagree, 7 = strongly agree |

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| | | | Past behaviour/ behavior | <p>I plan to perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks?</p> <p>It is likely that I will perform sun-protective behaviours for my child every time they go in the sun for more than 10 minutes during the next 2 weeks?</p> <p>Think about the past 2 weeks. In general, how often did you perform sun-protective behaviours for your child?</p> <p>Think about the past 2 weeks. To what extent did you ensure that you performed sun-protective behaviours for your child?</p> <p>Think about the past 2 weeks. In general, how often did you perform sun-protective behaviours for your child?</p> <p>Think about the past 2 weeks. On average, how often did you perform sun-protective behaviour on the weekend for your child?</p> <p>Think about the past 2 weeks. On average, how often did you perform sun-protective behaviour on a week day for your child?</p> <p>Think about the past 2 weeks. To what extent did you ensure that you performed sun-protective behaviours for your child?</p> | <p>1 = never, 7 = always</p> <p>1 = not at all, 7 = a large extent</p> |
| 27 | Parents | Parent-for-child toothbrushing | <p>Attitude</p> <p>Subjective norm</p> <p>Perceived behavioral control</p> <p>Intention</p> | <p>Supervising my child brushing their teeth for 2 minutes twice daily in the next two weeks would be...?</p> <p>Those people who are important to me would want me to supervise my child brushing their teeth in the next two weeks?</p> <p>Most people who are important to me would approve of me supervising my child brushing their teeth in the next two weeks?</p> <p>Most people who are important to me think I should supervise my child brushing their teeth in the next two weeks?</p> <p>In regards to supervising my child brushing their teeth for 2 minutes twice daily, do you agree that in the next two weeks...</p> <p>It is mostly up to me whether I supervise my child brushing their teeth?</p> <p>I have complete control over whether I supervise my child brushing their teeth?</p> <p>It would be easy for me to supervise my child brushing their teeth?</p> <p>I am confident that I could supervise my child brushing their teeth?</p> <p>In regards to supervising my child brushing their teeth for 2 minutes twice daily, do you agree that in the next two weeks...</p> <p>It is likely that I will supervise my child brushing their teeth?</p> <p>I intend to supervise my child brushing their teeth?</p> <p>I plan to supervise my child brushing their teeth?</p> | <p>1 = worthless, 7 = valuable</p> <p>1 = bad, 7 = good</p> <p>1 = unpleasant, 7 = pleasant</p> <p>1 = strongly disagree, 7 = strongly agree</p> <p>1 = strongly disagree, 7 = strongly agree</p> <p>1 = strongly disagree, 7 = strongly agree</p> |

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| 28 | Past behavior/ behavior | Think about the past two weeks. In general, how often did you supervise your child brushing their teeth for 2 minutes twice daily? | 1 = never, 7 = always 1 = never, 7 = a large extent |
| | Attitude | Think about the past two weeks. In general, to what extent did you supervise your child brushing their teeth for 2 minutes twice daily? For me to do regular physical activity in the next week would be...? | 1 = worthless, 7 = valuable 1 = bad, 7 = good 1 = unpleasant, 7 = pleasant 1 = strongly disagree, 7 = strongly agree |
| | Subjective norm | Most people who are important to me would approve of my doing regular physical activity in the next week. Those people who are important to me think that I should do regular physical activity in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | I have complete control over whether I do regular physical activity in the next week. It is mostly up to me whether or not I do regular physical activity in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Intention | I am confident I can do regular physical activity in the next week. It would be easy for me to do regular physical activity in the next week. I intend to do regular physical activity in the next week. I plan to do regular physical activity in the next week. I expect that I will do regular physical activity in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Past behavior/ behavior | On how many days in the course of the past week [past 7 days] have you engaged in at least 30 minutes of at least a moderate-intensity physical activity? | 0 = 0 days, 7 = 7 days |
| 29 | Attitude | For me to follow good sleep hygiene habits every day in the next month would be...? | 1 = awful, 7 = nice 1 = bad, 7 = good 1 = unpleasant, 7 = pleasant 1 = unwise, 7 = wise 1 = unnecessary, 7 = necessary 1 = strongly disagree, 7 = strongly agree |
| | Subjective norm | Most people who are important to me would approve of me following good sleep hygiene habits. Most people would want me to follow good sleep hygiene habits. Most people think that I should follow good sleep hygiene habits. | 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | I have complete control over whether or not I follow good sleep hygiene habits. It is up to me whether or not I follow good sleep hygiene habits. I am confident I can follow good sleep hygiene habits. It would be easy for me to follow good sleep hygiene habits. | 1 = strongly disagree, 7 = strongly agree |

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| 30 | University students | Heavy episodic drinking | Intention | I intend to follow good sleep hygiene habits. I plan to follow good sleep hygiene habits. It is likely I will follow good sleep hygiene habits. | 1 = strongly disagree, 7 = strongly agree |
| | | | Past behavior/ behavior | Think about the past month. In general, how often did you follow good sleep hygiene habits? Think about the past month. In general, to what extent did you follow good sleep hygiene habits? | 1 = never, 7 = very often 1 = I did not, 7 = a very large extent |
| | | | Attitude | Engaging in heavy episodic drinking over the next four weeks would be...? | 1 = bad, 7 = good 1 = unwise, 7 = wise 1 = unpleasant, 7 = pleasant 1 = awful, 7 = nice |
| | | | Subjective norm | In regards to engaging in heavy episodic drinking over the next four weeks, do you agree that... Those people who are important to me would want me to engage in heavy episodic drinking? Most people who are important to me would approve of me engaging in heavy episodic drinking? Most people who are important to me think I should engage in heavy episodic drinking? | 1 = strongly disagree, 7 = strongly agree |
| | | | Perceived behavioral control | In regards to engaging in heavy episodic drinking over the next four weeks, do you agree that... I have complete control over whether I engage in heavy episodic drinking? It is up to me whether I engage in heavy episodic drinking? If I wanted to it would be easy for me to engage in heavy episodic drinking? I am confident that I could engage in heavy episodic drinking? | 1 = strongly disagree, 7 = strongly agree |
| | | | Intention | In regards to engaging in heavy episodic drinking over the next four weeks, do you agree that... I am willing to engage in heavy episodic drinking? I intend to engage in heavy episodic drinking? I expect to engage in heavy episodic drinking? It is likely that I will engage in heavy episodic drinking in the next four weeks? | 1 = strongly disagree, 7 = strongly agree |
| 31 | | | Past behavior/ behavior | Think about the past four weeks. In general, how often did you engage in heavy episodic drinking? Think about the past four weeks. In general, to what extent did you did you engage in heavy episodic drinking? | 1 = never, 7 = always 1 = never, 7 = a large extent |
| | | | Attitude | For me to follow good sleep hygiene habits every day in the next month would be...? | 1 = awful, 7 = nice 1 = bad, 7 = good |

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| 32 | Subjective norm | Most people who are important to me would approve of me following good sleep hygiene habits. Most people would want me to follow good sleep hygiene habits. Most people think that I should follow good sleep hygiene habits. | 1 = unpleasant, 7 = pleasant 1 = unwise, 7 = wise 1 = unnecessary, 7 = necessary 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | I have complete control over whether or not I follow good sleep hygiene habits. It is up to me whether or not I follow good sleep hygiene habits. I am confident I can follow good sleep hygiene habits. It would be easy for me to follow good sleep hygiene habits. | 1 = strongly disagree, 7 = strongly agree |
| | Intention | I intend to follow good sleep hygiene habits. I plan to follow good sleep hygiene habits. It is likely I will follow good sleep hygiene habits. | 1 = strongly disagree, 7 = strongly agree |
| | Past behavior/behavior | Think about the past month. In general, how often did you follow good sleep hygiene habits? Think about the past month. In general, to what extent did you follow good sleep hygiene habits? | 1 = never, 7 = very often 1 = 1 did not, 7 = a very large extent |
| | Attitude | For me to do regular physical activity in the next week would be... | 1 = unenjoyable, 7 = enjoyable 1 = bad, 7 = good 1 = boring, 7 = exciting 1 = unpleasant, 7 = pleasant 1 = harmful, 7 = beneficial 1 = worthless, 7 = valuable 1 = strongly disagree, 7 = strongly agree |
| | Subjective norm | Those people who are important to me would want me to do regular physical activity in the next week. Most people who are important to be would approve of me doing regular physical activity in the next week. The people in my life whose opinions I value would think that my doing regular physical activity is desirable. | |
| | Perceived behavioral control | I have complete control over whether I do regular physical activity in the next week. I am confident that I could do regular physical activity in the next week. It would be easy for me to do regular physical activity in the next week. It is mostly up to me whether or not I do regular physical activity in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Intention | I intend to do regular physical activity in the next week. I plan to do regular physical activity in the next week. | 1 = strongly disagree, 7 = strongly agree |

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| 33 | Past behavior/ behavior | I expect that I will do regular physical activity in the next week. | |
| | | It is likely that I will do regular physical activity in the next week. | |
| | | In the last week to what extent did you do regular physical activity? How often in the last week did you do regular physical activity? | 1 = not at all, 7 = very often 1 = never, 7 = very often |
| | Attitude | In the last week, on how many days did you do regular physical activity of a moderate intensity for at least 30 minutes? | 0 = 0 days, 7 = 7 days |
| | | For me, to limit free sugar in my daily diet in the next two weeks is... | 1 = unenjoyable, 7 = enjoyable 1 = bad, 7 = good 1 = unpleasant, 7 = pleasant 1 = unwise, 7 = wise |
| | | | |
| 34 | Subjective norm | Most people who are important to me would want me to limit free sugar intake in my daily diet in the next two weeks. | 1 = strongly disagree, 7 = strongly agree |
| | | Most people I know would approve of me limiting free sugar intake in my daily diet in the next two weeks. | 1 = disapprove very strongly, 7 = approve very strongly |
| | | People who are important to me would _____ of me limiting my daily intake of free sugar in the next two weeks. | |
| | Perceived behavioral control | It is mostly up to me whether I limit free sugar intake in my daily diet in the next two weeks. | 1 = strongly disagree, 7 = strongly agree |
| | | I am confident I can limit free sugar in my daily diet in the next two weeks. | |
| | | I am in complete control over limiting free sugar intake in my diet in the next two weeks. | |
| 34 | Intention | If I wanted too, it would be easy for me to limit free sugar intake in my daily diet in the next two weeks. | |
| | | I am willing to limit free sugar intake in my daily diet in the next two weeks. | 1 = strongly disagree, 7 = strongly agree |
| | | I intend to limit free sugar intake in my daily diet in the next two weeks. | |
| | Past behavior/ behavior | I plan to limit free sugar intake in my daily diet in the next two weeks. | |
| | | It is likely I will limit free sugar intake in my daily diet in the next two weeks. | |
| | | Think about the past 2 weeks, how often did you limit free sugar in your daily diet? | 1 = never, 7 = very often 1 = 1 did not, 7 = a very large extent |
| 34 | Attitude | Think about the past 2 weeks, to what extent did you limit free sugar in your daily diet? | |
| | | For me to [restrict my sugary drink consumption/eat the recommended serves of fruits and vegetables per day] in the next week would be... | 1 = unenjoyable, 7 = enjoyable 1 = bad, 7 = good 1 = unpleasant, 7 = pleasant 1 = unwise, 7 = wise |

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| 35 | Subjective norm | Do you agree that in the next week... Most people who are important to me would approve of me [restricting my sugary-drink consumption/eating the recommended serves of fruits and vegetables per day]. Those people who are important to me think that I should [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. The people in my life whose opinion I value would think my [restricting my sugary-drink consumption/eating the recommended serves of fruits and vegetables per day] is desirable | 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | Do you agree that in the next week... It is mostly up to me whether I [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. It would be easy for me to [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. I have complete control over whether I [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. I am confident that I could [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. | 1 = strongly disagree, 7 = strongly agree |
| | Intention | Do you agree that in the next week... I intend to [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. It is likely that I will [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. I expect that I will [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. | 1 = strongly disagree, 7 = strongly agree |
| | Past behavior/behavior | Think about the past 7 days. In general, how often did you [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. Think about the past 7 days. On how many days did you [restrict my sugary-drink consumption/eat the recommended serves of fruits and vegetables per day]. | 1 = never, 7 = always 0-1 days = 1, 7 days = 7 |
| | Attitude | For me, [ensuring that my child eats a wide variety of foods from the five food groups following the recommended serves/limiting my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday would be... | 1 = harmful, 7 = beneficial 1 = bad, 7 = good 1 = unfavourable, 7 = favourable 1 = undesirable, 7 = desirable |
| | Subjective norm | Most people who are important to me would approve of me [ensuring that my child eats a wide variety of foods from the five food groups following | 1 = strongly disagree, 7 = strongly agree |

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| Perceived behavioral control | <p>the recommended serves/limiting my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>Those people who are important to me think that I should [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>The people in my life whose opinions I value would think that [ensuring that my child eats a wide variety of foods from the five food groups following the recommended serves/limiting my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday is desirable.</p> <p>It is mostly up to me whether I [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>I have complete control over whether I [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>It would be easy for me to [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>I am confident that I could [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> | 1 = strongly disagree, 7 = strongly agree |
| Intention | <p>I intend to [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>I plan to [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> <p>I expect that I will [ensure that my child eats a wide variety of foods from the five food groups following the recommended serves/limit my child's consumption of discretionary choices to a maximum of 0-1 serves] everyday.</p> | 1 = strongly disagree, 7 = strongly agree |

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| 36 | Past behavior/ behavior | In the previous week, to what extent did you [ensure that your child ate a wide variety of foods from the five food groups following the recommended serves/limit your child's consumption of discretionary choices to a maximum of 0-1 serves] everyday. In the previous week, how often did you [ensure that your child ate a wide variety of foods from the five food groups following the recommended serves/limit your child's consumption of discretionary choices to a maximum of 0-1 serves] everyday. | 1 = not at all, 7 = a very large extent 1 = never, 7 = very often |
| | Attitude | For me to [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week would be... | 1 = bad, 7 = good 1 = worthless, 7 = valuable 1 = unfavourable, 7 = favourable |
| | Subjective norm | Most people who are important to me would approve of me [ensuring that my child is physically active for at least 3 hours every day/limiting my child's screen time to less than one hour per day] in the next week. Those people who are important to me think that I should [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. The people in my life whose opinions I value would think that my [ensuring that my child is physically active for at least 3 hours every day/limiting my child's screen time to less than one hour per day] in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | It is mostly up to me whether I [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. I have complete control over whether I [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. It would be easy for me to [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. I am confident that I could [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. | 1 = strongly disagree, 7 = strongly agree |
| | Intention | I intend to [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. I plan to [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week. | 1 = strongly disagree, 7 = strongly agree |

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| 37 | Pregnant women | Physical activity and fruit and vegetable consumption | Past behavior | <p>I expect that I will [ensure that my child is physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day] in the next week.</p> <p>In the last week, on how many days [was your child physically active for at least 3 hours/did you limit your child's screen time to less than one hour per day].</p> <p>In the past week, to what extent did you [ensure that your child was physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day].</p> <p>How often, in the previous week, did you [ensure that your child was physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day].</p> | <p>0 = 0 days, 7 = 7 days</p> <p>1 = not at all, 7 = a very large extent</p> <p>1 = never, 7 = very often</p> |
| | | | Behavior | <p>In the past week, to what extent did you [ensure that your child was physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day].</p> <p>How often, in the previous week, did you [ensure that your child was physically active for at least 3 hours every day/limit my child's screen time to less than one hour per day].</p> | <p>1 = not at all, 7 = a very large extent</p> <p>1 = never, 7 = very often</p> |
| | | | Attitude | <p>[Performing the recommended level of physical activity/consuming the recommended serves of fruits and vegetables] over the next week would be...</p> | <p>1 = undesirable, 7 = desirable</p> <p>1 = bad, 7 = good</p> <p>1 = unpleasant, 7 = pleasant</p> <p>1 = harmful, 7 = beneficial</p> |
| | | | Subjective norm | <p>Most people who are important to me would approve of me [performing the recommended level of physical activity/consuming the recommended serves of fruits and vegetables] in the next week?</p> <p>Those people who are important to me think that I should [perform the recommended level of physical activity/ consume the recommended serves of fruits and vegetables] in the next week?</p> <p>The people in my life whose opinion I value would think [performing the recommended level of physical activity/consuming the recommended serves of fruits and vegetables] in the next week is desirable?</p> | <p>1 = strongly disagree, 7 = strongly agree</p> |
| | | | Perceived behavioral control | <p>It is mostly up to me whether I [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> <p>It would be easy for me to [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> | <p>1 = strongly disagree, 7 = strongly agree</p> |
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| 38 | Intention | <p>I have complete control over whether I [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> <p>I am confident that I could [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> <p>I plan to [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> <p>I intend to [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> <p>I expect that I will [perform the recommended level of physical activity//consume the recommended serves of fruits and vegetables] in the next week?</p> <p>I am willing to [perform the recommended level of physical activity/consume the recommended serves of fruits and vegetables] in the next week?</p> | 1 = strongly disagree, 7 = strongly agree |
| | Past behaviour/behavior | <p>In the previous week, to what extent did you [perform physical activity following the recommended guidelines/eat the recommended serves of fruits and vegetables each day]?</p> <p>In the previous week, on how many days did you did you [perform physical activity following the recommended guidelines/eat the recommended serves of fruits and vegetables each day]?</p> <p>In the previous week, how often did you did you perform physical activity following the recommended guidelines/eat the recommended serves of fruits and vegetables each day]?</p> | <p>1 = not at all, 7 = a large extent</p> <p>0 days to 7 days</p> <p>1 = never, 7 = very often</p> |
| | Attitude | For me to [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day in the next week would be: | <p>1 = undesirable, 7 = desirable</p> <p>1 = bad, 7 = good</p> <p>1 = unfavourable, 7 = favourable</p> <p>1 = harmful, 7 = beneficial</p> |
| | Subjective norm | <p>Most people who are important to me would approve of me [eating fruits and vegetables following the recommended serves/limiting my consumption of discretionary choices to a maximum of 0-1 serves] each day.</p> <p>Those people who are important to me think that I should [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day.</p> <p>The people in my life whose opinion I value would think my [eating fruits and vegetables following the recommended serves/limiting my</p> | 1 = strongly disagree, 7 = strongly agree |

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| | | | | consumption of discretionary choices to a maximum of 0-1 serves] each day is desirable. | |
| | | | | Perceived behavioral control It is mostly up to me whether I [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. It would be easy for me to [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. I have complete control over whether I [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. I am confident that I could [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. | 1 = strongly disagree, 7 = strongly agree |
| | | | | Intention I intend to [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. I plan to [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. I expect that I will [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. | 1 = strongly disagree, 7 = strongly agree |
| | | | | Past behavior In the previous week, on how many days did you [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. | 0 = 0 days, 7 = 7 days |
| | | | | Behavior In the previous week, to what extent did you [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. In the previous week, on how many days did you [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. In the previous week, how often did you [eat fruits and vegetables following the recommended serves/limit my consumption of discretionary choices to a maximum of 0-1 serves] each day. | 1 = not at all, 7 = a large extent 0 = 0 days, 7 = 7 days 1 = never, 7 = very often |
| 39 | University students | Drinking alcohol within safe limits and physical activity | Attitude | How likely will the following result if you [drank alcohol within safe limits on each individual occasion / engaged in regular physical activity] over the next four weeks...? | 1 = unwise, 7 = wise 1 = bad, 7 = good 1 = unpleasant, 7 = pleasant 1 = awful, 7 = nice |

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| | Subjective norm | In regards to [drinking alcohol within safe limits on each individual occasion / doing regular physical activity] over the next four weeks, do you agree that... Most people who are important to me would approve of me [drinking alcohol within safe limits on each individual occasion / doing regular physical activity]. Most people who are important to me think I should [drink alcohol within safe limits on each individual occasion / do regular physical activity]. | 1 = strongly disagree, 7 = strongly agree |
| | Perceived behavioral control | In regards to [drinking alcohol within safe limits on each individual occasion / doing regular physical activity] over the next four weeks, do you agree that... I have complete control over whether I [drink alcohol within safe limits / do regular physical activity]? It is up to me whether I [drink alcohol within safe limits / do regular physical activity]? If I wanted to it would be easy for me to [drink alcohol within safe limits / do regular physical activity]? I am confident that I could [drink alcohol within safe limits / do regular physical activity]? | 1 = strongly disagree, 7 = strongly agree |
| | Intention | In regards to [drinking alcohol within safe limits on each individual occasion / doing regular physical activity] over the next four weeks, do you agree that... I will [drink alcohol within safe limits / do regular physical activity]? I intend to [drink alcohol within safe limits / do regular physical activity]? I expect to [drink alcohol within safe limits / do regular physical activity]? | 1 = strongly disagree, 7 = strongly agree |
| | Past behaviour/ behavior | Think about the past four weeks. In general, how often did you [drink alcohol within safe limits on each individual occasion / do regular physical activity]? Think about the past four weeks. In general, to what extent did you [drink alcohol within safe limits on each individual occasion / do regular physical activity]? | 1 = never, 7 = always 1 = never, 7 = a large extent |

Note. ^aItem used in the Hungary and Estonia samples only; ^bMultiple behaviors were: regular exercise, eating a portion of vegetables twice every day, taking multi-vitamin tablets, brushing and flossing twice per day, sleeping 7 hours per night, eating five portions of fresh fruit and vegetables regularly, avoiding smoking, drinking 4 pints of water every day, going to the pub, using a condom when having sex, avoiding eating junk food, avoiding taking caffeine and other legal stimulants, hand washing after visiting the toilet, wearing a seatbelt when in a car, avoiding getting drunk, avoiding taking illegal drugs, sitting with the correct posture when using a computer, seeking medical care when ill, studying in good light, and avoiding making long calls on a mobile phone (>10 minutes); ^cThis perceived behavioral control item was omitted due to

negative correlations with the other items; ^dThis intention item was dropped in the Singapore sample due to excessive missing data; TPB = Theory of planned behavior;

Appendix D

Details of One-Stage Meta-Analytic Structural Equation Modeling with Interaction Effects

When a study reports more than one measure or target, the variables are averaged before other analyses. Suppose that there are two variables (x and m); they are standardized before calculating their interaction term (xm) (Cohen et al., 2003). After applying a standardization on the variables, a covariance matrix of the variables, including x , m , and xm is calculated and used in the subsequent analyses. Variances of x and m are always equal to 1, whereas the variance of xm may not necessarily be 1.

Jak and Cheung (2020) proposed a one-stage meta-analytic structural equation modelling (OSMASEM) approach to conduct meta-analytic structural equation modelling (MASEM) with moderators. We may first review a multivariate meta-analysis, which extends a standard meta-analysis to several dependent effect sizes (e.g., Cheung, 2013). The model for the correlation between variables in the i th study is expressed as:

$$\mathbf{r}_i = \boldsymbol{\rho}_i + \mathbf{u}_i + \mathbf{e}_i, \quad (1)$$

where \mathbf{r}_i , $\boldsymbol{\rho}_i$, \mathbf{u}_i , and \mathbf{e}_i are the vectors of observed correlations, population correlations, random effects, and sampling errors, respectively. The standard assumption is that the variance-covariance matrix of the sampling errors is assumed known, i.e., $V_i = \text{Var}(\mathbf{e}_i)$. Then the unknown parameters in the model are the population correlations and the heterogeneity variance $T_{\rho}^2 = \text{Var}(\mathbf{u}_i)$.

The OSMASEM extends the multivariate meta-analysis by including a correlation structure $\boldsymbol{\rho}(\boldsymbol{\theta})_i$ on the population correlations. The model of OSMASEM in the i th study is

$$\mathbf{r}_i = \boldsymbol{\rho}(\boldsymbol{\theta})_i + \mathbf{u}_i + \mathbf{e}_i. \quad (2)$$

The meanings of the parameters are the same as those in the multivariate meta-analysis except that the population correlations $\boldsymbol{\rho}_i$ are now replaced by the correlation structure $\boldsymbol{\rho}(\boldsymbol{\theta})_i$. The advantage of doing this is that we may test structural equation models in a meta-analysis.

More importantly, categorical and continuous moderators can be included in $\boldsymbol{\rho}(\boldsymbol{\theta})_i$ to predict the regression paths with the use of definition variables. The full-information maximum likelihood (FIML) estimation method is used to fit the models. After fitting the OSMASEM, we may test the model fit by using the exact and approximate fit indices. As the models with and without the moderators are nested, we may test their statistical significance by using a likelihood ratio test. The OSMASEM approach is implemented in an R package called metaSEM (Cheung, 2015), which is freely available in the open-source R environment.

Similar to a standard meta-analysis and multivariate meta-analysis, there are several assumptions in OSMASEM. First, the sample correlation vector is assumed distributed with a known and multivariate distribution. This assumption is justified by using the central limit theorem with large sample sizes. The sample sizes in the data vary from $N = 84$ to $N = 1,238$ with a median of $N = 250$, which seem reasonable enough to apply the central limit theorem. The second assumption is that the random effects \mathbf{u}_i are normally distributed. This is a standard assumption in meta-analysis, structural equation models, and other latent variable models. The last assumption is that the correlation structure $\boldsymbol{\rho}(\boldsymbol{\theta})_i$ is correctly specified. The last assumption can be tested by using various exact and approximate fit indices available in structural equation models. Jak and Cheung (2020) conducted a comprehensive simulation study with 5 variables to evaluate the empirical performance of OSMASEM under various settings. They found that the

parameter estimates (within $\pm 5\%$) and standard errors (within $\pm 10\%$) were unbiased when the number of groups was 30 even with 60% of studies with missing data of 60% of variables. Their simulation settings were similar to the current sample of studies (both with 5 variables); and we do not have any missing data. Therefore, our data should work well with OSMASEM and provide precise estimates.

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Appendix E

Descriptive Statistics and Reliability Coefficients for Theory of Planned Behavior Constructs for Datasets with a Single Target Behavior

| Dataset | Construct | <i>M</i> | <i>SD</i> | Rel. | Items | Dataset | Construct | <i>M</i> | <i>SD</i> | Rel. | Items |
|---------|------------------------|----------|-----------|------|-------|---------|------------------------|----------|-----------|------|-------|
| 1 | Intention ^a | 3.483 | 1.928 | .924 | 3 | 19 | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Attitude ^a | 5.446 | 1.497 | .862 | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | SN ^b | 4.587 | 1.498 | .658 | 2 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | PBC ^a | 5.989 | 1.054 | .889 | 4 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Past Beh. | | | | 2 | | Past Beh. | | | | 2 |
| 2 | Behavior ^b | 3.778 | 2.050 | .958 | | 21 | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Intention ^a | 3.027 | 2.079 | .959 | 3 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Attitude ^a | 2.991 | 1.745 | .919 | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | SN ^a | 2.540 | 1.486 | .927 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | PBC ^a | 5.123 | 1.519 | .935 | 4 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| 3 | Past Beh. | | | | 2 | 22 | Past Beh. | | | | 2 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Intention ^c | 4.395 | 1.516 | — | 1 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Attitude ^a | 4.332 | 0.979 | .893 | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | SN ^b | 3.959 | 1.000 | .521 | 2 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| 4 | PBC ^b | 5.164 | 0.922 | .638 | 2 | 23 | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Past Beh. | | | | | | Past Beh. | | | | 2 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Intention ^a | 4.979 | 1.868 | .949 | 3 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Attitude ^a | 6.039 | 1.119 | .800 | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| 5 | SN ^a | 4.863 | 1.544 | .688 | 4 | 24 | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | PBC ^a | 6.059 | 1.099 | .912 | 4 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Past Beh. | | | | 2 | | Past Beh. | | | | 2 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Intention ^a | 3.929 | 1.889 | .976 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| 6 | Attitude ^a | 3.461 | 1.495 | .944 | 4 | 25 | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | SN ^a | 3.111 | 1.542 | .899 | 3 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | PBC ^a | 5.895 | 1.005 | .904 | 4 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Past Beh. ^b | 2.429 | 1.434 | .939 | 2 | | Past Beh. | | | | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| 7 | Attitude ^a | 5.876 | 1.452 | .906 | 4 | 26 | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Past Beh. | | | | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Past Beh. | | | | 2 |
| 8 | Intention ^a | 5.549 | 1.674 | .985 | 3 | 27 | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |

| | | | | | | | | | | | |
|----|------------------------|-------|-------|------|---|----|------------------------|-------|-------|------|---|
| 9 | SN ^b | 5.107 | 1.521 | .783 | 2 | 28 | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Past Beh. | | | | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Past Beh. | | | | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| 10 | Attitude ^a | 5.876 | 1.452 | .906 | 4 | 29 | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Past Beh. | | | | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Past Beh. | | | | 2 |
| 11 | Intention ^a | 5.549 | 1.674 | .985 | 3 | 30 | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Past Beh. | | | | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| 12 | Behavior ^b | 2.155 | 1.347 | .864 | | 31 | Past Beh. | | | | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| 13 | Past Beh. | | | | 3 | 32 | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | Past Beh. | | | | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| 14 | PBC ^a | 5.850 | 1.293 | .959 | 4 | 33 | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Past Beh. | | | | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | Past Beh. | | | | 2 |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| 15 | PBC ^a | 5.850 | 1.293 | .959 | 4 | 34 | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | Past Beh. | | | | 3 | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Past Beh. | | | | 2 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| 16 | PBC ^a | 5.850 | 1.293 | .959 | 4 | | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Past Beh. | | | | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Past Beh. | | | | 2 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Behavior ^b | 3.778 | 2.050 | .958 | |

| | | | | | | | | | | | |
|----|------------------------|-------|-------|------|---|----|------------------------|-------|-------|------|---|
| 17 | PBC ^a | 5.850 | 1.293 | .959 | 4 | 35 | Intention ^a | 3.483 | 1.928 | .924 | 3 |
| | Past Beh. | | | | 3 | | Attitude ^a | 5.446 | 1.497 | .862 | 3 |
| | Behavior ^b | 2.155 | 1.347 | .864 | | | SN ^b | 4.587 | 1.498 | .658 | 2 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | PBC ^a | 5.989 | 1.054 | .889 | 4 |
| | Attitude ^a | 5.876 | 1.452 | .906 | 4 | | Past Beh. | | | | 2 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Behavior ^b | 3.778 | 2.050 | .958 | |
| | PBC ^a | 5.989 | 1.054 | .889 | 4 | | | | | | |
| | Past Beh. | | | | 2 | | | | | | |
| | Behavior ^b | 3.778 | 2.050 | .958 | | | | | | | |

Note. ^aReliability estimate is Revelle's omega coefficient (ω); ^bReliability estimate is the Spearman rank-order correlation coefficient (ρ) between items; ^cSingle item, no reliability computed; ^dOrdinal data assumed, reliability estimate is ordinal omega coefficient (ω). Rel. = Reliability coefficient; Items = Number of items; SN = Subjective norms; PBC = Perceived behavioral control.

Appendix F

Descriptive Statistics and Reliability Coefficients for Theory of Planned Behavior Constructs for Datasets with Multiple Target Behaviors

| Dataset | Construct | <i>M</i> | <i>SD</i> | Rel. | Items | Dataset | Construct | <i>M</i> | <i>SD</i> | Rel. | Items |
|---------|------------------------|----------|-----------|------|-------|---------|------------------------|----------|-----------|------|-------|
| 1 | Intention ^a | 3.483 | 1.928 | .924 | 3 | 7 | SN ^a | 6.165 | 0.770 | .888 | 5 |
| | Attitude ^a | 5.446 | 1.497 | .862 | 3 | | PBC ^a | 5.854 | 1.011 | .833 | 4 |
| | SN ^b | 4.587 | 1.498 | .658 | 2 | | Behavior ^a | 5.641 | 1.339 | .759 | 4 |
| | PBC ^a | 5.989 | 1.054 | .889 | 4 | | Intention ^a | 6.458 | 0.977 | .918 | 3 |
| | Behavior ^b | 3.778 | 2.050 | .958 | 2 | | Attitude ^a | 6.468 | 1.153 | .965 | 4 |
| 2 | Intention ^a | 3.027 | 2.079 | .959 | 3 | 8 | SN ^a | 6.501 | 0.929 | .933 | 3 |
| | Attitude ^a | 2.991 | 1.745 | .919 | 3 | | PBC ^a | 6.410 | 0.916 | .911 | 4 |
| | SN ^a | 2.540 | 1.486 | .927 | 4 | | Intention ^a | 6.111 | 1.153 | .903 | 3 |
| | PBC ^a | 5.123 | 1.519 | .935 | 4 | | Attitude ^a | 6.276 | 1.126 | .945 | 4 |
| | Behavior ^b | 2.155 | 1.347 | .864 | 2 | | SN ^b | 6.110 | 1.168 | .928 | 3 |
| 3 | Intention ^c | 4.395 | 1.516 | — | 1 | 9 | PBC ^d | 6.040 | 1.142 | .933 | 4 |
| | Attitude ^a | 4.332 | 0.979 | .893 | 3 | | Intention ^a | 5.124 | 1.701 | .904 | 4 |
| | SN ^b | 3.959 | 1.000 | .521 | 2 | | Attitude ^a | 5.767 | 1.272 | .900 | 4 |
| | PBC ^b | 5.164 | 0.922 | .638 | 2 | | SN ^a | 5.829 | 1.352 | .937 | 3 |
| | Intention ^a | 4.979 | 1.868 | .949 | 3 | | PBC ^a | 5.458 | 1.229 | .846 | 4 |
| 4 | Attitude ^a | 6.039 | 1.119 | .800 | 3 | 10 | Behavior ^a | 4.014 | 1.766 | .950 | 3 |
| | SN ^a | 4.863 | 1.544 | .688 | 4 | | Intention ^a | 5.411 | 1.771 | .955 | 3 |
| | PBC ^a | 6.059 | 1.099 | .912 | 4 | | Attitude ^a | 5.690 | 1.362 | .949 | 4 |
| | Behavior ^b | 3.915 | 2.177 | .954 | 2 | | SN ^b | 5.775 | 1.225 | .680 | 2 |
| | Intention ^a | 3.929 | 1.889 | .976 | 4 | | PBC ^a | 6.301 | 1.027 | .949 | 4 |
| 5 | Attitude ^a | 3.461 | 1.495 | .944 | 4 | 11 | Behavior ^b | 4.621 | 2.160 | .940 | 2 |
| | SN ^a | 3.111 | 1.542 | .899 | 3 | | Intention ^a | 6.551 | 0.868 | .894 | 3 |
| | PBC ^a | 5.895 | 1.005 | .904 | 4 | | Attitude ^a | 6.409 | 1.006 | .939 | 5 |
| | Behavior ^b | 2.429 | 1.434 | .939 | 2 | | SN ^a | 6.454 | 0.720 | .921 | 5 |
| | Intention ^a | 5.549 | 1.674 | .985 | 3 | | PBC ^a | 6.285 | 0.746 | .799 | 4 |
| 6 | Attitude ^a | 5.876 | 1.452 | .906 | 4 | 12 | Behavior ^b | 5.160 | 1.689 | .965 | 2 |
| | SN ^b | 5.107 | 1.521 | .783 | 2 | | Intention ^a | 6.172 | 1.356 | .970 | 3 |
| | PBC ^a | 5.850 | 1.293 | .959 | 4 | | Attitude ^a | 5.753 | 1.366 | .867 | 3 |
| | Behavior ^a | 4.716 | 1.416 | .870 | 3 | | SN ^a | 5.792 | 1.160 | .877 | 3 |
| | Intention ^a | 6.379 | 0.758 | .955 | 4 | | PBC ^a | 5.985 | 0.992 | .857 | 4 |
| 7 | Attitude ^a | 5.882 | 1.081 | .927 | 5 | 13 | Behavior ^b | 6.041 | 1.269 | .950 | 2 |

Note. ^aReliability estimate is Revelle's omega coefficient (ω); ^bReliability estimate is the Spearman rank-order correlation coefficient (ρ) between items; ^cSingle item, no reliability computed; ^dOrdinal data assumed, reliability estimate is ordinal omega coefficient (ω). Rel. = Reliability coefficient; Items = Number of items; SN = Subjective norms; PBC = Perceived behavioral control.

Appendix G

Table G1

Results of Conventional Meta-Analysis of Correlations Among Theory of Planned Behavior Constructs

| Correlation ^a | <i>r</i> | 95% CI | | <i>Q</i> ^b | τ^2 | <i>I</i> ² (%) |
|---------------------------|----------|--------|------|-----------------------|----------|---------------------------|
| | | LB | UB | | | |
| Attitude-Intention | .575 | .532 | .618 | 599.67 | .017 | 92.48 |
| Subjective norm-Intention | .385 | .330 | .440 | 452.80 | .028 | 92.78 |
| PBC-Intention | .513 | .455 | .572 | 888.16 | .032 | 94.85 |
| Behavior-Intention | .480 | .396 | .563 | 1439.60 | .062 | 96.86 |
| Subjective norm-Attitude | .344 | .292 | .397 | 365.28 | .025 | 91.54 |
| PBC-Attitude | .404 | .358 | .450 | 405.37 | .018 | 89.29 |
| Behavior-Attitude | .322 | .256 | .388 | 64.24 | .038 | 92.95 |
| PBC-Subjective norm | .318 | .263 | .372 | 49.59 | .027 | 91.57 |
| Behavior-Subjective norm | .199 | .148 | .251 | 326.46 | .021 | 86.51 |
| Behavior-PBC | .297 | .223 | .371 | 705.30 | .047 | 94.14 |

Note. ^aSample size in all cases was 39. ^bAll correlations were statistically significant ($p < .001$). *r* = Averaged bias corrected correlation coefficient from conventional random effects meta-analysis; 95% CI = 95% confidence interval; *Q* = Cochran's (1962) *Q* statistic testing homogeneity in the correlation; τ^2 = Tau-square true variability in correlation; *I*² = Higgins and Thompson's (2002) *I*² coefficient expressed as a percentage indicating residual variance in effect size; PBC = Perceived behavioral control.

Figure G1. Forest plot of the attitude-intention correlation.

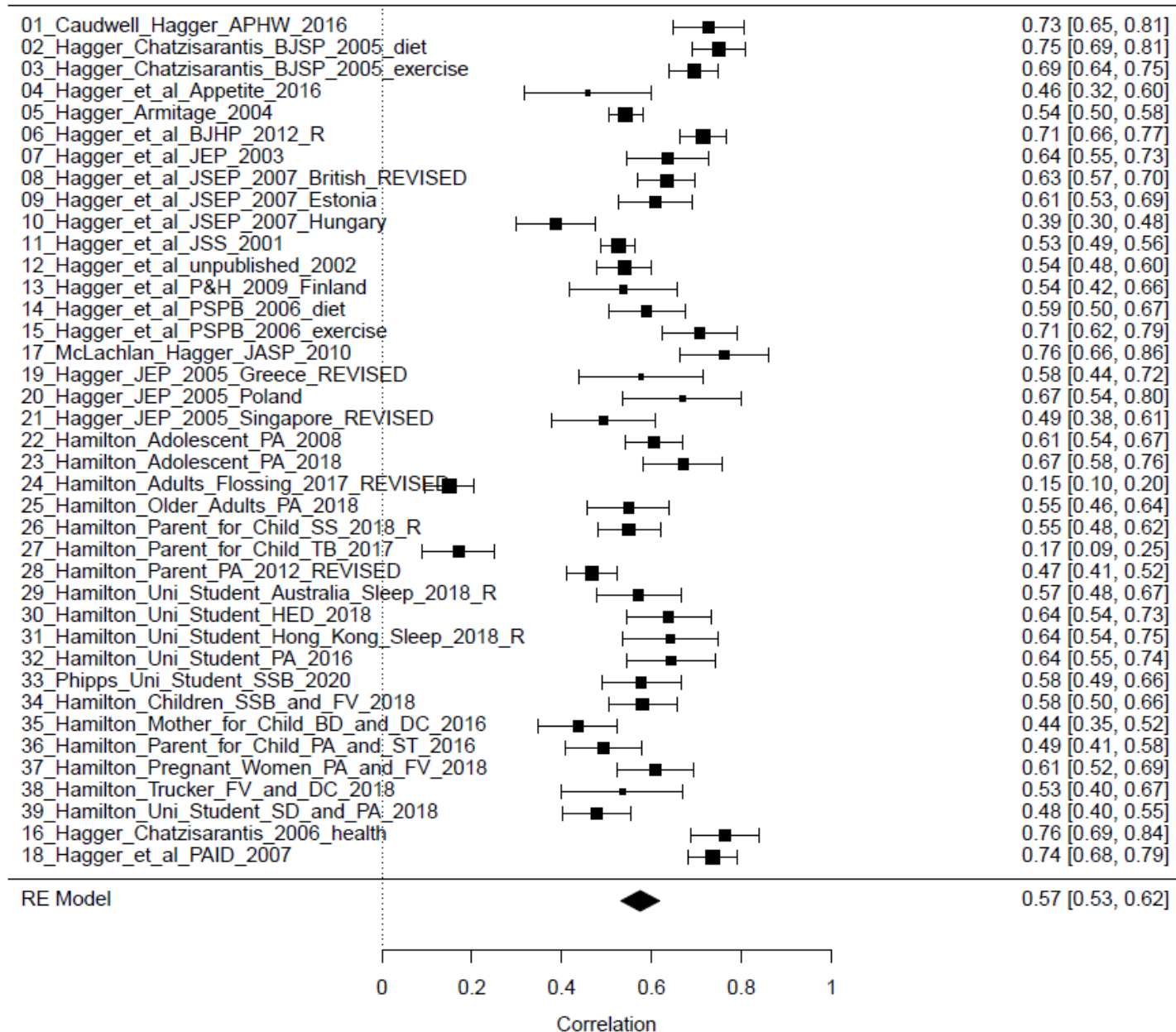


Figure G2. Forest plot of the subjective norm-intention correlation.

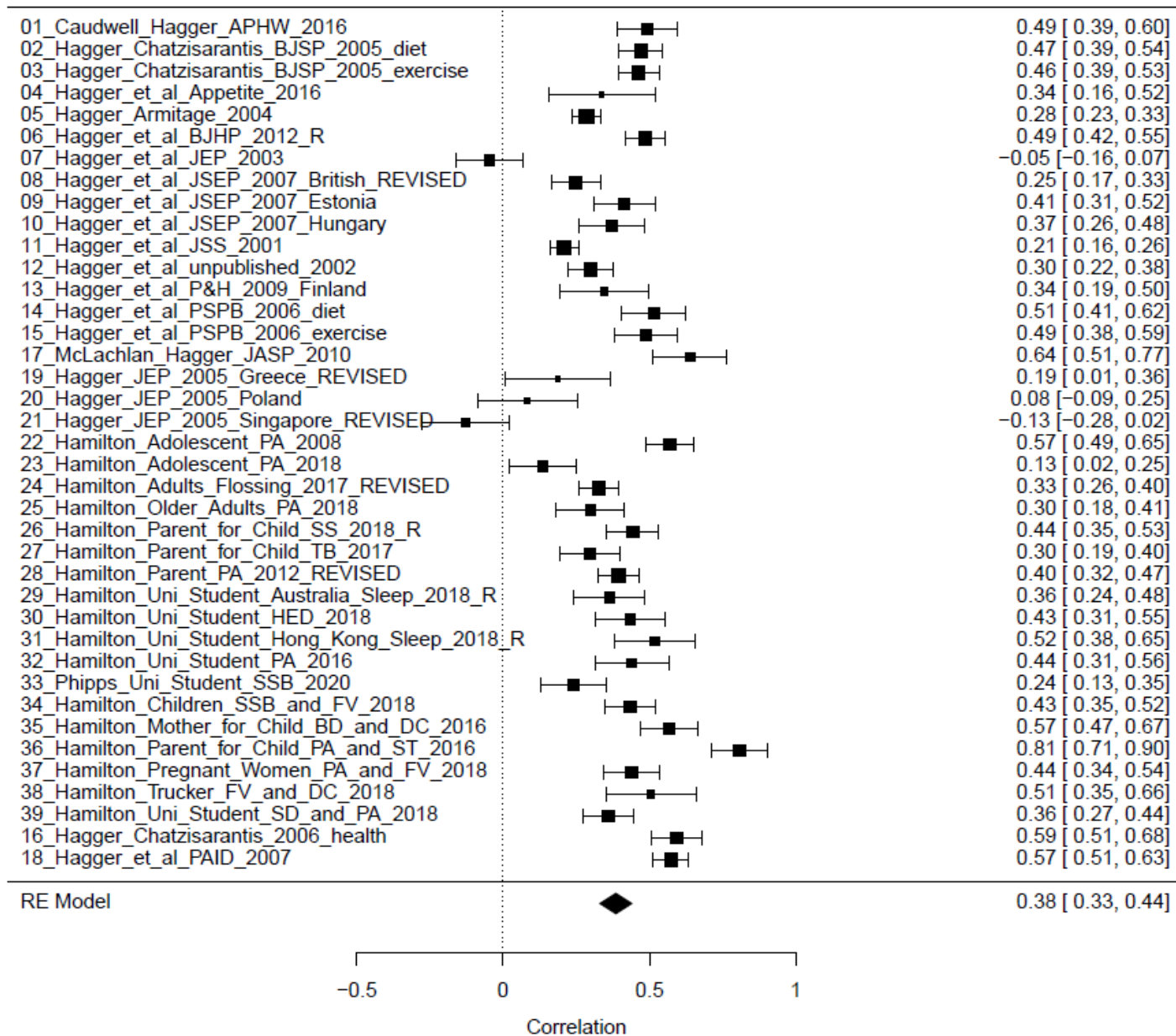


Figure G3. Forest plot of the perceived behavioral control-intention correlation.

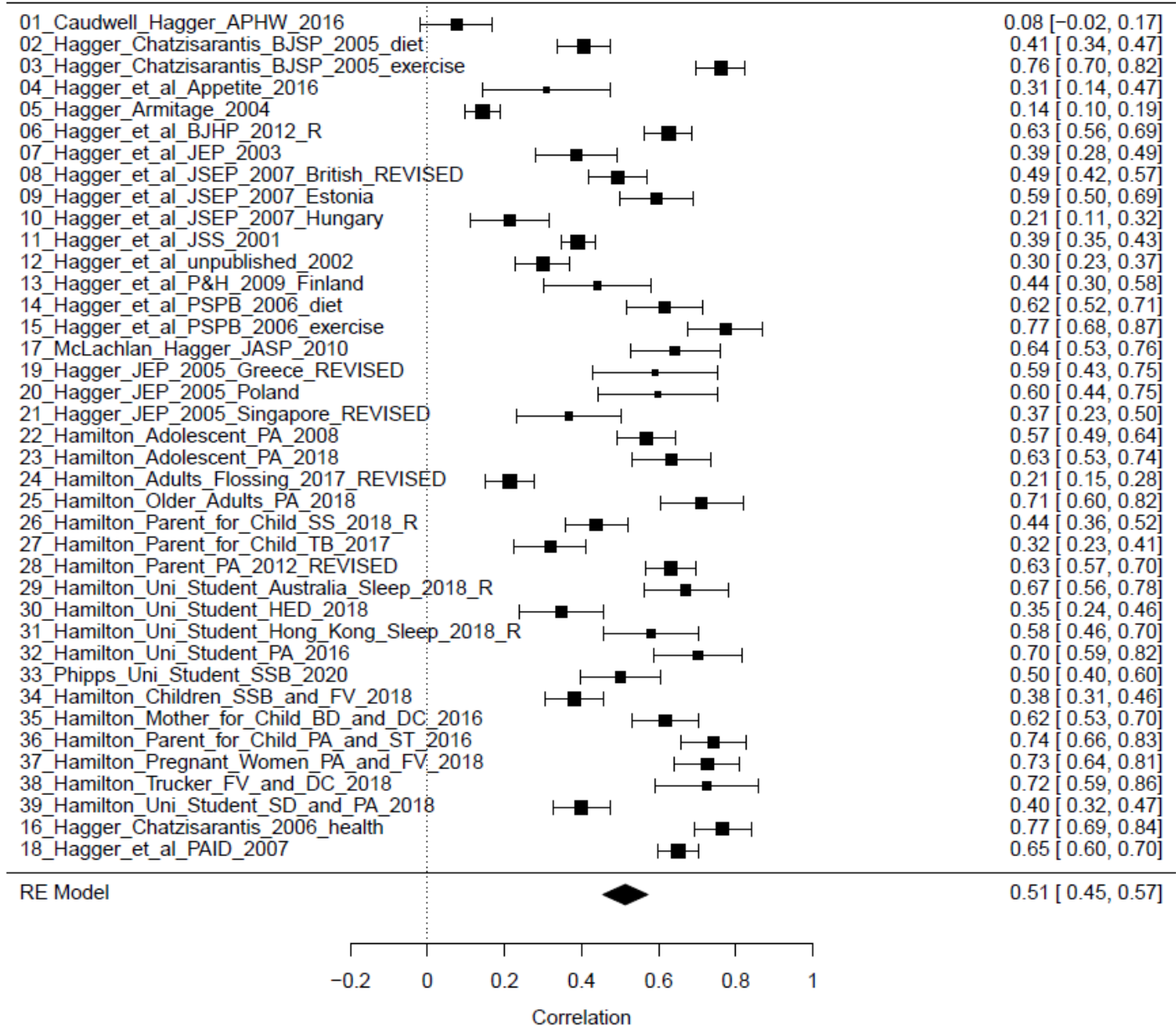


Figure G4. Forest plot of the behavior-intention correlation.

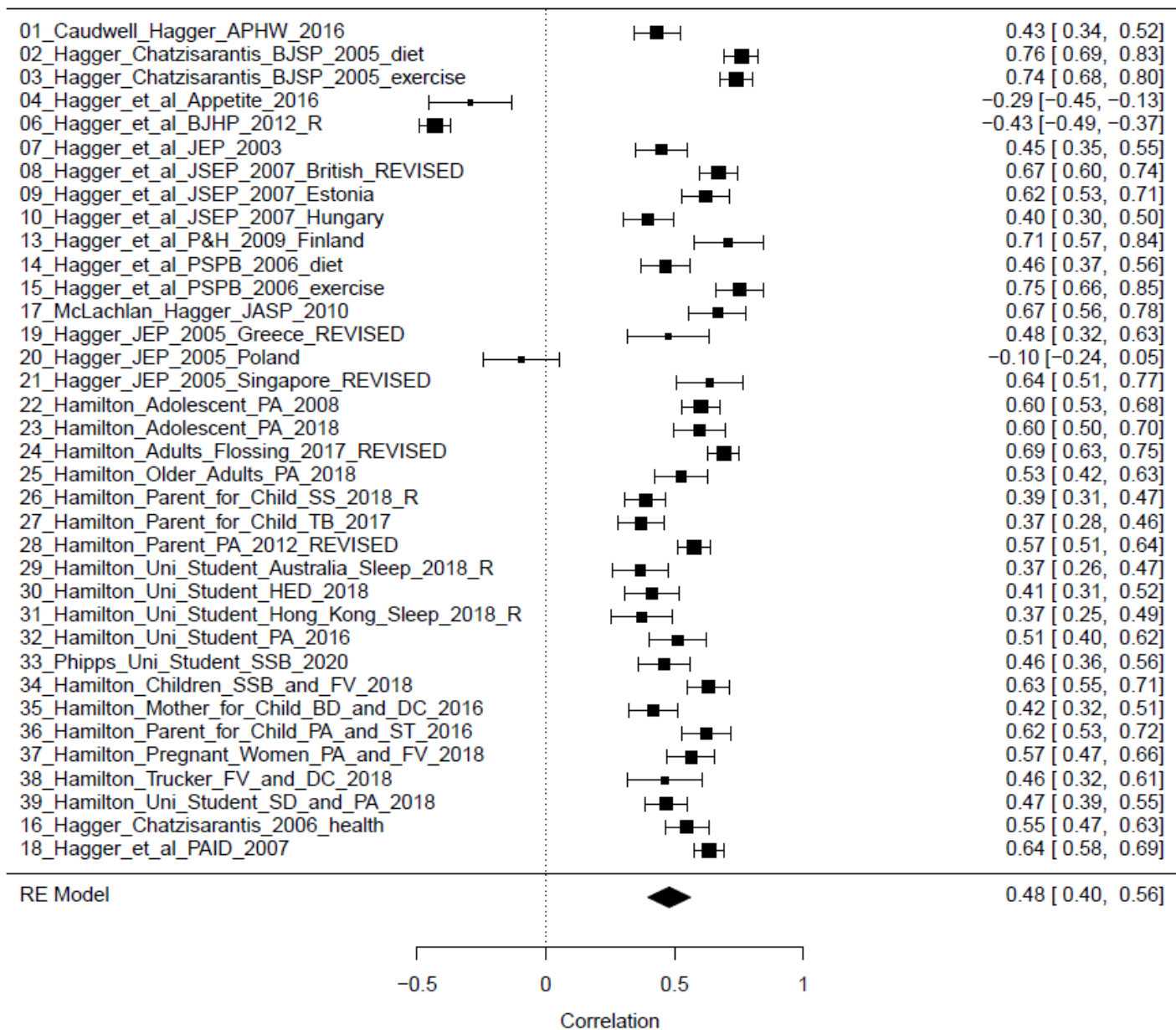


Figure G5. Forest plot of the subjective norm-attitude correlation.

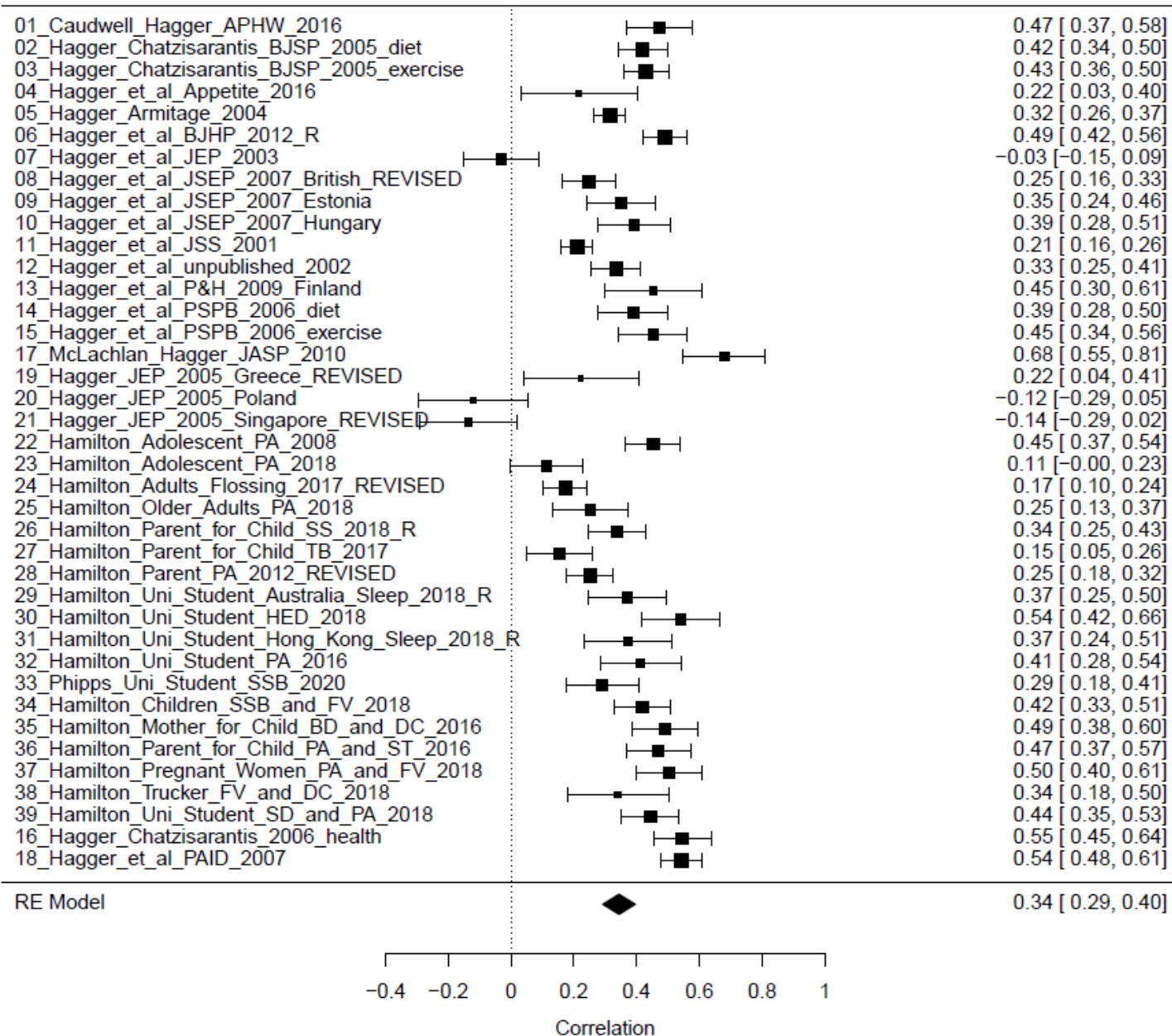


Figure G6. Forest plot of the perceived behavioral control-attitude correlation.

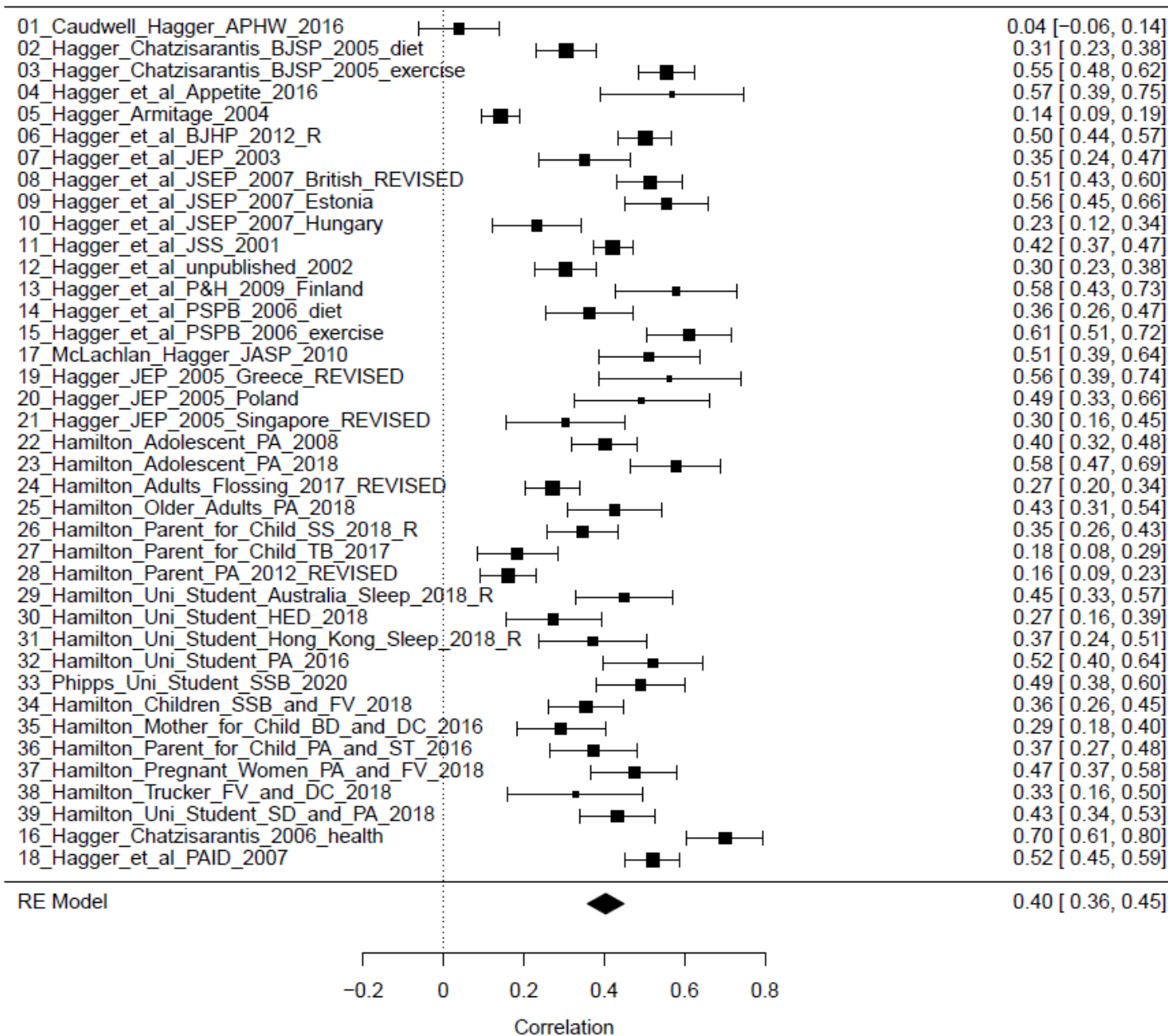


Figure G7. Forest plot of the behavior-attitude correlation.

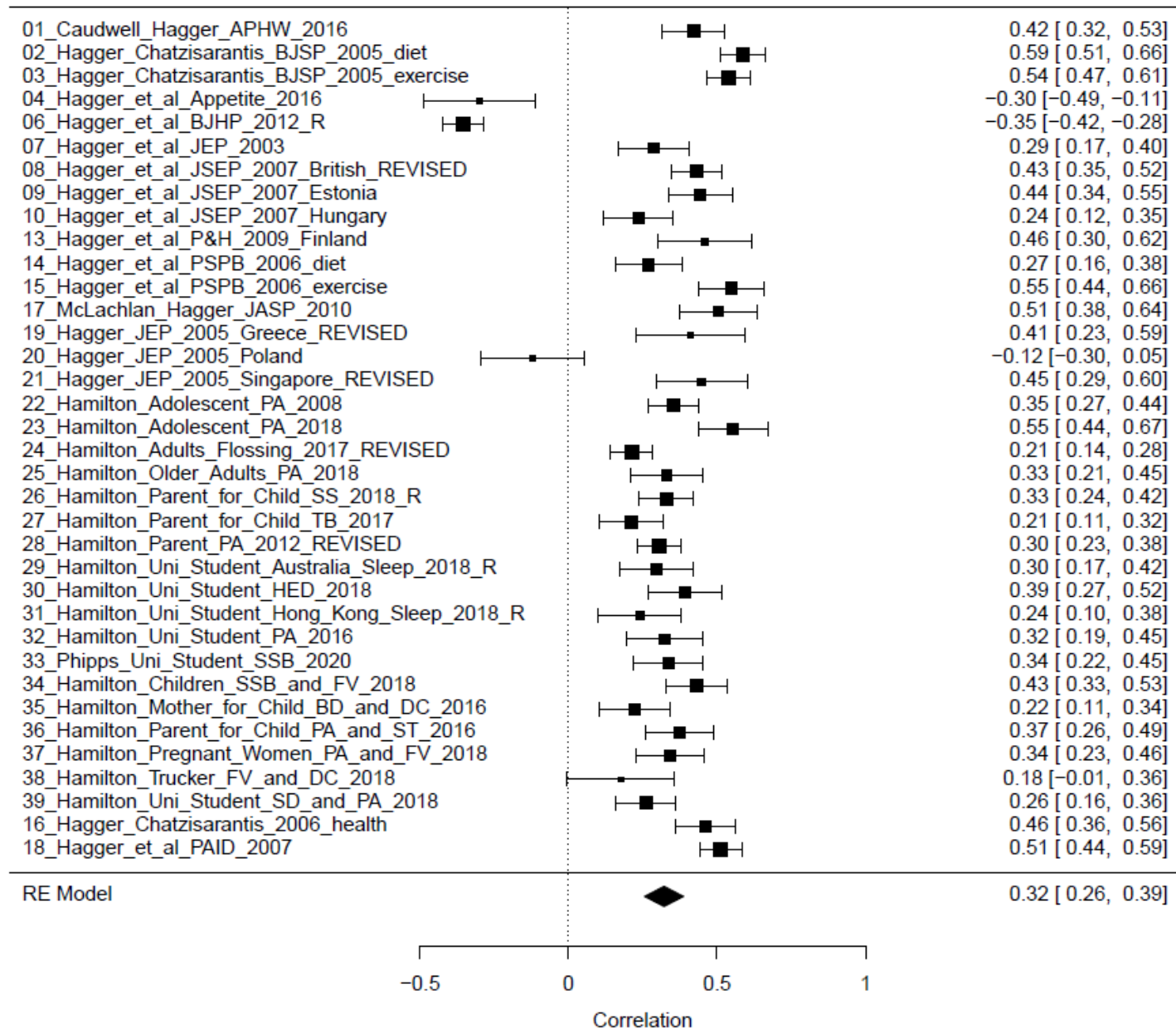


Figure G8. Forest plot of the perceived behavioral control-subjective norm correlation.

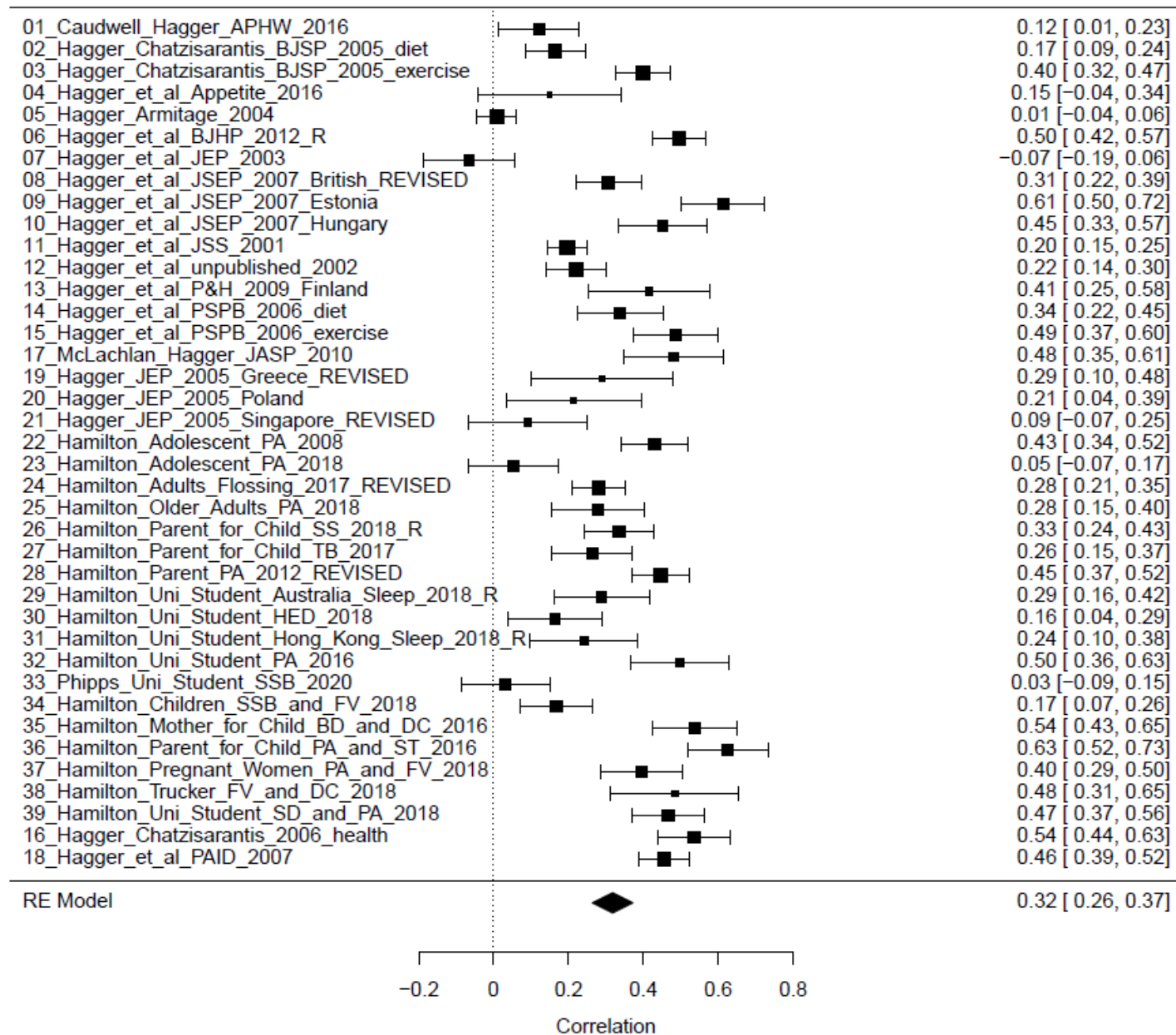


Figure G9. Forest plot of the behavior-subjective norm correlation.

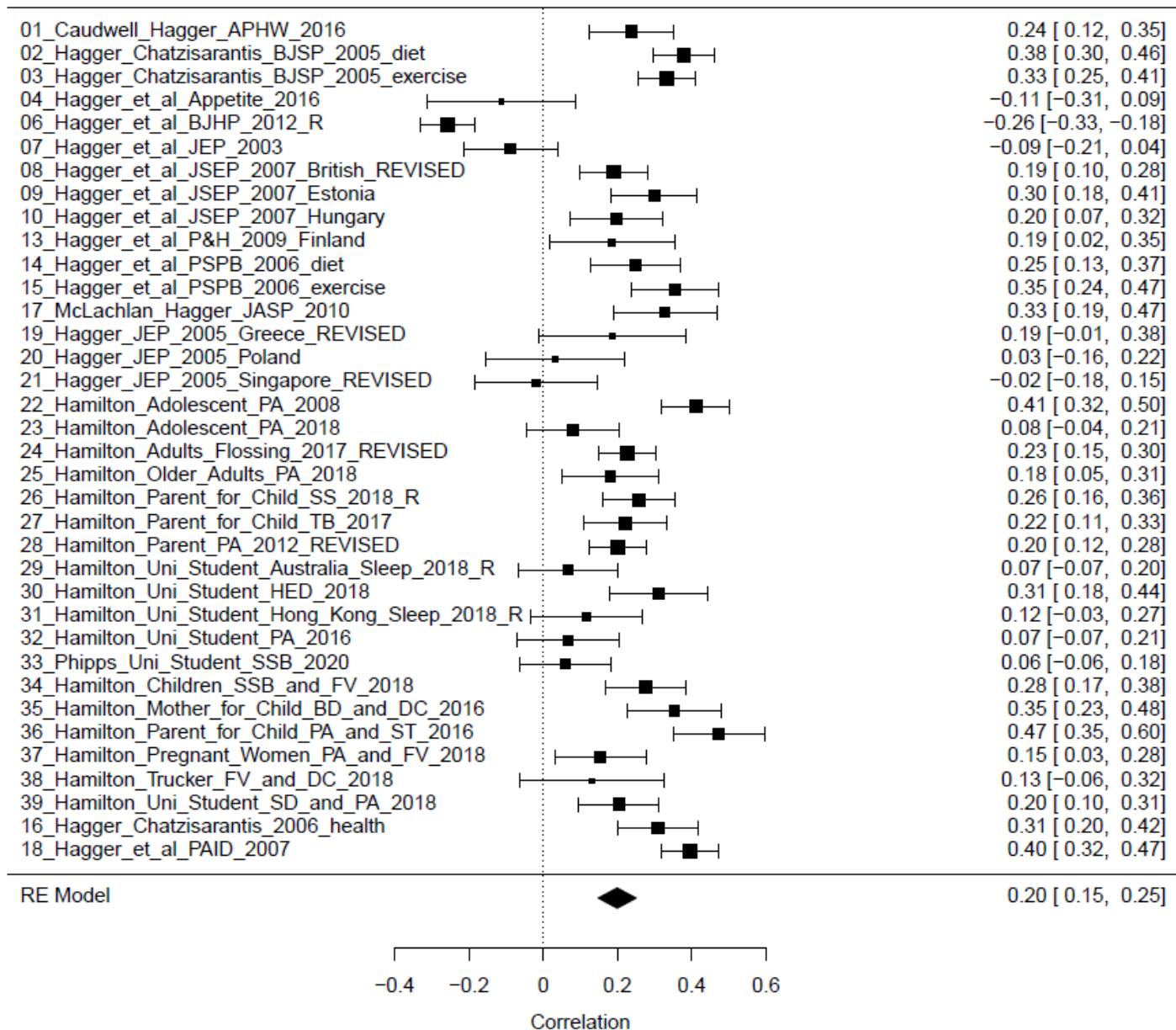
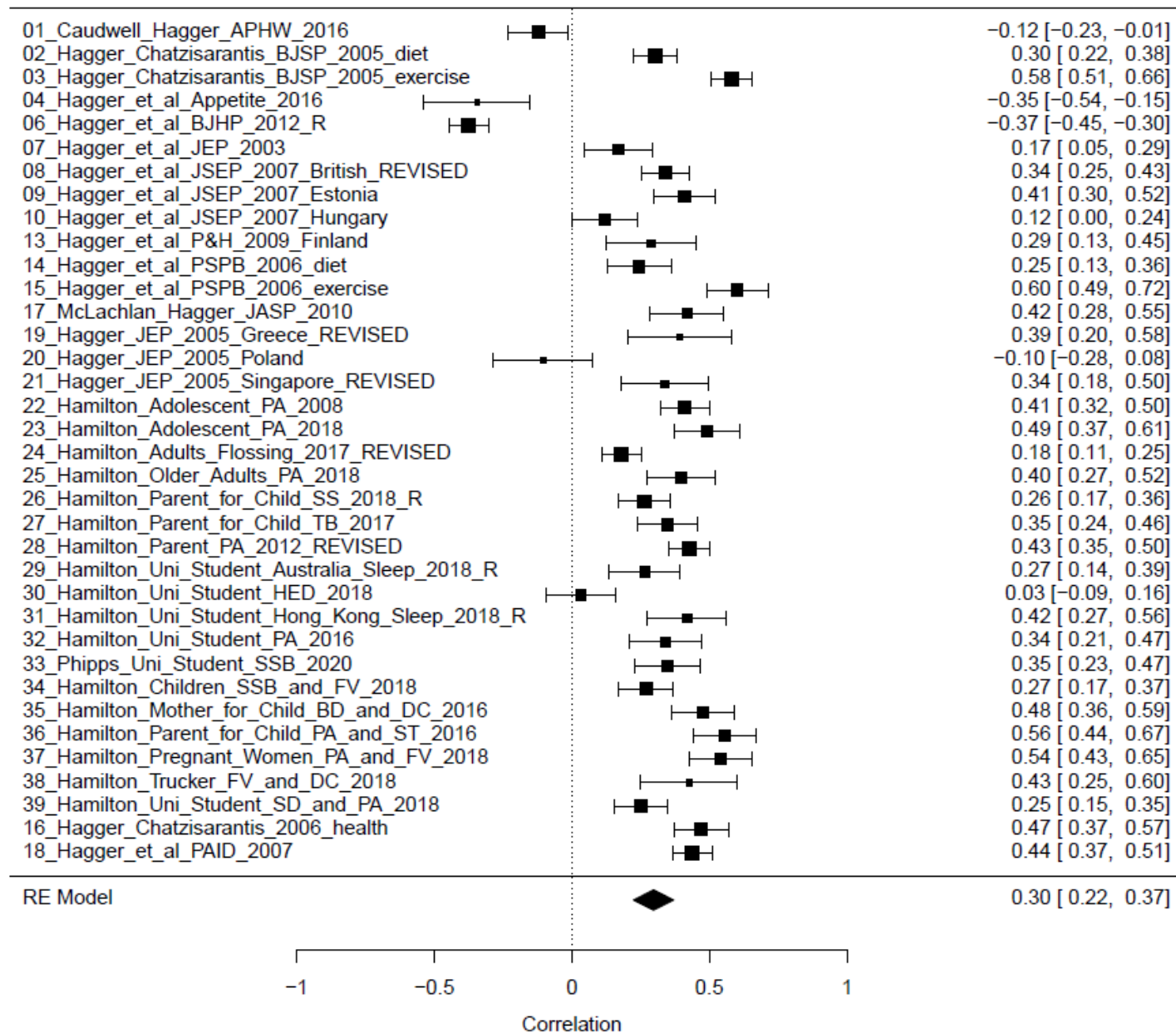


Figure G10. Forest plot of the behavior-perceived behavioral control correlation.



Appendix H: Results of Meta-Analytic Structural Equation Models Moderator Analyses

Table H1

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects at Levels of the Behavior Type Moderator

| Effect | Model in studies on ‘health promoting’ behaviors | | | Model in studies on ‘health compromising’ behaviors | | | Model differences | |
|---------------------|--|-----------------------|-------|---|-----------------------|--------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.394*** | 0.325 | 0.463 | 0.360*** | 0.219 | 0.500 | 0.248 | .618 |
| SN→Int. | 0.153*** | 0.092 | 0.213 | 0.145* | 0.011 | 0.278 | 0.014 | .905 |
| PBC→Int. | 0.331*** | 0.255 | 0.408 | 0.101 | -0.053 | 0.254 | 9.152 | .002 |
| Int.→Beh. | 0.549*** | 0.458 | 0.641 | -0.031 | -0.190 | 0.127 | 48.333 | <.001 |
| PBC→Beh. | 0.124** | 0.040 | 0.207 | -0.418*** | -0.551 | -0.285 | 52.528 | <.001 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | -0.063 | -0.161 | 0.035 | 0.043 | -0.102 | 0.190 | 3.125 | .077 |
| SN x PBC→Int. | 0.071 | -0.018 | 0.161 | 0.144* | 0.012 | 0.277 | 1.771 | .183 |
| Int. x PBC→Beh. | 0.055* | 0.008 | 0.101 | 0.118* | 0.023 | 0.214 | 1.804 | .179 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.191*** | 0.146 | 0.236 | 0.127** | 0.032 | 0.223 | — | — |
| SN→Int.→Beh. | 0.073*** | 0.041 | 0.106 | 0.042 | -0.031 | 0.115 | — | — |
| PBC→Int.→Beh. | 0.170*** | 0.115 | 0.224 | 0.244*** | 0.118 | 0.370 | — | — |

Note. β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; PBC = Perceived behavioral control; Int. = Intention; Beh. = Behavior.

Table H2

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects at Levels of the Specific Behaviors Moderator

| Effect | Model in studies on physical activity behaviors | | | Model in studies on dietary behaviors | | | Model in studies on ‘other’ health behaviors | | | Model differences | |
|---------------------|---|-----------------------|-------|---------------------------------------|-----------------------|-------|--|-----------------------|-------|-------------------|----------|
| | β | Wald CI ₉₅ | | B | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | | | | |
| Att.→Int. | 0.431*** | 0.355 | 0.507 | 0.416*** | 0.307 | 0.525 | 0.338*** | 0.242 | 0.434 | 3.655 | .161 |
| SN→Int. | 0.128*** | 0.061 | 0.195 | 0.211*** | 0.108 | 0.313 | 0.159** | 0.065 | 0.253 | 2.162 | .339 |
| PBC→Int. | 0.330*** | 0.243 | 0.418 | 0.292*** | 0.167 | 0.417 | 0.193*** | 0.081 | 0.305 | 5.771 | .056 |
| Int.→Beh. | 0.588*** ^a | 0.465 | 0.710 | 0.448*** | 0.289 | 0.608 | 0.331*** ^a | 0.188 | 0.474 | 13.267 | .001 |
| PBC→Beh. | 0.126 ^a | -0.003 | 0.255 | 0.019 | -0.139 | 0.178 | -0.103 ^a | -0.248 | 0.043 | 11.585 | .003 |
| Interaction effects | | | | | | | | | | | |
| Att. x PBC→Int. | -0.074 | -0.169 | 0.022 | 0.024 | -0.106 | 0.153 | 0.004 | -0.112 | 0.120 | 4.325 | .115 |
| SN x PBC→Int. | 0.049 | -0.037 | 0.135 | 0.065 | -0.044 | 0.174 | 0.080 | -0.019 | 0.179 | 0.547 | .761 |
| Int. x PBC→Beh. | 0.053 | -0.004 | 0.110 | 0.036 | -0.045 | 0.117 | 0.072 [*] | 0.004 | 0.141 | 0.579 | .749 |
| Indirect effects | | | | | | | | | | | |
| Att.→Int.→Beh. | 0.239*** | 0.165 | 0.312 | 0.234*** | 0.154 | 0.314 | 0.252*** | 0.158 | 0.346 | — | — |
| SN→Int.→Beh. | 0.052 [*] | 0.009 | 0.094 | 0.036 | -0.023 | 0.095 | 0.020 | -0.045 | 0.087 | — | — |
| PBC→Int.→Beh. | 0.186*** | 0.102 | 0.271 | 0.191*** | 0.088 | 0.293 | 0.208*** | 0.090 | 0.326 | — | — |

Note. β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; PBC = Perceived behavioral control; Int. = Intention; Beh. = Behavior. Coefficients marked with similar superscripted letters are significantly different based on Schenker and Gentleman's (2001) 'standard method' using confidence intervals about the mean difference ($p < .05$).

Table H3

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Moderation Effects for the Attitude and Perceived Behavioral Control Scale Score Coverage Moderator

| Effect | Model in studies with low percentage of scores above scale midpoint (high coverage) | | | Model in studies with high percentage of scores above scale midpoint (low coverage) | | | Model differences | |
|---------------------|---|-----------------------|-------|---|-----------------------|-------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.401*** | 0.297 | 0.504 | 0.414*** | 0.337 | 0.490 | 0.063 | .802 |
| SN→Int. | 0.143** | 0.045 | 0.242 | 0.145*** | 0.077 | 0.213 | 0.001 | .975 |
| PBC→Int. | 0.230*** | 0.111 | 0.347 | 0.302*** | 0.215 | 0.390 | 1.589 | .208 |
| Int.→Beh. | 0.427*** | 0.259 | 0.596 | 0.509*** | 0.381 | 0.637 | 1.101 | .293 |
| PBC→Beh. | 0.034 | -0.047 | 0.114 | 0.059** | 0.006 | 0.114 | 0.377 | .539 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | 0.067 | -0.058 | 0.192 | -0.074 | -0.175 | 0.026 | 7.396 | .007 |
| SN x PBC→Int. | 0.141** | 0.041 | 0.243 | 0.022 | -0.063 | 0.106 | 6.058 | .014 |
| Int. x PBC→Beh. | 0.007 | -0.166 | 0.179 | 0.048 | -0.095 | 0.190 | 0.308 | .578 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.192** | 0.071 | 0.314 | 0.179* | 0.042 | 0.318 | — | — |
| SN→Int.→Beh. | 0.064* | 0.007 | 0.120 | 0.061*** | 0.026 | 0.019 | — | — |
| PBC→Int.→Beh. | 0.098*** | 0.075 | 0.188 | 0.104** | 0.036 | 0.173 | — | — |

Note. PBC = Perceived behavioral control; β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; PBC = Perceived behavioral control; Int. = Intention; Beh. = Behavior.

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

Table H4

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects for the Subjective Norm and Perceived Behavioral Control Scale Variability Moderator

| Effect | Model in studies with low percentage of scores above scale midpoint (high coverage) | | | Model in studies with high percentage of scores above scale midpoint (low coverage) | | | Model differences | |
|---------------------|---|-----------------------|-------|---|-----------------------|-------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.395*** | 0.311 | 0.480 | 0.426*** | 0.341 | 0.511 | 0.472 | .492 |
| SN→Int. | 0.097** | 0.025 | 0.170 | 0.195*** | 0.121 | 0.269 | 5.130 | .024 |
| PBC→Int. | 0.232*** | 0.139 | 0.324 | 0.341*** | 0.246 | 0.436 | 4.968 | .026 |
| Int.→Beh. | 0.479*** | 0.337 | 0.621 | 0.499*** | 0.361 | 0.636 | 0.087 | .768 |
| PBC→Beh. | 0.019 | -0.133 | 0.170 | 0.052 | -0.096 | 0.200 | 0.285 | .594 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | -0.012 | -0.119 | 0.096 | -0.081 | -0.193 | 0.031 | 2.452 | .117 |
| SN x PBC→Int. | 0.104* | 0.019 | 0.189 | 0.008 | -0.080 | 0.097 | 6.043 | .014 |
| Int. x PBC→Beh. | 0.054 | -0.009 | 0.117 | 0.053 | -0.005 | 0.111 | <0.001 | .992 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.222*** | 0.138 | 0.307 | 0.224*** | 0.126 | 0.323 | — | — |
| SN→Int.→Beh. | 0.052* | 0.009 | 0.094 | 0.050* | 0.006 | 0.094 | — | — |
| PBC→Int.→Beh. | 0.114** | 0.043 | 0.185 | 0.112** | 0.045 | 0.179 | — | — |

Note. SN = Subjective norm; PBC = Perceived behavioral control; β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; PBC = Perceived behavioral control; Int. = Intention; Beh. = Behavior; PB = Past behavior.

Table H5

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects for the Intention and Perceived Behavioral Control Scale Variability Moderator

| Effect | Model in studies with low percentage of scores above scale midpoint (high coverage) | | | Model in studies with high percentage of scores above scale midpoint (low coverage) | | | Model differences | |
|---------------------|---|-----------------------|-------|---|-----------------------|-------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.395*** | 0.311 | 0.479 | 0.430*** | 0.340 | 0.520 | 0.580 | .446 |
| SN→Int. | 0.140*** | 0.065 | 0.215 | 0.150*** | 0.070 | 0.230 | 0.485 | .825 |
| PBC→Int. | 0.225*** | 0.129 | 0.322 | 0.367*** | 0.260 | 0.474 | 7.241 | .007 |
| Int.→Beh. | 0.439*** | 0.304 | 0.574 | 0.560*** | 0.414 | 0.707 | 3.240 | .072 |
| PBC→Beh. | -0.038 | -0.185 | 0.109 | 0.131 | -0.021 | 0.285 | 7.320 | .007 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | 0.068 | -0.019 | 0.156 | -0.201* | -0.294 | 0.107 | 41.122 | <.001 |
| SN x PBC→Int. | 0.145** | 0.053 | 0.237 | -0.044 | -0.142 | 0.053 | 24.327 | <.001 |
| Int. x PBC→Beh. | 0.101*** | 0.043 | 0.158 | -0.006 | -0.068 | 0.057 | 9.675 | .002 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.238*** | 0.157 | 0.320 | 0.238*** | 0.131 | 0.343 | — | — |
| SN→Int.→Beh. | 0.075** | 0.030 | 0.119 | 0.075** | 0.030 | 0.119 | — | — |
| PBC→Int.→Beh. | 0.132** | 0.054 | 0.210 | 0.132*** | 0.060 | 0.205 | — | — |

Note. PBC = Perceived behavioral control; β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; Int. = Intention; Beh. = Behavior; PB = Past behavior.

Table H6

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects for the Sample Age Moderator

| Effect | Model in studies on younger samples | | | Model in studies on older samples | | | Model differences | |
|---------------------|-------------------------------------|-----------------------|-------|-----------------------------------|-----------------------|--------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.398*** | 0.326 | 0.471 | 0.361*** | 0.277 | 0.445 | 0.828 | .363 |
| SN→Int. | 0.223*** | 0.161 | 0.285 | 0.059 | -0.014 | 0.131 | 17.166 | <.001 |
| PBC→Int. | 0.352*** | 0.276 | 0.429 | 0.243*** | 0.153 | 0.333 | 5.840 | .016 |
| Int.→Beh. | 0.467*** | 0.357 | 0.576 | 0.542*** | 0.411 | 0.673 | 1.737 | .188 |
| PBC→Beh. | 0.049 | -0.074 | 0.172 | 0.105 | -0.038 | 0.249 | 1.037 | .309 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | -0.031 | -0.130 | 0.069 | -0.078* | -0.182 | -0.026 | 1.444 | .229 |
| SN x PBC→Int. | 0.065 | -0.026 | 0.157 | 0.092 | -0.008 | 0.192 | 0.535 | .465 |
| Int. x PBC→Beh. | 0.078*** | 0.034 | 0.123 | 0.030 | -0.031 | 0.091 | 2.389 | .122 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.165*** | 0.109 | 0.221 | 0.171*** | 0.123 | 0.219 | — | — |
| SN→Int.→Beh. | 0.098*** | 0.058 | 0.138 | 0.083** | 0.025 | 0.141 | — | — |
| PBC→Int.→Beh. | 0.161*** | 0.093 | 0.228 | 0.148*** | 0.069 | 0.227 | — | — |

Note. PBC = Perceived behavioral control; β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; Int. = Intention; Beh. = Behavior; PB = Past behavior.

Table H7

Standardized Path Coefficients for the Meta-Analytic Structural Equation Model of the Theory of Planned Behavior Including Interaction Effects for the Publication Status Moderator

| Effect | Model in published studies | | | Model in unpublished studies | | | Model differences | |
|---------------------|----------------------------|-----------------------|-------|------------------------------|-----------------------|-------|-------------------|----------|
| | β | Wald CI ₉₅ | | β | Wald CI ₉₅ | | LRT | <i>p</i> |
| | | LL | UL | | LL | UL | | |
| Direct effects | | | | | | | | |
| Att.→Int. | 0.306*** | 0.214 | 0.399 | 0.406*** | 0.340 | 0.472 | 4.903 | .027 |
| SN→Int. | 0.114* | 0.015 | 0.213 | 0.175*** | 0.109 | 0.241 | 1.541 | .214 |
| PBC→Int. | 0.251*** | 0.141 | 0.360 | 0.330*** | 0.254 | 0.406 | 2.256 | .133 |
| Int.→Beh. | 0.542*** | 0.395 | 0.688 | 0.476*** | 0.368 | 0.583 | 1.015 | .314 |
| PBC→Beh. | 0.113 | -0.043 | 0.268 | 0.054 | -0.066 | 0.175 | 0.875 | .350 |
| Interaction effects | | | | | | | | |
| Att. x PBC→Int. | -0.035 | -0.156 | 0.085 | -0.054 | -0.154 | 0.046 | 0.183 | .669 |
| SN x PBC→Int. | 0.095 | -0.014 | 0.204 | 0.070 | -0.020 | 0.160 | 0.377 | .539 |
| Int. x PBC→Beh. | 0.054 | -0.015 | 0.123 | 0.069** | 0.025 | 0.112 | 0.177 | .674 |
| Indirect effects | | | | | | | | |
| Att.→Int.→Beh. | 0.145** | 0.057 | 0.233 | 0.138*** | 0.057 | 0.219 | — | — |
| SN→Int.→Beh. | 0.099** | 0.027 | 0.172 | 0.101* | 0.021 | 0.181 | — | — |
| PBC→Int.→Beh. | 0.155** | 0.043 | 0.268 | 0.154** | 0.039 | 0.269 | — | — |

Note. PBC = Perceived behavioral control; β = Standardized path coefficient; Wald CI₉₅ = Wald 95% confidence interval of path coefficient; LL = Lower limit of CI₉₅; UL = Upper limit of CI₉₅; LRT = Likelihood ratio test; Att. = Attitude; SN = Subjective norms; Int. = Intention; Beh. = Behavior; PB = Past behavior.