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Social cognition, personality and social-political correlates of health behaviors: Application of an integrated theoretical model

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ABSTRACT

Objective: Dispositional, intra-personal constructs such as personality traits and generalized beliefs are consistently related to health behaviors, but relatively few studies have tested the theory-based mechanisms by which these constructs relate to health behaviors and compared them across behavior type. In the current study we tested an integrated theoretical model in which belief-based social cognition constructs (attitudes, subjective norms, perceived behavioral control) were proposed to mediate effects of personality traits (conscientiousness, extroversion) and socio-political beliefs (political beliefs, locus of control, free will beliefs) on participation in three health-related behaviors: physical activity, COVID-19 vaccination, and sugar-sweetened beverage restriction.

Methods: Proposed integrated model effects were tested in a five-week prospective correlational study. Finnish residents completed measures of personality, socio-political, and social cognition constructs with respect to physical activity participation (N = 557), COVID-19 vaccination uptake (N = 1,115), and sugar-sweetened beverage restriction (N = 558) and self-reported their behavior at follow-up.

Results: Structural equation models revealed direct effects of intention on behavior, and of social-cognition constructs on intention, across all behaviors. We also found indirect effects of political beliefs on behavior mediated by social cognition constructs and intentions for COVID-19 vaccination and sugar-sweetened beverage restriction behaviors, indirect effects of conscientiousness on behavior mediated by social cognition constructs and intentions for physical activity and sugar-sweetened beverage restriction behaviors, and indirect effects of health locus of control on behavior mediated by social cognition constructs and intentions for physical activity behavior. Finally, we found a negative total effect of populist beliefs on behavior for COVID-19 vaccination behavior.

Conclusion: Findings contribute to an evidence base for the effects of dispositional and social cognition constructs of health behaviors, point to a possible mechanism by which these generalized constructs relate to health behavior, and outline how the pattern of effects varies across the different behaviors.

1. Social cognition, personality and social-political correlates of three health behaviors: application of an integrated theoretical model

Adherence to preventive health behaviors is important for minimizing communicable (e.g., COVID-19, HIV-AIDS; Giannou et al., 2016) and non-communicable (e.g., diabetes, cardiovascular diseases; Barbaresko et al., 2018) disease risk. Developing efficacious behavioral interventions to increase uptake of, and adherence to, these behaviors is considered a priority by healthcare providers and health departments.

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Research has suggested that these interventions are likely to be optimally efficacious and efficient if they target change in the modifiable determinants of the behavior of interest and the processes involved (e.g., McEwan et al., 2019). Application of theories from the behavioral sciences, particularly social psychology, can assist in identifying these determinants and associated processes, and help inform intervention development (Conner and Norman, 2015; Hagger and Hamilton, 2022a).

Theories of social cognition have featured prominently in research aimed at identifying health behavior determinants (Conner and Norman, 2015). The theory of planned behavior is a leading theory of this type and focuses on how individuals' beliefs inform their subsequent decisions to perform a given target behavior in future. According to the theory, intention, a motivational construct representing how much effort an individual will likely invest in pursuing the behavior, is the most proximal correlate of behavior (Ajzen, 1991). Intention is a function of three belief-based constructs: attitude, subjective norms, and perceived behavioral control. Attitudes reflect individuals' appraisals of the utility of the target behavior in producing outcomes. Subjective norms reflect individuals' beliefs that important others approve or disapprove of their participation in the behavior. Perceived behavioral control reflects individuals' beliefs in their capacity to perform the behavior. Effects of these three constructs on behavior are proposed to be mediated by intention. The theory has been widely applied, and meta-analyses of research applying the theory has provided general support for its predictions, and it accounts for substantive variance in intention and behavior in multiple behaviors (Hagger and Hamilton, 2024) including health behaviors (McEachan et al., 2011) and has demonstrated efficacy in guiding interventions (Hagger et al., 2020). Further, the theory has been shown to have utility in predicting behaviors that are performed regularly and behaviors that are seldom performed, or those that are performed on a one-off basis (McEachan et al., 2011). For example, studies have demonstrated that the theory accounts for non-trivial variance in behaviors with relatively limited time commitment, such as behaviors that tend to be one-off behaviors (e.g., blood donation; Masser et al., 2009) and those performed only once or twice per year (e.g., vaccination; Bogg et al., 2023) as well as those preformed regularly with more substantive time commitment (e.g., physical activity, diet; Chatzisarantis and Hagger, 2008; Nejad et al., 2004).

An important auxiliary prediction of the theory is that its constructs serve to summarize the information available to the individual with respect to future performance of the target behavior (Ajzen, 1991). However, the informational sources on which the constructs are based, and the associated processes by which they relate to behavior, are not explicitly specified in the theory. Multiple informational sources have been proposed, such as information from the individuals' environment or context, or from their own self-knowledge (e.g., self-identity, self--schema). Consequently, the theory constructs are expected to mediate the effects of variables representing environmental and contextual (e.g., socio-structural variables such as age and income) and intra-personal (e.g., dispositions and traits) information on intention toward, and actual performance of, the target behavior. Effects of these variables on intentions and behavior are, therefore, proposed to be indirect and provide a potential mechanistic explanation, at least in part, for observed relations between these variables and health behavior engagement (Bogg and Roberts, 2004; Hagger and Hamilton, 2021). Supporting this premise, research has confirmed that relations between intra-personal constructs such as personality traits and health behavior are mediated by the belief-based constructs from the theory (Conner and Abraham, 2001; Godin et al., 2010; Rhodes and Courneya, 2003).

In the present study, we aimed to extend this research by examining the extent to which the theory of planned behavior constructs mediated a panel of highly salient intra-personal constructs on health behavior. We tested a proposed model in which effects of personality traits (i.e., conscientiousness and extroversion) and dispositional socio-political beliefs (i.e., political beliefs, locus of control, and free will beliefs) on health behaviors are mediated by the theory of planned behavior constructs in accordance with the auxiliary prediction of the theory (Hagger and Hamilton, 2022b). The value of the model test is that it will inform the extent to which these intra-personal variables explain unique variance in health behaviors and, importantly, the mechanisms involved. Specifically, we proposed that the intra-personal constructs represent sources of information on which individuals base their beliefs with respect to future behavioral performance (i.e., attitudes, subjective norms, and perceived behavior control). The effects of these constructs on intentions and health behavior are, therefore, expected to be mediated by the social cognition constructs in our model. We tested these effects in three health behaviors: physical activity, COVID-19 vaccination, and restriction of sugar-sweetened beverage (SSB) consumption and tested for expected differences in the patterns of effects of these constructs on behavior across each based on a priori conceptual justifications.

1.1. A proposed integrated model

The intra-personal constructs included in our proposed model have been previously identified as correlates of health behavior. For example, personality traits, locus of control, and political orientation have all been linked to participation in a variety of health behaviors (Chatzisarantis and Hagger, 2008; Kannan and Veazie, 2018). Prior research has proposed and tested integrated models that encompass social cognition constructs (e.g., attitudes, subjective norms, intentions) alongside intra-personal constructs (e.g., personality traits, control orientations) and socio-political variables (e.g., political orientation) as independent predictors of behavior (e.g., Godfrey et al., 2023; Hagger and Hamilton, 2022b). These tests have generally adopted an approach in which the dispositional and socio-political constructs are distal behavioral correlates with their effects mediated by the social cognition constructs proposed as proximal behavioral determinants consistent with social cognition theories, and with formal descriptions of these proposals such as the dispositional-belief-motivational framework (Vo and Bogg, 2015). However, relatively few studies have tested conceptually based mediation effects that describe the processes by which these intra-personal constructs relate to health behaviors in the context of social cognition theories, and, importantly, systematically test the extent to which these effects vary across behavior type. Specifically, we proposed that the effects of these constructs on behavior would be mediated by the belief-based constructs from the theory of planned behavior based on their informational function, consistent with Ajzen's (1991) predictions and prior research (Conner and Abraham, 2001; Vo and Bogg, 2015). We also expected the model to apply across multiple behaviors, although the relevance of the intra-personal constructs, and therefore their indirect effects on behavior mediated by the social cognition constructs, was expected to vary by behavior dependent upon the extent to which decisions to perform them were likely to be based on political beliefs. We tested these predictions by applying the model in multiple health behaviors. Next, we outline the conceptual basis of our proposed model, outline the rationale for the inclusion of each intra-personal factor and the proposed process by which they relate to intentions and behavior, and outline the basis for our selection of these behaviors.

1.1.1. Political beliefs

Political beliefs, an often-overlooked construct in research examining health behavior determinants, has emerged as an important socio-structural predictor of health behavior. Political beliefs is a broad term that encompasses multiple belief-based constructs including political orientation, populist attitudes, and trust in government. Political orientation is typically operationalized as a person's self-identified position on scales ranging from the political left or 'liberal' to the political right or 'conservative' (Napier and Jost, 2008) and has been linked to various health behaviors (Hagger and Hamilton, 2022b; Kannan and

Veazie, 2018) particularly COVID-19 prevention behaviors (Bogg et al., 2023; Godfrey et al., 2023; Milad and Bogg, 2021). Unlike other measures of political beliefs such as right-wing attitudes (e.g., right-wing authoritarianism, social dominance orientation) or political party affiliation, political orientation captures an individual's identification with a particular political ideology (Napier and Jost, 2008). While extent of endorsement of right wing attitudes and political party affiliation also tend to be aligned with political identity, such measures are less suited to cross-cultural comparisons due to variability in the pervading political traditions within a given society and idiosyncratic variance in the pervading political ideology endorsed by leading parties and institutions across national political systems.

Populist attitudes, a related but conceptually distinct construct to political orientation, reflect beliefs that society is divided into two opposing groups, the ordinary 'pure citizen' versus the 'corrupt elite', and by the belief that politics should reflect the general will of the citizens (Mudde, 2004). Populist beliefs have also been shown to be associated with health behaviors, particularly those perceived as linked to government or leaders with a particular political agenda, such as vaccine hesitancy, distrust of vaccinations, and lower COVID-19 vaccination uptake (Stecula and Pickup, 2021). Given the recent rise in populist political parties and figures across European nations (Guth and Nelsen, 2021), populist beliefs may be a more relevant source of information when individuals form beliefs about health behavior than they have been in the past.

In addition, individuals' trust in government has been identified as a correlate of individuals' decisions to engage in, or desist from, health behaviors, particularly in contexts where the health behavior is strongly endorsed by the government. For example, trust in government and its agencies has been shown to predict COVID-19 vaccination intentions (Van Oost et al., 2022), and in-depth interview studies have found that distrust of government health care systems contribute to vaccine hesitancy (Morales et al., 2022). Similarly, trust in government is associated with support for legislation aimed at influencing health behaviors such as introducing a tax on SSBs to reduce obesity (Eykelenboom et al., 2019). Individuals who express trust in government may be more likely to endorse or participate in health behaviors, particularly those promoted by government. During the COVID-19 pandemic, levels of trust in government have increased in some countries (e.g., Australia, New Zealand) and decreased in others (e.g., The United States; Goldfinch et al., 2021). Given the that development of COVID-19 vaccines was a fundamental strategy for the mitigation of infection rates and reducing incidence serious infections among at-risk groups for most governments, and that vaccine development, distribution, and messaging was funded and co-ordinated by government health departments worldwide, trust in government was expected to be a salient source of information informing the value individuals attach to getting vaccinated, and their decisions to do so, in most countries, with the level of trust likely to be associated with greater support and higher intentions to receive the vaccine. Similar considerations may be relevant for decisions to participate in behaviors that have been legislated against by the governmental public health initiatives, such as placing restrictions on foods and drinks that present a health risk when consumed in excess (e.g., sugar-sweetened beverages). Trust in government is, therefore, a further potentially important predictor of health behaviors that tend to be endorsed or restricted by government agencies.

Taken together, these generalized socio-political beliefs are proposed as key correlates of health behavior in our integrated model. In the model, we predicted that effects of these beliefs on health behavior would be mediated by social cognition constructs and intentions. This premise is in keeping with the theoretical prediction that these factors serve an informational function when it comes to decision making.

1.1.2. Personality traits

Beyond socio-political beliefs, other dispositional constructs such as the conscientiousness and extroversion personality traits have been shown to be associated with health behaviors (Allen et al., 2017). In social cognition theories such traits are conceptualized as indirect correlates of behavior mediated by the belief-based constructs (e.g., attitudes, norms, perceived behavioral control) (Ajzen, 1991), but may also predict behaviors directly. The mediated effects represent the informational function of these traits, that is, they likely serve as an implicit bias that influences individuals' estimates of their beliefs with respect to performing the target behavior in future. Direct effects represent spontaneous, non-conscious engagement in the behavior independent of the belief-mediated decision-making process and likely represent well-learned associations between approach-related traits and behavioral responses. For example, research has demonstrated that inclusion of personality traits, particularly extroversion and conscientiousness, in tests of the theory of planned behavior has revealed both direct and indirect effects of these traits on exercise behavior (Chatzisarantis and Hagger, 2008; Rhodes and Courneya, 2003; Vo and Bogg, 2015). Conscientiousness, in particular features prominently in research examining links between personality and health. For example, meta-analytic syntheses of multiple studies has corroborated the relationship between conscientiousness and exercise participation (Rhodes and Smith, 2006), and has also linked this trait with better health and longevity (Bogg and Roberts, 2004, 2013). Given these observations, we focus on these two personality traits in the current model, and conceptualize them as indirect predictors of health behavior, mediated by social cognition constructs, consistent with the social cognition approach and prior research, but do not rule out the potential for direct effects consistent with prior research.

1.1.3. Control perceptions

Perceptions of control, such as free will beliefs and internal locus of control, are also constructs that have been associated with health behavior participation. Free will beliefs reflect a belief in responsible autonomy and freedom of conscious, uncoerced choice (Baumeister and Monroe, 2014). Prior research has indicated that these beliefs are associated with higher self-efficacy and setting goals to achieve personally relevant goals and outcomes (Crescioni et al., 2016; Hagger and Hamilton, 2022b). There have been calls for more research incorporating free will beliefs into social cognition models, and for these models to be applied to a variety of health behaviors (St Quinton and Crescioni, 2022). Prior research that has incorporated free will beliefs in integrated social cognition models found the relationship between free will beliefs and intention to receive the COVID-19 booster was mediated by social cognition constructs (Hagger and Hamilton, 2022b). However, this research focused on intention and has yet to be extended to the prediction of behavior.

Similarly, an internal health locus of control has been identified as an individual difference correlate of health behavior. Internal locus of control is a generalized orientation that reflects individuals' beliefs that their personal actions will result in expected, desirable outcomes (Rotter, 1966). Individuals are more likely to engage in behaviors when they expect their behavior will be positively reinforced through feedback indicating that they are moving closer to attaining desired outcomes (Rotter, 1966). Individuals who rate their locus of control for health highly are more likely to believe health behavior participation is integral to health outcomes, and individuals high in internal locus of control for health are more likely to engage in health-promoting behaviors (Hagger and Armitage, 2007; Norman et al., 1998). Based on theory and evidence, we expected a similar role and pattern of effects for these control-related perceptions on health behavior in our proposed integrated model.

1.2. The present study

The current integrated social cognition model incorporated multiple intra-personal dispositional factors and traits (e.g., political beliefs, locus of control, personality, free will beliefs) as correlates of health

behavior alongside social cognition constructs from the theory of planned behavior (e.g., attitudes, subjective norms, perceived behavioral control). The intra-personal variables were chosen based on their previously-demonstrated association with health behaviors that tend to be performed regularly (e.g., physical activity, SSB consumption) and seldom or on a one-off basis (e.g., vaccination) and prior tests of integrated models that have included them as additional predictors of behavior and tested the mechanisms by which they relate to health behavior (Bogg et al., 2023; Conner and Abraham, 2001). Our model outlines how these intra-personal factors serve as indirect correlates of behavior mediated by the social cognition beliefs implicated in decisions to engage in health behavior. This is predicated on the basis that these factors serve an informational function that shapes or informs individuals' beliefs with respect to performing the behavior in future. Nevertheless, we also expected direct effects which reflect processes that are independent of the reasoned, deliberative processes that precede action represented by the social cognition constructs.

We tested the model in a five-week prospective study of Finnish residents in which we measured these constructs at an initial time point with a follow-up measure of behavior taken five-weeks later for three health behaviors: COVID-19 vaccination, physical activity, and restriction of sweetened beverage consumption. The five-week lag between measures of model constructs and behavior at follow up represents relatively longer-range prediction as defined by measurement lag specified in prior meta-analytic syntheses of similar theories, and has been considered sufficient to provide evidence for the predictive validity of such theories while simultaneously minimizing error variance attributable to the use of common measurement methods (McEachan et al., 2011). The value of identifying the determinates of health behaviors using this integrated model is that it contributes to the evidence base of generalized intra-personal factors and social cognition correlates of health behaviors and tests the potential mechanisms by which the intra-personal factors relate to behavior. It may also inform the development of optimally efficacious and efficient interventions to promote behavior uptake by identifying potentially modifiable targets.

We selected these three behaviors as they are associated with reduced disease risk and adaptive health outcomes. Specifically, physical activity and sugar-sweetened beverage consumption are associated with reduced risk of chronic diseases and conditions that pose a risk to health (e.g., diabetes, cardiovascular disease, obesity; Hu and Malik, 2010; Warburton and Bredin, 2017), and COVID-19 vaccination is central to ongoing management of COVID-19 infection outbreaks and minimization of serious cases. We also selected these behaviors because we expected them to vary in the extent to which they were subject to political beliefs and other intra-personal traits. Specifically, decisions to perform two of the behaviors (i.e., COVID-19 vaccination, sugar-sweetened beverage consumption) were expected to depend on political beliefs, represented by a key set of constructs in the current study (i.e., political orientation, trust in government, populist beliefs), while decisions to perform the other behavior (i.e. physical activity) was expected to be less subject to such beliefs and more likely to be dependent on other intra-personal dispositions (e.g., personality). Studying the effects of these dispositional variables on multiple behaviors allowed us to compare these patterns across behaviors with varying levels of politicization.

While we recognized that the proposed effects in our model would, to some extent, reflect generalized decision-making processes and that they would hold across behaviors consistent with other social cognition theories, we also acknowledged that the size or relative contribution of the individual difference factors would likely vary across these behaviors. In particular, we expected to exhibit larger effects of the socio-political dispositions (i.e., political orientation, trust in government, free-will beliefs) on COVID-19 vaccination and restriction of SSB consumption intentions and behavior relative to physical activity. These expectations are based on evidence that these behaviors tend to be strongly advocated by governmental agencies and are also perceived as representative of excessive governmental control and overreach (Eykelenboom et al., 2019; Gollust et al., 2014; Stecula and Pickup, 2021). Consequently, they are more likely to be more salient when it comes to individuals' decisions to act for these behaviors.

In terms of specific predictions, we hypothesized there would be direct effects of the dispositional constructs (e.g., conscientiousness, extraversion, trust in government, political orientation, populist beliefs, free will beliefs, health locus of control) on the social cognition constructs (i.e., attitude, subjective norms, perceived behavioral control); direct effects of each of the social cognition constructs on intentions; and direct effects of intentions and perceived behavioral control on behavior. In addition, we expected indirect effects of each dispositional construct on intention mediated by each social cognition construct; indirect effects of each social cognition construct on behavior mediated by intentions; and indirect effects of each dispositional construct on behavior mediated by each social cognition construct and intention. We expected these effects to apply to all three behaviors (i.e., physical activity, SSB consumption restriction, COVID-19 vaccination), but also expected variability in the size of some of the effects. Specifically, we hypothesized that the indirect effects of the socio-political dispositions (i.e., political orientation, trust in government, populist beliefs) on intention and behavior would be larger for the model estimated in the COVID-19 vaccination and restriction of SSB consumption behaviors relative to the model for physical activity behavior. Our predictions are summarized in the table in Appendix A (supplemental materials).

2. Method

2.1. Participants and recruitment

Three samples of Finnish residents were recruited via an online research panel company (taloustutkimus.fi) and consenting participants from each sample completed two surveys, five-weeks apart, comprising study measures for physical activity (N = 557; M age = 48.56, SD = 17.15; 57.63% female), COVID-19 vaccination (N = 1,115; M age = 48.14, SD = 17.16; 57.85% female), and restriction of SSB consumption (N = 558; M age = 47.72, SD = 17.16; 58.06% female) behaviors. To be eligible for inclusion, members of the research panel were required to be aged 18 or older and agree to provide informed consent to participate in the study prior to completing study measures. Participants were also prompted to self-report their demographic characteristics (age, gender, education, income, and ethnicity). Sample characteristics for baseline and follow-up for each behavior are provided in Appendix B (supplemental materials). Data were collected between August and October 2021. At the time of data collection there were no COVID-19 restrictions on access to sport and fitness facilities in Finland and the COVID-19 vaccine was widely available and offered free-of-charge to Finnish residents.

2.2. Design and procedure

The study adopted a prospective correlational design. Participants were invited to participate in the study by a panel company and were informed that the survey focused on their views and beliefs on health behaviors. On the first data collection occasion (T1), 1,115 participants completed online self-report measures of personality traits, social-political beliefs, social cognition constructs, and intentions for COVID-19 vaccination were administered. All participants (N = 1,115) completed study measures relating to COVID-19 vaccination behavior, as this behavior was the primary focus of the current study, while subsamples of these participants also completed measures relating to either the physical activity (n = 557) or SSB consumption (n = 558) behaviors with random assignment. This procedure optimized data collection with respect to recruiting a sufficiently representative sample compliant with the sample size requirements for the predicted model estimated from our a priori statistical power analysis, and ensuring that the data collection

performed by panel company was cost effective and within budget. Five weeks after the first occasion (T2), 339 participants self-reported their physical activity and COVID-19 vaccination behavior, and 372 participants self-reported restriction of SSB consumption behavior. The study was approved by the [MASKED] University IRB.

2.3. Measures

Study measures were administered to participants using the *Qualtrics* online survey tool. Descriptions of study measures and their origin and development are described next. Complete study measures for each target behavior are provided in Appendix C (supplemental materials) and associated internal consistency reliability data are provided in the table in Appendix D (supplemental materials).

Demographic Variables. Participants self-reported their age, gender, employment status, marital status, annual household income, and highest level of education. Dichotomized versions of these variables were included as covariates in our model tests.

Social Cognition Constructs. Measures of attitudes (physical activity, Revelle (2019) omega (ω) total reliability coefficient = 0.798; restriction of SSB consumption, ω = 0.842; COVID-19 vaccination, ω = 0.902):, subjective norms (physical activity, ω = 0.686; restriction of SSB consumption, ω = 0.727; vaccination, ω = 0.690), perceived behavioral control (physical activity, ω = 0.696; restriction of SSB consumption, ω = 0.657; vaccination, ω = 0.405) and intention (physical activity, ω = 0.938; restriction of SSB consumption, ω = 0.898; vaccination, ω = 0.972) for each behavior were operationalized and developed according to Ajzen's (2002) guidelines with responses provided on 7-point scales. Participants were presented with a definition of the target behavior prior to completing the measures.

Intra-Personal Dispositional Constructs. Political orientation ("How would you describe your political orientation?"; ω = 0.725) was measured on a single item derived from similar measures (Napier and Jost, 2008). Populist attitudes were measured using four items (e.g., "Elected officials talk too much and take too little action"; ω = 0.830) based on a measure developed by Akkerman et al. (2014). Trust in government was measured using seven items (e.g., "The government is capable"; ω = 0.979) based on a previous measure (Grimmelikhuijsen and Knies, 2017). The conscientiousness (e.g., "Please indicate the extent to which a pair of words applies to you … dependable, self--disciplined"; ω = 0.442) and extroversion (e.g., "Please indicate the extent to which a pair of words applies to you … extroverted, enthusiastic"; ω = 0.797) personality dimensions were measured using two-item scales from the Ten Item Personality Inventory (TIPI; Gosling et al., 2003). Free will beliefs were measured using five items (e.g., "People always have free will"; ω = 0.875) from the Free Will Inventory (Nadelhoffer et al., 2014). Internal locus of control was measured using the 4-item Multidimensional Health Locus of Control Scale (Wallston et al., 1978; ω = 0.840). Responses to all intra-personal construct measures were provided on 7-point scales.

Behavior. We used three-item scales to measure physical activity (e.g., "In the past five weeks, to what extent did you do at least 150 min of moderate-to-vigorous physical activity each week?; ω = 0.956) and restriction of SSB consumption (e.g., "In the past five weeks, to what extent did you restrict your daily intake of sugar-sweetened beverages each week?"; ω = 0.956) behavior based on previously-validated self-report behavior measures (Amireault and Godin, 2015; Godin et al., 2010) with responses provided on 7-point scales. COVID-19 vaccination behavior was measured using a single item (e.g., "Have you received at least one dose of the vaccine against coronavirus?") with responses provided on a dichotomous scale (1 = *no*, 2 = *yes*).

2.4. Data analysis

Preliminary analyses. Prior to model testing, manifest variable scores for each study construct and behavior measure were computed by taking the average score of the scale items used to indicate each measure. Descriptive sample statistics were also generated for each variable or construct and matrices of zero-order correlations among them produced for each behavior.

Model testing. Hypothesized relations among constructs in the proposed model were tested separately for each behavior using single-indicator structural equation modeling (SISEM) implemented in the *lavaan* package in R. The SISEM approach was selected over a full latent variable model due to the relative complexity and large number of parameters in the proposed model. The single-indicator approach is well-suited for such models as it reduces parameterization but still produces estimates closely comparable to full latent variable models (Savalei, 2019). We used the Omega total (ω) reliability coefficients to estimate the measurement error of each variable in the model. Proposed relations between the intra-personal constructs, social cognition constructs, intentions, and behavior were set as free parameters. Demographic characteristics (e.g., age, sex, education, employment, ethnicity) were included as covariates in the model. Missing data patterns in our data were imputed using full information maximum likelihood imputation, in which missing values in the data file were imputed based on all available data for that variable from all cases. The analysis was implemented in the lavaan package in R (Rosseel, 2012). The analysis indicated four missing data patterns were imputed in each model. We employed multiple indices to evaluate model fit including: the model chi-square value (χ^2), comparative fit index (CFI), root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR). A non-significant χ^2 value ($p > 0.05$), a CFI value exceeding 0.90, and RMSEA and SMSR values approaching or below 0.05 and 0.08, respectively, indicate good fit of the model with the data. Formal differences in parameter estimates between behaviors were tested using the confidence interval about the mean difference in the estimates.

Sample size justification. We conducted a statistical power analysis using MacCallum, Browne, and Sugawara's (1996) method based on the RMSEA, implemented using the WebPower function in R. We specified our model effect size estimate based on the final RMSEA fit index of 0.054 from a similar SISEM model conducted in the same domain with an identical same number of latent variables (n = 10), which was compared to the null hypothesis RMSEA (Hagger and Hamilton, 2022b). The degrees of freedom estimate ($n = 75$) used for the analysis was based on the expected number of free parameters in the proposed model. Statistical power was set at 0.90 and the alpha level set at 0.05. The analysis returned an expected sample size of 201 participants.

Input scripts and output for all analyses are available online: https://osf.io/3as4r.

3. Results

3.1. Sample size and attrition analyses

After attrition across the two data collection occasions, 399 participants (M age = 51.77, SD = 16.65; 54.4% female; attrition rate = 28.37%) completed measures targeting physical activity behavior, 399 (M age = 51.77, SD = 16.65; 54.4% female; attrition rate = 64.22%) completed measures targeting COVID-19 vaccination behavior, and 372 participants (M age = 51.45, SD = 16.76; 55.9% female; attrition rate = 33.33%) completed measures targeting the restriction of SSB consumption behavior. Sample characteristics at baseline and follow-up for each behavior are presented in Appendix B (supplemental materials). Attrition analyses for the model estimated in the physical activity behavior revealed that participants lost to attrition were younger, t (555) = −7.334, $p < 0.001$, and more likely to be male, χ^2 (1, N = 399) = 5.604, $p = 0.017$, and less educated, χ^2 (5, N = 399) = 13.868, p = 0.016, than participants retained at follow-up. Analyses for the COVID-19 vaccination behavior revealed that participants lost to attrition were younger, t (1113) = −5.337, $p < 0.001$, and less educated, χ^2 (5, N =

399) = 17.017, $p = 0.004$, than those remaining at follow-up. Analyses for the restriction of SSB behavior revealed that participants lost to attrition were younger, t (556) = −7.636, $p < 0.001$, and less likely to be married than participants retained at follow up, χ^2 (4, N = 372) = 15.837, $p = 0.003$. No other differences in demographic variables were identified. MANOVAs with the social cognition constructs and behavior measures as multiple dependent variables and attrition status as the independent predictor revealed no statistically significant main effect of attrition in the samples targeting physical activity (Wilks' Λ = 0.984, F (5,551) = 1.790, $p = 0.112$), COVID-19 vaccination (Wilks' Λ = 0.997, F (5,1109) = 0.600, $p = 0.663$), and restriction of SSB consumption (Wilks' Λ = 0.988, F (5,1109) = 1.300, $p = 0.265$) behaviors. These analyses indicated no overall differences in these variables between those that remained in the study and those lost to follow up.

3.2. Preliminary analyses

Omega total scale reliability coefficients exceeded the cut-off criterion (ω > 0.700) for all study constructs. The only exceptions were the perceived behavioral control for the COVID-19 vaccination behavior variable (ω = 0.405) and conscientiousness construct (ω = 0.442). Reported effects involving these measures are, therefore, likely to be associated with increased measurement error and should be interpreted with this caveat in mind. Zero-order correlations among the study constructs and variables indicated statistically significant, positive correlations among the social cognition constructs and behavior for the physical activity (r range = 0.160 to 0.651, $ps < 0.001$), COVID-19 vaccine (r range = 0.269 to 0.837, $ps < 0.001$), and restriction of SSB consumption (r range = 0.160 to 0.604, $ps < 0.001$) behaviors. The only exception was the correlation between the subjective norms and perceived behavioral control constructs for the restriction of SSB consumption behavior, which was not statistically significant. Intercorrelations for the study variables for each behavior are presented in Appendices D, E, and F (supplemental materials).

3.3. Model fit

Our proposed model exhibited adequate fit with the data for the single-indicator structural equation models estimated in the physical activity ($\chi^2 = 165.929$, $p < 0.001$; CFI = 0.951; SRMR = 0.046; RMSEA = 0.048, CI 0.038, 0.057), COVID-19 vaccination ($\chi^2 = 273.870$, $p < 0.001$; CFI = 0.950; SRMR = 0.043; RMSEA = 0.052, CI 0.046, 0.059), and restriction of SSB consumption ($\chi^2 = 216.590$, $p < 0.001$; CFI = 0.898; SRMR = 0.049; RMSEA = 0.057, CI 0.048, 0.066) behaviors.

3.4. Model effects

Standardized parameter estimates for key direct effects of the models for all samples are summarized in Fig. 1 and indirect effects are reported in Table 1. Full results including all direct and indirect effects are presented in Appendix H (supplemental materials), and full results of the difference analyses are provided in Appendices I, J, and K (supplemental materials).

Direct effects of social cognition and intention constructs. We found a non-zero direct effect of intention on behavior for the models estimated in the physical activity, COVID-19 vaccination, and restriction of SSB consumption behaviors. In addition, we found non-zero direct effect of perceived behavioral control on behavior in the model for physical activity behavior, and a negative direct effect of populist beliefs on behavior in the model for COVID-19 vaccination behavior. We also found non-zero direct effects of attitudes, social norms, and perceived behavioral control on intention in the models for all behaviors.

Formal comparisons of the parameter estimates of these effects revealed differences in the direct effects of subjective norms on intention

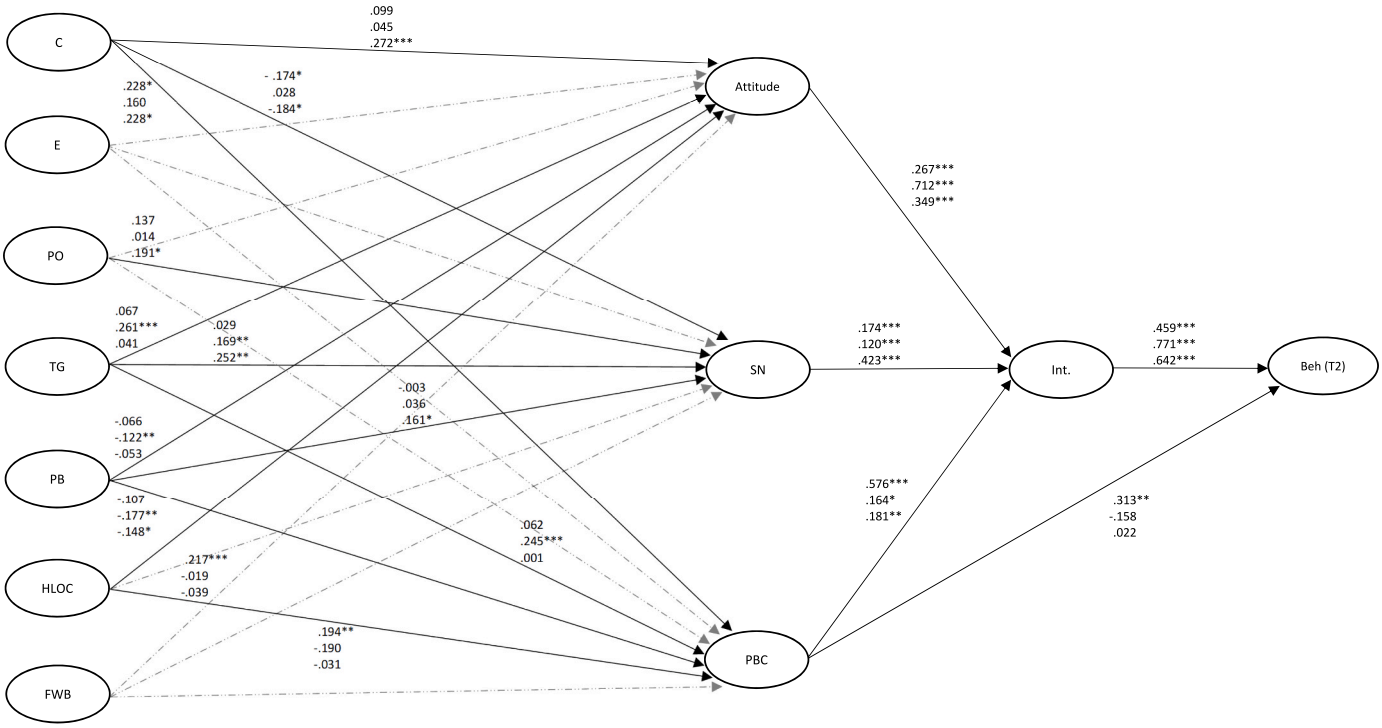

Fig. 1. Proposed integrated social cognition model with standardized parameter estimates from structural equation models for each behavior.
Note. Effects of age, sex, income, ethnicity, education, employment, and relationship status as covariates on intention and behavior are not illustrated. C = Conscientiousness personality trait; E = Extroversion personality trait; PO= Political orientation; TG = Trust in government; PB = Populist beliefs; HLOC = Health locus of control; FWB = Free will beliefs; SN = Subjective norm; PBC = Perceived behavioral control; Int. = Intention; Beh. = Behavior; T2 = Measure taken at follow-up 4 weeks after other measures. Coefficients printed on the upper line are for the physical activity sample, coefficients printed on the middle line are for the COVID-19 vaccination sample, and coefficients printed on the lower line are for the SSB sample. *$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.

Table 1
Standardized parameter estimates and 95% confidence intervals for indirect effects in the single-indicator structural equation models for physical activity, COVID-19 vaccination, and sugar-sweetened beverage consumption behaviors.

Effect	Physical activity			COVID-19 vaccination			Sugar-sweetened Beverage Consumption		
	β	95% CI		β	95% CI		β	95% CI	
		LL	UL		LL	UL		LL	UL
Indirect effects[a]									
C→Att→Int	0.026	−0.016	0.069	0.032	−0.040	0.104	0.095**	0.031	0.158
C→SN→Int	−0.030	−0.062	0.001	0.003	−0.011	0.018	−0.078*	−0.153	−0.002
C→PBC→Int	0.131**	0.040	0.223	0.026	−0.002	0.055	0.041	0.001	0.082
E→Att→Int	0.026	−0.005	0.057	0.026	−0.023	0.074	0.000	−0.037	0.038
E→SN→Int	0.009	−0.012	0.030	−0.005	−0.014	0.005	0.004	−0.043	0.051
E→PBC→Int	−0.002	−0.065	0.061	0.006	−0.010	0.022	−0.005	−0.026	0.017
PO→Att→Int	0.010	−0.039	0.060	−0.027	−0.106	0.052	−0.005	−0.063	0.054
PO→SN→Int	0.024	−0.013	0.061	0.002	−0.014	0.017	0.081*	0.005	0.157
PO→PBC→Int	0.009	−0.099	0.116	−0.007	−0.033	0.019	−0.008	−0.041	0.026
HLOC→Att→Int	0.058**	0.015	0.100	−0.013	−0.069	0.042	−0.014	−0.060	0.033
HLOC→SN→Int	0.023	−0.003	0.048	−0.003	−0.014	0.009	0.006	−0.052	0.065
HLOC→PBC→Int	0.112**	0.037	0.187	−0.012	−0.034	0.010	−0.006	−0.032	0.021
FWB→Att→Int	−0.012	−0.050	0.026	−0.005	−0.063	0.053	−0.012	−0.056	0.032
FWB→SN→Int	0.007	−0.020	0.034	0.002	−0.010	0.014	−0.016	−0.073	0.040
FWB→PBC→Int	0.030	−0.053	0.113	0.018	−0.004	0.039	0.012	−0.015	0.039
TG→Att→Int	0.018	−0.027	0.063	0.186***	0.114	0.258	0.014	−0.035	0.064
TG→SN→Int	0.005	−0.027	0.037	0.020*	0.004	0.036	0.107**	0.040	0.173
TG→PBC→Int	0.036	−0.063	0.135	0.040*	0.007	0.074	0.000	−0.028	0.029
PB→Att→Int	−0.018	−0.054	0.019	−0.087**	−0.143	−0.031	−0.018	−0.061	0.024
PB→SN→Int	−0.001	−0.026	0.025	−0.009	−0.020	0.003	0.068*	0.012	0.124
PB→PBC→Int	−0.062	−0.142	0.019	−0.029*	−0.054	−0.005	−0.027	−0.056	0.003
C→Att→Int→Beh	0.012	−0.008	0.033	0.025	−0.031	0.081	0.061**	0.019	0.103
C→SN→Int→Beh	−0.014	−0.030	0.002	0.003	−0.008	0.014	−0.050	−0.099	−0.001
C→PBC→Int→Beh	0.060*	0.013	0.108	0.020	−0.003	0.043	0.026	0.000	0.053
E→Att→Int→Beh	0.012	−0.004	0.027	0.020	−0.018	0.058	0.000	−0.024	0.024
E→SN→Int→Beh	0.004	−0.006	0.014	−0.003	−0.011	0.004	0.003	−0.028	0.033
E→PBC→Int→Beh	−0.001	−0.030	0.028	0.005	−0.008	0.017	−0.003	−0.017	0.011
PO→Att→Int→Beh	0.005	−0.018	0.027	−0.021	−0.082	0.041	−0.003	−0.040	0.034
PO→SN→Int→Beh	0.011	−0.007	0.028	0.001	−0.011	0.013	0.052*	0.003	0.101
PO→PBC→Int→Beh	0.004	−0.046	0.053	−0.005	−0.026	0.015	−0.005	−0.027	0.017
HLOC→Att→Int→Beh	0.027*	0.003	0.050	−0.010	−0.054	0.033	−0.009	−0.039	0.021
HLOC→SN→Int→Beh	0.010	−0.002	0.023	−0.002	−0.011	0.007	0.004	−0.034	0.042
HLOC→PBC→Int→Beh	0.051*	0.012	0.091	−0.009	−0.027	0.008	−0.004	−0.021	0.014
FWB→Att→Int→Beh	−0.006	−0.023	0.012	−0.004	−0.049	0.041	−0.008	−0.036	0.021
FWB→SN→Int→Beh	0.003	−0.009	0.016	0.001	−0.008	0.010	−0.011	−0.047	0.026
FWB→PBC→Int→Beh	0.014	−0.025	0.052	0.014	−0.004	0.031	0.008	−0.009	0.025
TG→Att→Int→Beh	0.008	−0.013	0.029	0.143***	0.077	0.209	0.009	−0.023	0.041
TG→SN→Int→Beh	0.002	−0.013	0.017	0.016*	0.003	0.029	0.068**	0.025	0.112
TG→PBC→Int→Beh	0.016	−0.029	0.062	0.031*	0.002	0.060	0.000	−0.018	0.018
PB→Att→Int→Beh	−0.008	−0.025	0.009	−0.067**	−0.113	−0.021	−0.012	−0.039	0.016
PB→SN→Int→Beh	0.000	−0.012	0.012	−0.007	−0.016	0.003	0.044*	0.007	0.080
PB→PBC→Int→Beh	−0.028	−0.066	0.010	−0.022*	−0.043	−0.002	−0.017	−0.036	0.002
Sums of indirect effects[b]									
C→Soc Cog→Int	0.127*	0.005	0.250	0.062	−0.029	0.153	0.059	−0.056	0.173
E→Soc Cog→Int	0.033	−0.054	0.120	0.027	−0.034	0.089	0.000	−0.071	0.071
PO→Soc Cog→Int	0.043	−0.106	0.192	−0.032	−0.132	0.068	0.069	−0.043	0.180
HLOC→Soc Cog→Int	0.192***	0.094	0.291	−0.028	−0.099	0.043	−0.013	−0.101	0.075
FWB→Soc Cog→Int	0.024	−0.090	0.139	0.014	−0.060	0.089	−0.016	−0.101	0.068
TG→Soc Cog→Int	0.059	−0.077	0.195	0.246***	0.160	0.333	0.121*	0.026	0.217
PB→Soc Cog→Int	−0.080	−0.189	0.029	−0.125**	−0.195	−0.055	0.023	−0.060	0.106
C→Soc Cog→Int→Beh	0.058	−0.002	0.119	0.048	−0.024	0.119	0.038	−0.036	0.111
E→Soc Cog→Int→Beh	0.015	−0.025	0.056	0.021	−0.027	0.069	0.000	−0.046	0.046
PO→Soc Cog→Int→Beh	0.020	−0.049	0.088	−0.025	−0.102	0.053	0.044	−0.028	0.116
HLOC→Soc Cog→Int→Beh	0.088**	0.030	0.147	−0.022	−0.077	0.033	−0.008	−0.065	0.048
FWB→Soc Cog→Int→Beh	0.011	−0.042	0.064	0.011	−0.046	0.068	−0.011	−0.065	0.044
TG→Soc Cog→Int→Beh	0.027	−0.036	0.090	0.190***	0.105	0.275	0.078*	0.015	0.140
PB→Soc Cog→Int→Beh	−0.037	−0.089	0.016	−0.096**	−0.156	−0.036	0.015	−0.039	0.068
Total effects[c]									
C→Beh	0.087	−0.060	0.234	0.000	−0.151	0.151	0.045	−0.138	0.228
E→Beh	0.024	−0.070	0.117	−0.019	−0.119	0.082	−0.010	−0.115	0.095
PO→Beh	0.031	−0.129	0.191	−0.073	−0.234	0.089	0.048	−0.118	0.215
HLOC→Beh	0.058	−0.058	0.173	−0.068	−0.186	0.050	0.064	−0.075	0.203
FWB→Beh	−0.035	−0.157	0.087	0.054	−0.069	0.177	−0.044	−0.170	0.082
TG→Beh	0.003	−0.144	0.150	0.150	−0.012	0.312	0.022	−0.116	0.161
PB→Beh	0.009	−0.112	0.130	−0.231***	−0.357	−0.104	−0.070	−0.197	0.058

Note.
*$p < 0.05$ **$p < 0.01$ ***$p < 0.001$.
[a] Indirect effects of each trait and dispositional belief on intentions and behavior through each social cognition construct.
[b] Sums of indirect effects of each trait and dispositional belief on intentions and behavior through all social cognition constructs.

[c] Total effects of traits and dispositional beliefs on behavior comprising sums of indirect effects through all social cognition constructs and direct effects; β = Standardized path coefficient; 95% CI = 95% confidence intervals of the standardized path coefficient; LL = Lower limit of the 95% confidence interval; UL = Upper limit of the 95% confidence interval; Int = Intention; Beh = Behavior; PBC = Perceived behavioral control; C = Conscientiousness personality trait; E = Extroversion personality trait; PO = Political orientation; HLOC = Health locus of control; FWB = Free will beliefs; TG = Trust in government; PB = Populist beliefs; Att = Attitude; SN = Subjective norm.

($t(769) = -4.142$, $p < 0.001$) and the direct effect of perceived behavioral control on intention ($t(769) = 4.736$, $p < 0.001$) across models estimated in the physical activity and restriction of SSB consumption behaviors. In addition, we found differences in the direct effects of attitudes on intention ($t(796) = -5.704$, $p < 0.001$) and perceived behavioral control on intention ($t(796) = 4.945$, $p < 0.001$) across models in the physical activity and COVID-19 vaccination behaviors. Finally, there were differences in the direct effects of attitudes on intention ($t(769) = 5.381$, $p < 0.001$) and subjective norms on intention ($t(769) = -5.796$, $p < 0.001$) across the models in the COVID-19 vaccination and restriction of SSB consumption behaviors.

Direct effects of dispositional constructs. There was a non-zero direct effect of health locus of control on attitudes in the model for physical activity. Both trust in government and populist beliefs had non-zero direct effects on attitudes in the model for COVID-19 vaccination behavior. We also found a non-zero positive direct effect of conscientiousness on attitudes in the model for the restriction of SSB consumption behavior, and non-zero negative direct effects of conscientiousness on subjective norms in the models for the physical activity and restriction of SSB consumption behaviors. There were non-zero direct effects of political orientation on subjective norms for model for SSM consumption, and for trust in government on subjective norms for the models for SSM consumption and the COVID-19 vaccination behaviors. In addition, there were non-zero direct effects of conscientiousness on perceived behavioral control in the models for physical activity and restriction of SSB consumption behaviors. Further, we found a non-zero direct effect of health locus of control on perceived behavioral control in the model for physical activity. We observed a non-zero negative direct effect of populist beliefs on perceived behavioral control in the models for COVID-19 vaccination and restriction of SSB consumption behaviors. Finally, there was a non-zero direct effect of trust in government on perceived behavioral control in the model for COVID-19 vaccination.

Formal comparison of parameter estimates indicated significant differences in the effects of health locus of control on attitudes ($t(769) = 2.799$, $p = 0.005$) and perceived behavioral control ($t(769) = 2.281$, $p = 0.002$) across models estimated in the physical activity and restriction of SSB consumption behaviors. We found a significant difference in the effects of health locus of control on attitudes ($t(796) = 3.221$, $p < 0.001$) and perceived behavioral control ($t(796) = 3.089$, $p = 0.002$) across models in the physical activity and COVID-19 vaccination behaviors.

Indirect effects on intention. We found non-zero indirect effects of health locus of control on intention mediated by attitudes and perceived behavioral control, respectively, in the model for physical activity behavior. We also found non-zero indirect effects of trust in government and populist beliefs on intentions mediated by attitudes in the model for COVID-19 vaccination behavior. There was a non-zero negative indirect effect of populist beliefs on intention mediated by perceived behavioral control in the model for COVID-19 vaccination behavior. We found a non-zero indirect effect of trust in government and populist beliefs on intentions mediated by subjective norms in the model for restriction of SSB consumption.

Formal comparison of parameter estimates indicated differences in the indirect effect of health locus of control on intention mediated by perceived behavioral control ($t(769) = 2.877$, $p = 0.004$) and the indirect effect of trust in government on intention mediated by subjective norms ($t(769) = -2.684$, $p = 0.008$) across models estimated in the physical activity and restriction of SSB consumption behaviors. We also found a difference in the indirect effect of trust in government on intention mediated by attitudes ($t(796) = -3.871$, $p < 0.001$) across models in the physical activity and COVID-19 vaccination behaviors. Finally, we found differences in the indirect effects of trust in government on intention mediated by attitudes ($t(769) = 3.846$, $p < 0.001$) and populist beliefs on intention mediated by subjective norms ($t(769) = -2.620$, $p = 0.009$) across models in the COVID-19 vaccination and restriction of SSB consumption behaviors.

Indirect effects on behavior. We found non-zero indirect effects of conscientiousness on behavior mediated by attitudes and intention in the model for restriction of SSB consumption and mediated by perceived behavioral control and intention in the model for physical activity. There were non-zero indirect effects of health locus of control on behavior mediated by attitudes and intention, and by perceived behavioral control and intention, in the model for physical activity. We also found non-zero indirect effects of trust in government on behavior mediated by subjective norms and intentions in the model for restriction of SSB consumption behaviors, and mediated by attitudes and intentions, subjective norms and intentions, and by perceived behavioral control and intentions, in the model for COVID-19 vaccination. There was a non-zero positive indirect effect of populist beliefs on behavior mediated by subjective norms and intentions in the model for restriction of SSB consumption behavior, and non-zero negative indirect effects of populist beliefs on behavior mediated by attitudes and intentions, and by perceived behavioral control and intention, in the model for COVID-19 vaccination behavior. There was also a non-zero positive indirect effect of political orientation on behavior mediated by subjective norms and intention in the model for restriction of SSB consumption behavior. Finally, we found a non-zero negative total effect of populist beliefs on behavior in the model for COVID-19 vaccination behavior.

Formal comparison of the estimates for these indirect effects indicated differences in the indirect effect of trust in government on behavior mediated by subjective norms across models estimated in the physical activity and restriction of SSB consumption behaviors ($t(769) = -2.794$, $p = 0.005$). We also found a difference in the indirect effect of health locus of control on behavior mediated by perceived behavioral control ($t(796) = 2.752$, $p = 0.006$), and in the indirect effect of trust in government on behavior mediated by attitudes ($t(796) = -3.826$, $p < 0.001$), across models estimated in the physical activity and COVID-19 vaccination behaviors. Finally, we found a difference in the indirect effect of trust in government on behavior mediated by attitudes across models estimated in the COVID-19 vaccination and restriction of SSB consumption behaviors ($t(769) = 3.590$, $p < 0.001$).

4. Discussion

We tested an integrated theoretical model specifying relations among social cognition constructs from the theory of planned behavior, a set of intra-personal personality and socio-political factors, and intentions toward, and participation in, three health behaviors (physical activity, COVID-19 vaccination, and restriction of SSB consumption) in a sample of Finland residents. Results indicated that the generalized model held in all three samples insofar as we found one or more indirect effects of the dispositional and socio-structural constructs on behavior mediated by the social cognition constructs in each case. However, we also observed some key variations in the patterns of effects in the model across behaviors in terms of the intra-personal constructs and the social cognition mediators. Taken together, our results provide useful insight into some of the key constructs that likely inform individuals' intention toward, and actual participation in, these health behaviors and, importantly, the salient mediators that may be indicative of the potential mechanism involved.

4.1. Effects of political beliefs

A prominent finding in the current analysis was the positive relations between trust in government with intention and behavior for COVID-19 vaccination and restriction of SSB consumption behaviors, which, in both cases, was mediated by subjective norms, consistent with the generalized predictions of our model. Considering the socio-political salience of government-sponsored COVID-19 vaccination initiatives and SSB taxation, our findings suggest that political beliefs likely inform individuals' decisions on whether or not to get a COVID-19 vaccination and restrict consumption of SSBs. Focusing on COVID-19 vaccination behavior, studies suggest that this behavior is linked to individuals' political and social beliefs – those that tend to endorse populist beliefs are less likely to get vaccinated (Stecula and Pickup, 2021). Analogously, research has demonstrated that higher levels of trust in government is associated with COVID-19 vaccination intentions (Van Oost et al., 2022). Our results corroborate and extend these findings, suggesting that individuals in the current study likely draw from these generalized beliefs when making decisions to get vaccinated, particularly their attitudes such that these generalized beliefs inform the sets of specific beliefs that line up future behavior, consistent with social cognition theories like the theory of planned behavior (Ajzen, 1991).

By contrast, prior evidence linking political and social beliefs with SSB consumption is relatively sparse. There is some research indicating that individuals' perceive SSB taxation as a potential solution to obesity (Eykelenboom et al., 2019), but it is unclear how such a belief relates to SSB consumption. Individuals from the current sample may have been aware of legislation surrounding SSB consumption, given the high-profile court case in which a policy that raised excise tax on high-sugar products including SSBs in Finland was repealed. Assuming participants were aware of governmental intervention to restrict SSB intake, our findings suggest that such knowledge informed their decisions to restrict their SSB consumption.

We also found a positive indirect effect of political orientation and populist beliefs on SSB restriction. This finding seems contrary to the pattern of effects that would be expected in other countries, such as the US. In these countries, this association would be expected to be negative in sign because individuals endorsing conservative political beliefs tend to be less supportive of government regulatory policy deemed to interfere with individual choice, such as restrictions on SSB consumption, relative to those endorsing liberal political beliefs (Gollust et al., 2014). However, the most widely known populist movement in Finland, the Finns Party, has been described as economically left-wing but socially right-wing (Yle Uutiset, n.d.), which may account for the sign of this effect in the current sample that runs counter to expectations. However, this explanation is speculative – we did not collect data on party affiliation or taxation attitudes, nor did we test the model in a US sample for comparison. We cannot, therefore, make an unequivocal judgment on the veracity of this explanation without further data.

Our findings emphasize the value of distinguishing between multiple facets of political beliefs (e.g., trust in government, populist attitudes) rather than using a generalized political orientation measure (e.g., political orientation). In fact, the generalized measure explained relatively little variance in these health behaviors while we found multiple effects for trust in government and populist attitudes on behavior in the models for two of the behaviors. The observed convergence in effects for the latter facets of political beliefs might be because both constructs effectively summarize individuals' attitudes toward political elites. Specifically, the anti-elitism aspect of populism could manifest as skepticism and distrust of scientists and experts endorsed by the government, which would be indicated in their reported trust in government. Consistent with this expectation, we observed a non-zero negative correlation between these factors, and a similar pattern of effects for these variables in the models targeting the two behaviors with political relevance, COVID-19 vaccination and restriction of SSB consumption. Future research should seek to corroborate these findings in other health behaviors that are promoted by government-endorsed experts.

4.2. Effects of personality

A noteworthy finding in the current analysis was the positive indirect effect of conscientiousness on intention and behavior mediated by perceived behavioral control and attitudes in the models for physical activity and restriction of SSB behaviors, respectively, with no direct effects. These findings suggest that conscientiousness serves as basis for individuals' beliefs with respect to performing these behaviors in future, corroborating the results of prior research (e.g., Chatzisarantis and Hagger, 2008). Our findings are consistent with predictions of disposition-belief-motivation models, which outline mechanisms by which personality traits affect multiple behaviors (Ajzen, 1991; Godfrey et al., 2023; Hagger et al., 2019; Vo and Bogg, 2015). It is noteworthy that we did not find effects for extroversion. While studies have demonstrated a relations between extroversion and behavior for some health behaviors (e.g., physical activity; Rhodes and Courneya, 2003), effects have tended to be more consistent for conscientiousness (Allen et al., 2017). It is also important to note that effects of personality traits are not often explored alongside effects of other traits such as political beliefs and control perceptions, which may have attenuated the personality trait effect sizes due to shared variance among them which they also share with intentions and behavior.

4.3. Control-related perceptions

We found positive indirect effects of health locus of control on intention and behavior for physical activity behavior, mediated by attitudes and perceived behavioral control, respectively. These findings indicate that health locus of control informs individuals' beliefs with respect to the perceived utility and capacity with respect to future physical activity participation, and ultimately informs their motivation and behavior. This is consistent with prior research indicating that such generalized control perceptions are relevant for behaviors like physical activity that are considered largely reasoned and planned with highly individual outcomes (Hagger and Armitage, 2007). This contrasts with behaviors like COVID-19 vaccination and restriction of SSB consumption, which may be more dependent on socio-political and other-oriented dispositions. Contrary to expectations, we did not find direct or indirect effects of free will beliefs on behavior in the three samples. This contrasts with research that found indirect effects of free will beliefs intentions to receive the COVID-19 vaccine booster through social cognition constructs (Hagger and Hamilton, 2022b). However, the latter findings were from research conducted in a US sample, and these beliefs may be more salient in making decisions about COVID-19 vaccination in that context, particularly considering that vaccine development and distribution has become highly politicized in the US.

4.4. Implications for intervention

One of the important implications of the current research is that it may point to dispositional constructs that may be salient in informing the beliefs that precede individuals' decisions to perform these health behaviors, and may signal the kinds of messages that may promote adaptive traits (e.g., conscientiousness) and allay dispositions that reflect concerns (e.g., lack of trust in government). However, it should be noted that such constructs may not be as malleable and subject to change given their trait-like properties (i.e., fixed, enduring, stable). So while there is evidence that such dispositions can be changed through intensive intervention (e.g., Olaru et al., 2023), such change is difficult to achieve and may be associated with small effect sizes and be relatively short lived. By contrast, a more feasible approach may be to target change in the social cognition constructs that are more proximal to decision making. These are likely to be more subject to change and, therefore, more viable as intervention targets. For example,

interventions that adopt persuasive communications that target attitudes (e.g., emphasizing the proximal and salient utility and advantages of the behavior) and perceived behavioral control (e.g., emphasizing the ease of access to, and low barriers for, performing the behavior) might be influential and negate effects of constructs such as populist beliefs on the behavior without the need to address or confront the populist beliefs. However, it should be noted that these suggestions assume that changes in the social cognition constructs will lead to changes in intentions and behavior, inferences based on theory rather than the current data because the current study design did not model change over time. The current effects, therefore, need corroboration in studies adopting longitudinal or experimental designs that permit the modeling of change.

4.5. Strengths, limitations, and avenues for future research

The current study had numerous strengths: proposal of an integrated theoretical approach to explain health behaviors drawing from theories of personality and social cognition including politically-oriented constructs that are particularly prescient and timely for behaviors such as COVID-19 vaccination; simultaneous examination of the effects of these intra-personal dispositional constructs alongside belief-based constructs on intentions and behavior in a single model estimated in three health behaviors; and adoption of appropriate and validated measures in a prospective study design.

It is, however, important to highlight some of the limitations of the current research that should be considered when interpreting its findings. First, our sample was not recruited using random selection or stratification and was limited to residents from a single national group. Therefore, we cannot generalize our findings to a broader population in Finland or further afield. This is important as the observed effects might be specific to this national group with particular social and cultural norms, political systems, and contextual patterns of behavior. Future studies should seek to replicate and compare the findings of the current model in representative samples and in other national groups. Another notable limitation of our sampling procedure is the low retention of younger participants. This is a common observation in psychological survey research – younger participants tend to be harder to reach and difficult to retain, possibly due to lifestyle factors (e.g., less stability) and reduced attention (e.g., they likely have a larger number of distractions). Future research should seek to obviate this potential limitation by adopting proactive participant recruitment strategies such as oversampling in younger demographics to compensate for the likely higher dropout rates in these age groups.

Second, a further limitation of this study is that we confined our analysis to a particular set of intra-personal dispositional constructs and while we had conceptual and empirical justification to do so, other traits and dispositions may have accounted for further variance in the beliefs on which individuals based their decisions to perform these health behaviors in our models. We look to future research that explores the potential for additional intra-personal dispositional constructs and variables that may be salient to decisions to perform health behaviors. For example, future studies might investigate the role of self-control, a trait-like disposition that has been shown to be associated with social cognition constructs in health behaviors (Hagger et al., 2019). Alongside this, while we had clear health and conceptual bases for selecting the set of intra-personal dispositional variables and the health behaviors targeted in the current study, we recognize that the intra-personal dispositional variables and social cognition constructs in our integrated model could feasibly be applied to the prediction of other health behaviors, particularly those that have received considerable attention in populist media for socio-political reasons. For example, behaviors such as flu vaccination, meat consumption, and fruit/vegetable consumption are behaviors that have been found to be associated with political beliefs (Kannan and Veazie, 2018). Such behaviors may be candidates to be targeted in future applications of the current integrated model.

Third, as with all studies adopting correlational designs, the causal direction of model effects in the current study is based on theory alone, and not the data. Future research should seek to verify current findings in studies adopting experimental and longitudinal panel designs that enable the modeling of change in model constructs. Finally, we relied exclusively on self-report measures of behavior, which are subject to socially desirable responding and recall bias. Future research should still seek to corroborate current findings with non-self-report behavioral measures.

5. Conclusion

The current research tested the predictions of an integrated model specifying effects of dispositional, intra-personal constructs on intentions and behavior for three health behaviors: physical activity, COVID-19 vaccination, and restriction SSB consumption. Findings support effects of social cognition constructs on intentions and behavior consistent with theory, and behavior-specific patterns of indirect effects of the personality and socio-political beliefs constructs on behavior mediated by the social cognition constructs and behavior. Our findings contribute to an evidence base of constructs that explain variance in these specific behaviors and signal potentially modifiable targets for behavioral intervention that may offset any deleterious effects of intra-personal dispositions on health behaviors. Findings should be regarded as preliminary and there is a need for future studies that corroborate our findings in representative samples and adopt experimental and longitudinal panel designs to better enable causal and directional inferences for the effects proposed in our model.

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CRediT authorship contribution statement

Zoe M. Griffith: Conceptualization, Data curation, Formal analysis, Writing – original draft, Writing – review & editing. **Juho Polet:** Data curation, Methodology, Writing – review & editing. **Taru Lintunen:** Conceptualization, Funding acquisition, Methodology, Writing – review & editing. **Kyra Hamilton:** Data curation, Methodology, Writing – review & editing. **Martin S. Hagger:** Conceptualization, Data curation, Formal analysis, Funding acquisition, Methodology, Writing – original draft, Writing – review & editing.

Data availability

Due to European GDPR legislation and University of Jyväskylä IRB policy, we were not permitted to share our data. We have shared our data analysis script and output, and associated study materials online: . https://osf.io/3as4r.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2024.116779.

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