

Associations of Psychological Needs with Alcohol Use and Related Outcomes

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Abstract

Objective: Self-determination theory (SDT) provides a useful framework for understanding engagement and change in health behaviors and has informed efficacious health intervention, but applications to alcohol use are limited. In the current research, we test hypotheses that greater satisfaction of the psychological needs (autonomy, competence, relatedness) is associated with protective factors for alcohol use, whereas greater need frustration is associated with risk factors. **Method:** In Studies 1 and 2, convenience samples of college students across the U.S. completed a cross-sectional survey (Study 1: $n=1,401$; $M_{age}=20.6$, $SD=4.0$; 73.3% female; 60.3% non-Hispanic White) (Study 2: $n=2,276$; $M_{age}=21.1$, $SD=5.0$; 70.4% female; 52.4% non-Hispanic White). In Study 3, a national sample of U.S. adults completed five surveys over two years ($n=1,719$; $M_{age}=49.0$, $SD=15.4$; 57.4% men; 71.8% non-Hispanic White). **Results:** In Studies 1 and 2, we found small associations of greater need satisfaction with more engagement in alcohol harm reduction behaviors, lower alcohol use severity, and fewer alcohol problems; need frustration demonstrated the opposite pattern of associations. In Study 3, we found large positive associations between need frustration and alcohol use severity at each time point, and a large positive association between change in need frustration and change in alcohol use severity. **Conclusions:** These findings suggest preliminary support for associations between psychological needs and alcohol use and related outcomes that may lead to future research on alcohol intervention development and refinement based on SDT. However, further research is needed, especially examination of psychological needs in the context of alcohol use or changes in alcohol use.

Keywords: Alcohol, protective behavioral strategies, motivation, psychological needs, self-determination theory

Public health significance statement: This study indicates that people who experience greater autonomy, competence, and relatedness tend to drink less alcohol and have fewer alcohol problems.

Associations of Psychological Needs with Alcohol Use and Related Outcomes

Most American adults have had an alcoholic drink in their lifetime (84.1%) and more than half have had a drink in the past month (52.9%) (Substance Abuse and Mental Health Services Administration, 2023). Harmful alcohol use is a leading cause of preventable death (>144,000 deaths per year in the U.S.) (Centers for Disease Control and Prevention, 2022), contributes to myriad acute (e.g., car crashes) and chronic conditions (e.g., cancer) (Shield et al., 2013), and is associated with a substantial economic burden (costing the U.S. almost \$250 billion in 2010) (Sacks et al., 2015). For the reasons above, reducing the harm of alcohol use has great potential to improve public health. A limitation to our ability to do so is that while much is known about why people drink, or drinking motives (i.e., enhancement, social, coping and conformity; (Cox & Klinger, 1988) (for a recent meta-analysis, see Bresin & Mekawi, 2021), much less is known about why people reduce or abstain from drinking and use strategies that protect against harms, irrespective of alcohol use (e.g., use a designated driver) (Richards, Pearson, & Witkiewitz, 2021). The motivational model of self-determination theory holds promise in helping to address these gaps by enhancing our understanding of both hazardous alcohol use and alcohol harm reduction behaviors. Accordingly, the present work seeks to test how motivational factors within self-determination theory—chiefly basic psychological needs—relate to protective and risk factors for alcohol use.

Basic Psychological Need Satisfaction and Need Frustration

Self-determination theory (SDT; Ryan & Deci, 2017) is a metatheory of motivation that can help explain health behaviors and inform health intervention. A central proposal of SDT is that people have three innate psychological needs for *autonomy* (volition and willingness), *competence* (effectiveness and mastery), and *relatedness* (warmth, bonding, and care) (Vansteenkiste et al., 2020). The satisfaction of these three needs are necessary conditions preceding the internalization of motivation to adopt and maintain engagement in health-promoting behaviors over time (Ryan et al., 2008). Several meta-analyses have shown that

health interventions that support psychological need fulfillment increase engagement in health-promoting behaviors and positive health outcomes (e.g., tobacco cessation, medication adherence, exercise) (Gillison et al., 2019; Ntoumanis et al., 2021; Sheeran et al., 2020).

Although research has historically focused on need satisfaction, an emerging research theme is to better understand the consequences of need frustration, a condition that involves active thwarting of the psychological needs rather than mere absence of satisfaction (Vansteenkiste et al., 2020). Need frustration is proposed to stymie the internalization of motivation and thereby promote behavioral disengagement, resulting in poor functioning and ill-being. Indeed, need frustration has been linked to health-impeding behaviors and poor health outcomes, such as lower quality sleep and higher cholesterol levels (Uysal et al., 2020). Among those who experience high need frustration, intervention techniques that resolve the active threat to the need(s) may be necessary to increase health-promoting behaviors prior to supporting need fulfillment, theoretically.

However, the most widely used measure of the psychological needs, the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS; Chen et al., 2015), which was used in the current research, was recently criticized for not validly assessing need frustration (Murphy et al., 2023). Murphy and colleagues argue that the need frustration items lack active thwarting content, and that many of these items are reverse-worded versions of their counterpart need satisfaction items, thus reflecting the opposite of need satisfaction rather than the distinct construct of need frustration as proposed by SDT. Indeed, they found that item-keying direction accounted for a substantial proportion of the covariance among the BPNSFS items, supporting their argument about the lack of face validity of the need frustration items. Two more recent studies, however, found evidence in support of the psychometric properties of the original 6-factor model of the BPNSFS, and both sets of authors conclude that, although the need frustration items lack active thwarting content, the need “frustration” factors are conceptually distinct from the need satisfaction factors (Grubbs et al., 2025; Holden et al.,

2025). Holden and colleagues argue further that active thwarting is an antecedent rather than a facet of the condition of need frustration according to SDT (Vansteenkiste & Ryan, 2013), and therefore the absence of active thwarting content in the need frustration items is appropriate. Given the ongoing debate about whether the BPNSFS validly assesses need frustration, we use the term need frustration throughout with the caveat that this construct might better reflect the opposite of need satisfaction (Murphy et al., 2023), or a construct that may or may not be need frustration given the lack of active thwarting content but still distinct from need satisfaction, referred to as need “dissatisfaction” by Grubbs et al. and need “unfulfillment” by Holden et al.

Applications of SDT to Alcohol Use

Despite measurement issues surrounding need frustration, SDT provides a useful framework for understanding health behavior and intervention, but applications to alcohol use are limited. In a recent meta-analysis of randomized controlled trials of SDT-based health interventions, only 2 of 65 total trials targeted alcohol use (Sheeran et al., 2020). However, SDT may be particularly informative given its potential to fill an important gap in the lack of understanding of why people engage in alcohol harm reduction behaviors in addition to hazardous alcohol use.

Research on SDT and alcohol use has mostly focused on the internalization continuum of motivation in relation to drinking “responsibly,” or engaging in alcohol harm reduction behaviors, referred to as protective behavioral strategies (PBS; e.g., using a designated driver, avoiding combining alcohol with other drugs, eating before or after drinking). Specifically, research has consistently found that more internal motives (e.g., “Because [drinking responsibly] is an important choice I really want to make”) are associated with more frequent PBS use (Richards et al., 2020, 2022, 2023; Richards, Morera, et al., 2021; Richards, Pearson, & Field, 2021). More internal motives are also negatively associated with alcohol use and related problems. In contrast, more external motives (e.g., “I feel pressure from others to [drink responsibly]”) and amotivation (e.g., “I don’t really think about [drinking responsibly]”) are

unrelated or negatively associated with PBS but positively associated with alcohol use and related problems. Additionally, in several of these studies, greater need satisfaction was associated with greater endorsement of more internal motives for drinking responsibly (Richards et al., 2020, 2023; Richards, Pearson, & Field, 2021). Though the internalization continuum of motivation is typically used to explain health-promoting behaviors, recent work by Courtney and colleagues (2025a, 2025b) applies the continuum to alcohol use. These authors find that autonomous motivation for drinking is associated with fewer alcohol problems and amotivation for drinking is associated with more alcohol problems (Courtney et al., 2025b). In sum, there is growing support for the postulates of the internalization continuum of motivation per SDT in alcohol research.

Few studies, however, have focused on the psychological needs in alcohol research. Conigrave et al. (2021) found that Indigenous Australians who reported greater need satisfaction while drinking also reported drinking more and greater symptoms of alcohol use disorder, suggesting that some people may drink to satisfy the psychological needs. Carey et al. (2013) found that providing mandated college students with a choice in alcohol intervention was associated with higher satisfaction of the intervention and increased likelihood that those at higher risk for alcohol problems selected a more intensive intervention. An SDT-informed smartphone application to support people with alcohol use disorder following treatment was found to reduce harmful alcohol use relative to treatment-as-usual (Gustafson et al., 2014). Thus, there is limited evidence that psychological needs are associated with alcohol use and other alcohol-related behaviors. Conigrave and colleagues examined the influence of drinking on need satisfaction, and, while important, psychological needs may also influence drinking, which is the premise of SDT-based health intervention. Additionally, trials of SDT-informed alcohol interventions have been limited in scope (i.e., focus only on choice, or autonomy) or SDT content is part of a more comprehensive intervention. Additional research is needed to determine whether greater need satisfaction is related to protective factors for alcohol use and

whether greater need frustration is related to risk factors for alcohol use, which, to our knowledge, was not considered in the studies described above. The limited research represents a critical gap given that the psychological needs would serve as the active ingredients of SDT-informed alcohol intervention to both promote protective factors and reduce risk factors for alcohol use.

Current Research

In three studies, two cross-sectional and one longitudinal, we examine the associations of psychological needs with protective and risk factors for alcohol use. We focused on general need satisfaction and need frustration as opposed to the individual needs for several reasons. First, SDT-based health interventions typically target all three needs simultaneously (Gillison et al., 2019; Ntoumanis et al., 2021; Sheeran et al., 2020). Second, the satisfaction and frustration of all three needs tends to co-occur as evidenced by large positive correlations (Chen et al., 2015). Consistent with these findings, general need satisfaction and need frustration composite scores are a common scoring method for the BPNSFS (Van Der Kaap-Deeder et al., 2020). Third, we had no hypotheses regarding differential associations for individual needs. Given that separation of the three psychological needs is common, however, we provide the correlations for the six BPNSFS subscales with the outcome variables in the current research as supplemental material (e.g., a prior meta-analysis on SDT and health synthesized effects for the individual psychological needs; Ng et al., 2012). Our general hypotheses were that need satisfaction would be positively associated with protective factors for alcohol harms, whereas need frustration would be positively associated with risk factors for alcohol harms.

Studies 1 and 2: Cross-Sectional Associations

As described above, no study, to our knowledge, has examined the associations of need satisfaction and need frustration with protective (e.g., PBS) and risk (e.g., alcohol use severity) factors for alcohol use. In two large cross-sectional studies among college students across the U.S. with similar methodologies, we sought to test these associations. We hypothesized that

need satisfaction would be positively associated with PBS, whereas need frustration would be positively associated with alcohol use severity and alcohol problems. We also hypothesized that need satisfaction would be positively associated with more internalized motives for drinking alcohol responsibly (i.e., autonomous motivation and introjected regulation) but negatively associated with less internalized motives (i.e., external regulation and amotivation). The opposite pattern of associations was hypothesized for need frustration.

Method

Participants and Procedures

We recruited college students from Psychology Department research participant pools at 10 universities in 8 states across the U.S. (AK, CA, CO, ID, NM, TX, VA, WA) from March to December 2020 for Study 1 and from October 2022 to July 2023 for Study 2. Nearly 5,500 students and over 4,100 students completed the surveys, respectively, but the analytic samples were restricted to those ≥ 18 years who reported past-month drinking and completed the Basic Psychological Need Satisfaction and Frustration Scale (BPNSFS) (Study 1: $n=1,401$; Study 2: $n=2,276$); the larger analytic sample in Study 2 is due to differences in planned missingness designs described below. We sought to obtain the largest sample sizes possible over the course of the recruitment periods. The analytic samples were 20.55 and 21.07 years of age on average ($SD=4.02$ and 4.99) and mostly female (73.3%, 70.4%) and non-Hispanic white (60.3%, 52.4%). All procedures were approved by the IRB at the University of New Mexico, and these studies were not preregistered.

Measures

We used planned missingness designs for a subset of measures to decrease participant burden. In Study 1, a random half of participants were assigned to complete the BPNSFS. In Study 2, all participants were presented 2 of 4 items at random for each of the 6 BPNSFS subscales. The other three study measures assessing the alcohol outcomes were completed in full by the analytic sample for both studies.

We used the 24-item BPNSFS (Chen et al., 2015) to assess satisfaction and frustration of the psychological needs for autonomy (e.g., “I feel a sense of choice and freedom in the things I undertake” and “Most of the things I do feel like ‘I have to’”), competence (e.g., “I feel confident that I can do things well” and “I have serious doubts about whether I can do things well”), and relatedness (e.g., “I feel that the people I care about also care about me” and “I feel excluded from the group I want to belong to”); response options range from 1 (Not true at all) to 5 (Completely true). We used a 21-item version of the Protective Behavioral Strategies Scale (PBSS; Martens et al., 2005; revised by Treloar et al., 2015) to assess frequency of engagement in behaviors that reduce the harms associated with alcohol use (see PBS definition above for example items). Response options range from 1 (Never) to 6 (Always), and a total PBSS score was created by averaging its items. We used the 24-item Brief-Young Adult Alcohol Consequences Questionnaire (B-YAACQ; Kahler et al., 2005) to assess a range of problems related to alcohol use experienced in the past month (e.g., “I have said or done embarrassing things” and “I have felt like I needed a drink after I’d gotten up [that is, before breakfast]”). A binary response scale was used (0=No, 1=Yes), and a total B-YAACQ score was created by summing its items. We used the 10-item version of the Alcohol Use Disorder Identification Test (AUDIT) that was adapted to U.S. guidelines (USAUDIT) to assess alcohol use severity (e.g., “How often have you found that you were not able to stop drinking once you had started?”) (Higgins-Biddle & Babor, 2018). Items are scored from 0-6 and a total USAUDIT score was created by summing the items. We used the 14-item Treatment Self-Regulation Questionnaire-Alcohol (TSRQ-Alcohol) to assess motives across the internalization continuum for drinking alcohol responsibly (Richards, Morera, et al., 2021; Richards, Pearson, & Field, 2021). Response options range from 1 (Not at all true) to 7 (Very true), and autonomous motivation, introjected regulation, external regulation, and amotivation subscales were created by averaging their respective items. Descriptive statistics for the study variables in Studies 1 and 2 are provided in Supplementary Table 1.

Statistical Analysis

All analyses were conducted using maximum likelihood estimation with robust standard errors (MLR) in *Mplus* 8.5 (Muthén & Muthén, 1998-2017), which uses full information maximum likelihood estimation to handle missing data.

We used confirmatory factor analysis (CFA) to confirm the higher-order measurement model of the BPNSFS: six first-order factors representing satisfaction and frustration of autonomy, competence, and relatedness, and two second-order factors representing general need satisfaction and need frustration (Chen et al., 2015). We estimated covariances between the first-order satisfaction and frustration factors for the same need and between the two second-order factors. Latent variables were provided a metric by setting the first factor loading to one. To evaluate model fit, we considered joint global fit criteria based on values of the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR) (Hu & Bentler, 1999). Values of $CFI \geq .95$, $RMSEA \leq .06$, and $SRMR \leq .08$, in combination, were considered as indicative of a good global fit to the data (Hu & Bentler, 1999). Reliability (ω) of the higher-order need satisfaction and need frustration factors was estimated in R statistical software (R Core Team, 2022) using the `compRelSEM()` function from the *semTools* package (Jorgensen et al., 2025), based on the results of the CFA described above re-conducted using the *lavaan* package (Rosseel, 2012).

Pending support for the measurement models, we then conducted structural models in which we correlated observed scores for motivation (TSRQ-Alcohol) and protective and risk factors for alcohol use (PBSS, B-YAACQ, and USAUDIT) with the general need satisfaction and need frustration latent factors. Covariances among the observed motivation and protective and risk factor scores were estimated.

We computed correlations between all subscales of the BPNSFS at each time point and all other key variables as a supplementary analysis.

Transparency and Openness

We report how we determined our sample size, all data exclusions, all manipulations, and all measures used for the current analyses in these studies, and we follow JARS (Kazak, 2018). This study's design and its analysis were not pre-registered. Materials and analysis code for these studies are available by emailing the corresponding author.

Results

The higher-order measurement model of the BPNSFS provided a good fit to the data in Study 1, Satorra-Bentler scaled χ^2 (242, $n=1,401$)=790.54, $p<.0001$; CFI=.958; RMSEA=.040, 90% CI=.037, .043; SRMR=.038. Model fit was also good, and better than Study 1 on most indices, in Study 2, Satorra-Bentler scaled χ^2 (242, $n=2,199$)=471.96, $p<.0001$; CFI=.977; RMSEA=.021, 90% CI=.018, .024; SRMR=.041. Standardized results of the measurement model are provided in Figures 1 and 2 for Studies 1 and 2, respectively. Each item loaded saliently onto its first-order factor ($.60 \leq \text{standardized } \lambda \leq .93$) and each first-order factor loaded saliently onto its second-order factor ($.65 \leq \text{standardized } \lambda \leq .95$). In Study 1, there were large negative residual correlations between satisfaction and frustration of relatedness ($r=-.75$) and competence ($r=-.85$) (both $ps<.001$), but not autonomy ($r=.02$, $p>.05$). There were also negative residual correlations between satisfaction and frustration of relatedness ($r=-.43$) and competence ($r=-.37$) in Study 2 (both $ps<.001$); however, they were smaller in magnitude. There was a small but significant positive correlation between satisfaction and frustration of autonomy in Study 2 ($r=.12$, $p=.014$). There was a moderate to large negative correlation between general need satisfaction and need frustration factors in Study 1 ($r=-.51$) and Study 2 ($r=-.42$) (both $ps<.001$). Reliability was adequate for the need satisfaction ($\omega = .84$ and $.79$) and need frustration ($\omega = .81$ and $.75$) higher-order factors in both Study 1 and 2, respectively.

The correlations of need satisfaction and need frustration with motivations for drinking responsibly and alcohol outcomes are provided in Table 1. As shown, need satisfaction was positively correlated with autonomous motivation and introjected regulation, and negatively correlated with external regulation and amotivation. In contrast, need frustration was positively

correlated with introjected regulation (but not significantly in Study 1), external regulation, and amotivation, but not significantly correlated with autonomous motivation. Further, need satisfaction was positively correlated with PBS and negatively correlated with alcohol problems and alcohol use severity. In contrast, need frustration was negatively correlated with PBS and positively correlated with alcohol problems and alcohol use severity. Except for the positive correlation between need satisfaction and autonomous motivation, which ranged from small to moderate, these correlations were small in magnitude.

Studies 1 and 2: Supplementary Analysis

The bivariate correlations between the original six BPNSFS subscales and motivations for drinking responsibly and alcohol outcomes are provided in Supplementary Table 2.

Discussion

Studies 1 and 2 provide converging, cross-sectional support for the hypothesized associations, though the magnitude of these associations was smaller than expected—potential reasons are provided in the general discussion. Specifically, need satisfaction was positively associated with more internalized motives for drinking responsibly and alcohol harm reduction behaviors, whereas need frustration was positively associated with less internalized motives for drinking responsibly, alcohol use severity, and alcohol problems.

Study 3: Longitudinal Associations

Studies 1 and 2 were limited by cross-sectional designs. In Study 3, we sought to test the longitudinal associations over two years between need satisfaction, need frustration, and alcohol use severity by conducting a secondary data analysis of data from a national sample of adults. Notably, only data on alcohol use severity was collected in this study, and we could not test our hypothesis that need satisfaction would be associated with protective factors for alcohol use. Thus, we hypothesized that need frustration would demonstrate positive associations with alcohol use severity over time, but that need satisfaction would *not* demonstrate a statistically significant association with alcohol use severity over time.

Method

Participants and Procedure

Participants were recruited by a polling service, YouGov America. YouGov uses a sample-matching method to construct census-matched samples from a large online opt-in panel. The sampling frame is a politically representative modeled frame of American adults, based upon the American Community Survey (ACS) public use microdata file, public voter file records, the 2020 Current Population Survey (CPS) Voting and Registration supplements, the 2020 National Election Pool (NEP) exit poll, and the 2020 CES surveys, including demographics and 2020 presidential vote. The cases and the frame were combined, and a logistic regression was estimated for inclusion in the frame. The propensity score function included age, gender, race/ethnicity, years of education, region, home ownership, and 2020 presidential vote choice. The propensity scores were grouped into deciles of the estimated propensity score in the frame and post-stratified according to these deciles. YouGov's proprietary data collection standards guarantee measures of quality control and responsiveness from participants. Accordingly, only participants who demonstrated appropriate levels of survey completion effort and who completed the survey were included.

Our target sample initially consisted of a cross-section of American adults ($n=2,806$; $M_{age}=48.9$, $SD=17.2$; 1365[48.6%] male; response rate=87.6%), matched and weighted to U.S. norms for age, gender, education, census region, and race/ethnicity as of the 2019 American Community Survey (U.S. Census Bureau, 2019), as well as an additional oversample of sports-gambling adults ($n=1,557$; $M_{age}=41.7$, $SD=15.3$; 1043[67%] men; response rate=78.7%). These sample sizes were determined by budgetary constraints associated with the larger grant funding effort from which this project is derived. More details regarding the larger study are available elsewhere (Grubbs et al., 2022; Grubbs & Kraus, 2022).

Participants were initially recruited in late March 2022 through early April 2022. Due to the inability to include all key measures in a relatively short survey, one week after completing

the initial survey, participants were recontacted to complete the BPNSFS. Analyses were limited to those who completed the BPNSFS, and, for consistency with the other studies, endorsed at least monthly alcohol use at baseline (see below for details). This resulted in our final analytic sample ($n=1,719$; $M_{age}=49.0$, $SD=15.4$; 986[57.4%] men; 71.8% white).

Survey results are reported in accordance with American Association for Public Opinion Research (AAPOR) guidelines for nonprobability internet panels. Subsequent to baseline measures, participants were invited to participate in follow-up surveys every six months, beginning in Fall of 2022 ($n=1,564$; average interval=192.4 days, $SD=5.2$), continuing through Spring ($n=1,365$; average interval=182.0 days, $SD=3.1$) and Fall ($n=1,091$; average interval=193.1 days, $SD=4.7$) of 2023, and concluding in Spring of 2024 ($n=1,077$; average interval=182.3 days, $SD=5.4$) for a total of five waves of data collection. The average total length of the study was slightly over two years (average interval=753.9, days, $SD=7.0$ days). These procedures were approved by the IRB at Bowling Green State University.

Measures

At each time point, the following measures were administered. The previously described BPNSFS was used to assess need satisfaction and need frustration. General need satisfaction and need frustration scores were computed by taking the average of the satisfaction and frustration items across the psychological needs.

Alcohol use severity was assessed using a modified version of the NIDA-ASSIST-2 (Group, 2002; National Institute on Drug Abuse, 2009). Participants responded to four frequency-based questions (“In the past three months, how often have you used alcohol,” “In the past three months, how often have you had a strong desire or urge to use alcohol?”, “In the past three months, how often has your use of alcohol led to health, social, legal, or financial problems for you?”, and “During the past 3 months, how often have you failed to do what was normally expected of you because of your use of alcohol?”). Responses were recorded on a scale of 1 (Never) to 6 (More than once per day). Additionally, participants responded to two

questions “Has a friend or relative or anyone else ever expressed concern about your drinking alcohol?” and “Have you ever tried and failed to control, cut down or stop drinking alcohol?”.

Response options for these were 0 (No, never), 3 (Yes, but not in the past 3 months), and 6 (Yes, in the past 3 months). Given varying response scales to items on the NIDA-Modified-ASSIST-2, responses to each of the above items were converted to proportions

$\left(\frac{\text{item score} - \text{item minimum}}{\text{item maximum}}\right)$, resulting in scores that ranged from 0 to 1. These proportions were

then multiplied by 6, resulting in final scores from 0-6, and a composite score was computed by taking the average of the items with higher scores reflecting more severe alcohol use.

Descriptive statistics for the study variables are provided in Supplementary Table 3.

Statistical Analysis

Within and across time points, Pearson correlations with Holm adjusted test statistics were computed for included scales were computed. Additionally, we computed full correlations between all subscales of the BPNSFS at each time point and all other key variables, as a supplementary analysis. To assess trajectories over time, we computed latent growth curve models (LGCs). For all LGCs, we report multiple fit indices, including the χ^2 values, CFI, Tucker-Lewis Indices (TLI), RMSEA, and SRMR.

Longitudinally, single process growth curves were plotted for each of the three key dimensions (alcohol problems, need satisfaction, and need frustration). All growth curves were calculated using the *lavaan* package (Rosseel, 2012) for R Statistical software (R Core Team, 2022). Each model was specified using MLR estimation.¹ After computing each single-process

¹ Robustness checks for all analyses were conducted using robust diagonally weighted least squares estimation (DWLS), as such estimation is preferable for non-normal and ordinal data and is robust against possible violations of general regression assumptions such as homoscedasticity and normality of residuals (Flora & Curran, 2004; Li, 2016; Mîndrilă, 2010; Wang & Cunningham, 2005). Missing data were handled with Multiple Imputation using the *Amelia* (Honaker et al., 2011), *miTools* (Lumley, 2019), and *semTools* (Jorgensen et al., 2020) packages for R statistical software. Results for all LGC's represent pooled results across 24 imputed datasets using Rubin's (1987) rules for pooling point and SE estimates. In each case, model fit, as well as the sign, significance, and relative magnitude of estimated effects were similar across ML techniques using FIML imputation of missing data and DWLS techniques using Multiple

curve, we computed a parallel process growth curve for all three key variables (need satisfaction, need frustration, and alcohol use severity).

Transparency and Openness

We report how we determined our sample size, all data exclusions, all manipulations, and all measures used for analysis in the study, and we follow JARS (Kazak, 2018). This secondary analysis of these data was not preregistered. Materials and analysis code for this study are available by emailing the corresponding author.

Results

Correlations

Bivariate correlations among the study variables at each time point are reported in Supplementary Table 3. A full bivariate matrix of all subscales of the BPNSFS is provided in Supplementary Table 4. Large positive correlations of each study variable across time indicate that the constructs were relatively stable. Both within and across timepoints, need frustration was negatively correlated with need satisfaction; the magnitude of these associations was strong ($|r| > .40$). Both within and across time points, need frustration was positively correlated with alcohol use severity, with effect sizes ranging from moderate ($|r| > .20$) to large ($|r| > .40$). Need satisfaction was negatively related to alcohol use severity, both within and across time points, though these associations were small ($|r| < .2$).

Latent Growth Curves (LGCs)

Results from single process LGCs are available in Supplementary Table 5. In the parallel process LGC, the trends were similar to those found in the single process LGCs (see Table 2). Need satisfaction did not demonstrate a significant slope, though the variance of this slope was significant. Need frustration demonstrated a negative slope, which also demonstrated significant variance. Finally, alcohol use severity demonstrated a significant negative slope, though the

Imputation. As such, we elected to present results of MLR analyses with FIML imputation to maintain continuity with other studies within the present work.

variance for this slope was not significant, suggesting a more uniform downward trend over two years.

Table 3 presents the associations among the intercepts and slopes of the study variables. As shown, the correlation of the intercepts of need frustration and need satisfaction was negative and large. The correlation between the intercepts of need satisfaction and alcohol use severity was negative and small. Finally, the correlation of the intercepts of need frustration and alcohol use severity was positive and large.

Regarding trends over time, the slope of need frustration was significantly related to the slope of need satisfaction. This association was large and negative, suggesting that these two slopes generally move in opposition to each other over time. Regarding the slope of need satisfaction, two significant correlations emerged. The slope of need satisfaction was negatively related to the intercepts of alcohol use severity and need frustration, though these associations were small to moderate, suggesting that individuals with higher baseline alcohol use severity and/or need frustration are more likely to decrease in need satisfaction over time (rather than remaining stable as was the general trend). Regarding the slope of alcohol use severity, three associations emerged. The slope of alcohol use severity was negatively correlated with its intercept and the intercept of need frustration, suggesting that higher baseline levels of both alcohol use severity and need frustration are associated with greater decreases in alcohol use severity over time, possibly due to regression to the mean. However, and more interestingly, the slope of alcohol use severity was positively correlated with the slope of need frustration, indicating that increases or decreases in one would likely correspond to increases or decreases in the other.

Discussion

The findings of Study 3 demonstrated that greater need frustration was concurrently and prospectively associated with more severe alcohol use, with clear correspondence between the two slopes; these associations were quite strong both with regard to starting values (i.e.,

intercepts) and trajectories (i.e., slopes). In contrast, we found that greater need satisfaction was associated with less severe alcohol use at baseline, but these associations were small in magnitude and need satisfaction was not associated with changes in alcohol use severity. These findings are consistent with the findings of Study 1 such that need frustration emerged as a positive correlate of risk factors but need satisfaction did not emerge as a substantial negative correlate.

General Discussion

At the outset of the current research, we sought to examine the associations of basic psychological need satisfaction and need frustration with protective and risk factors for alcohol use across three large observational studies. Although SDT may provide a useful framework to understand the motivational conditions of both alcohol harm reduction and hazardous alcohol use to inform intervention, applications in this domain are scarce. We hypothesized, consistent with SDT, that general need satisfaction would emerge as a positive correlate of protective factors for alcohol use whereas need frustration would emerge as a positive correlate of risk factors for alcohol use.

Given our focus on general need satisfaction and need frustration, we tested a higher-order factor model in Studies 1 and 2. This model provided a good fit to the data, but as described previously, other factor models of the BPNSFS have been supported, including the original six-factor model (Chen et al., 2015; Holden et al., 2025), and a model with four substantive factors—two autonomy factors, one competence factor, and one relatedness factor—and two item-keying factors (Murphy et al., 2023). We do not suggest that the higher-order factor model examined in the current research is superior. Rather, a common finding across these models is large positive correlations among satisfaction and frustration factors of the individual needs, and findings of latent profile analyses show that satisfaction and frustration of the individual psychological needs tend to co-occur (Li et al., 2021; Rouse et al., 2020). Perhaps more importantly, SDT-based health interventions typically include techniques to

support all three psychological needs in tandem (Teixeira et al., 2020). For these reasons, there is a strong basis for our decision to focus on general need satisfaction and need frustration.

However, whether the BPNSFS validly assesses need frustration remains to be seen. Although not the focus of the current research, the large negative correlations between competence satisfaction and frustration ($r=-.85$) and relatedness satisfaction and frustration ($r=-.75$), but a non-significant correlation between autonomy satisfaction and frustration ($r=.02$), found in Study 1 is consistent with the findings of Murphy et al. (2023). Though the negative correlations between competence satisfaction and frustration ($r=-.37$) and relatedness satisfaction and frustration ($r=-.43$) were smaller in Study 2, one reason for this might be because of the planned missingness design—Murphy et al. point out that several need frustration items are reverse-worded versions of need satisfaction items, and thus completing a random set of two of the four items for each subscale would reduce the magnitude of the correlations. Although strong negative correlations between need satisfaction and need frustration are expected as “the presence of need frustration denotes the absence of need satisfaction” (Vansteenkiste & Ryan, 2013, p. 9), correlations of $-.75$ and $-.85$ cast doubt on whether separate constructs are being assessed. Importantly, need frustration research is in its nascency and greater clarity in the operational definition and improved measurement of this construct are critical, like most psychological constructs. If active thwarting is indeed an antecedent of need frustration as opposed to a feature of the condition or experience, but also what makes need frustration distinct from need satisfaction, then this is likely to create measurement challenges. A necessary direction for future research on the application of SDT to alcohol use is the replication of the current research with revised or novel measures of need frustration. That said, given limited research on the psychological needs and alcohol use, the present findings are informative whether the BPNSFS need frustration items assess need frustration, the opposite of need satisfaction, or a construct that is distinct from need satisfaction but not need frustration.

Across all three studies, we found some support for our SDT-based hypotheses regarding the associations between the psychological needs and protective and risk factors for alcohol use. Motives on the internalization continuum for drinking responsibly were assessed in Studies 1 and 2, and we found associations entirely consistent with SDT. In Studies 1 and 2, greater need satisfaction was associated with greater endorsement of autonomous motivation and introjected regulation, whereas need frustration was associated with greater endorsement of external regulation and amotivation. Importantly, research has shown that, as motivation increases in internalization, the correlation with PBS becomes increasingly positive (Richards, Morera, et al., 2021; Richards, Pearson, & Field, 2021). Together, these findings suggest promise for future research to consider the SDT model of health behavior change in relation to alcohol use. That is, need satisfaction results in positive alcohol outcomes by internalizing motivation for drinking responsibly, whereas need frustration results in poor alcohol outcomes by stymying the internalization of motivation for drinking responsibly. The inability to test this full SDT model of health behavior change is a limitation of the current research as Studies 1 and 2 were cross-sectional and Study 3 was a secondary data analysis for which the parent study did not assess motives on the internalization continuum. However, our aim for the current research was to address the critical omission of consideration of the psychological needs in applications of SDT to alcohol use which serve as the active ingredients of SDT-based health intervention.

Across Studies 1-3, we found consistent evidence for associations between need satisfaction and protective factors for alcohol use and need frustration and risk factors for alcohol use. In Studies 1 and 2, need satisfaction emerged as the salient correlate of PBS, whereas need frustration emerged as the salient correlate of alcohol use severity and alcohol problems, consistent with expectations. Study 3 extended these findings via demonstration that the association of trajectories of need frustration and alcohol use severity was positive and substantial over the two-year period of the study. Another important contribution of this study is the extension of these associations to a national sample of American adults who drank alcohol

in the past month as Studies 1 and 2 relied on convenience samples of college students. Given that Study 3 was a secondary data analysis and PBS were not assessed in the parent study, we could not test our hypothesis regarding need satisfaction and protective factors for alcohol use longitudinally. An interesting finding is the differences in effect size between Studies 1 and 2 and Study 3. That is, the positive associations between need frustration and alcohol use severity and alcohol problems were modest in Studies 1 and 2 ($r=.133-.237$), but the cross-sectional and longitudinal positive associations between need frustration and alcohol use severity were large in Study 3 ($r=.525$ and $.640$). One potential explanation is the difference in samples: college students versus general adult population). Given that alcohol use is ubiquitous in college, and young adults, more generally, report higher rates of hazardous drinking than any other age group, need frustration may be a more important psychological antecedent of hazardous drinking among the older general population of adults.

However, based on the modest associations found in Study 1 and 2, we cannot rule out the possibility that psychological needs exert a small influence on alcohol use and related behaviors, and that SDT-based alcohol intervention may not be efficacious. That said, we believe that there are compelling reasons that this may not be the case. Three recent meta-analyses found support for the efficacy of SDT-based interventions across health behaviors (Gillison et al., 2019; Ntoumanis et al., 2021; Sheeran et al., 2020), and the few trials of SDT-based alcohol interventions have found positive effects (e.g., Gustafson et al., 2014). Further, the modest associations are not necessarily inconsistent with SDT. As described previously, in the SDT model of health behavior change, the psychological needs are a more distal antecedent of health behavior with motivation serving as the more proximal, intermediary antecedent. Indeed, SDT has been most widely applied to physical activity, and the average correlation between need satisfaction and physical activity in a meta-analysis was $.22$ ($[\.15+.36+.14]/3$; Ng et al., 2012). This is consistent with the effect sizes found in the current research. Also consistent with the SDT model of health behavior change, the correlations of

need satisfaction and need frustration with motives on the internalization continuum were generally larger in magnitude. In other words, psychological needs should have a stronger influence on the internalization of motivation than directly on health behavior. Again, the inability to test this full model is a limitation of the current research, but we sought to provide preliminary support for the associations of psychological needs with alcohol outcomes prior to more intensive studies necessary for testing the full SDT model of health behavior change.

Next, the current research focused on need satisfaction and need frustration in general as opposed to specific to the context of alcohol use (i.e., global versus contextual motivation; Vallerand, 1997). Although measures of need satisfaction have been adapted for other health behaviors (e.g., exercise; Wilson et al., 2006), no measure of need satisfaction and/or need frustration has been adapted for alcohol use, to our knowledge. Contextual motivation is proposed to have a stronger influence on behavior than global motivation, and it may be that measures of need satisfaction and need frustration adapted to alcohol use demonstrate stronger associations with alcohol outcomes. Relatedly, the current research was not conducted in the context of alcohol-related behavior change (e.g., an alcohol intervention). It may be that need satisfaction and need frustration are relatively stable, as in the two years of Study 3, but that there is greater variability in context-specific need satisfaction and need frustration while individuals are attempting alcohol-related behavior change. Greater consideration of need satisfaction and need frustration in the context of alcohol use and change in alcohol use is an important direction for future research.

Limitations

There are several limitations of the current research. Studies 1 and 2 used convenience sampling and the samples in all three studies were predominantly non-Hispanic white. Future research with more diverse samples is needed to improve generalizability of the findings. In Study 2, participants completed a random 50% of items for each BPNSFS subscale, and it is unclear whether results may have changed if participants completed the BPNSFS in its entirety.

Although described at length previously, it warrants mention again here—we used the BPNSFS to assess need frustration, which has been recently criticized for not adequately assessing need frustration given the lack of thwarting content that, arguably, distinguishes need frustration from the absence of need satisfaction (Murphy et al., 2023). Further research is needed to determine whether other indicators of well- and ill-being account for the associations between the psychological needs and alcohol-related outcomes. Finally, all three studies were observational, and future experimental research is needed to causally infer whether the psychological needs affect alcohol use and related behaviors, though an aim of the current research was to motivate further experimental research, if hypotheses were supported.

Conclusions

The framework of SDT for understanding health behaviors and SDT-based health interventions have received vast support, and the findings of the current research suggest that this support may extend to alcohol use and related behaviors. Overall, our findings across three studies support some association between psychological need satisfaction and need frustration with protective and risk factors of alcohol use, respectively. Future research is needed that considers the internalization of motivation as a mechanism by which need satisfaction and need frustration exert their effects on alcohol outcomes. Additionally, context-specific measures of need satisfaction and need frustration in relation to alcohol use and related behaviors (e.g., changes in drinking) are needed. Experimental tests that manipulate support for the psychological needs are also needed. Further support in future research with greater contextual specificity would suggest that alcohol interventions might benefit from SDT-informed active ingredients and mechanisms of behavior change.

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Table 1

Correlations of Need Satisfaction and Need Frustration with Motives for Drinking Responsibly and Alcohol Outcomes.

	Study 1 (n=1,401)		Study 2 (n=2,254)	
	Satisfaction	Frustration	Satisfaction	Frustration
Autonomous Motivation	.311**	-.043	.196**	.026
Introjected Motivation	.208**	.030	.091**	.117**
External Motivation	-.104*	.301**	-.139**	.272**
Amotivation	-.173**	.220**	-.128**	.185**
Protective Behavioral Strategies	.264**	-.121**	.223**	-.056*
Alcohol Problems	-.173**	.237**	-.127**	.221**
Alcohol Use Severity	-.106**	.133**	-.105**	.162**

Table 2

Intercept, Slope, and Model Fit Statistics for Three Parallel Process Latent Growth Curve Model of Need Satisfaction, Need Frustration, and Alcohol Use Severity (Study 3; n = 1,719).

	Mean	SE	p-value	Variance	SE	p-value
Satisfaction Intercept	3.82	0.017	<.001	0.378	0.018	<.001
Satisfaction Slope	-0.002	0.005	.602	0.006	0.002	.002
Frustration Intercept	2.24	0.02	<.001	0.665	0.026	<.001
Frustration Slope	-0.049	0.005	<.001	0.006	0.002	.002
Alcohol Use Severity Intercept	1.354	0.027	<.001	1.050	.065	<.001
Alcohol Use Severity Slope	-0.058	0.006	<.001	0.005	0.004	.211

$\chi^2(90)=144.4, p<.001$

CFI=.993, TLI=.991, RMSEA=.034, SRMR=.027

Note. CFI=Robust Comparative Fit Index, TLI=Robust Tucker-Lewis Index, RMSEA=Robust Root Mean Square Error of Approximation, and SRMR=Standardized Root Mean Square Residual.

Table 3

Covariances and Correlations between Latent Intercepts and Slopes for the Three Parallel Process Growth Curve Model of Need Satisfaction, Need Frustration, and Alcohol Problems (Study 3; n = 1,719).

	Frustration Intercept	Frustration Slope	Satisfaction Intercept	Satisfaction Slope	Alcohol Use Severity Intercept	Alcohol Use Severity Slope
Frustration Intercept	--	-.129	-.601**	-.206*	.524**	-.365**
Frustration Slope	-0.008	--	.032	-.486*	-.131	.640*
Satisfaction Intercept	-0.301**	0.002	--	.091	-.113**	.106
Satisfaction Slope	-0.012*	-0.003*	0.004	--	-.228*	.269
Alcohol Use Severity Intercept	0.438**	-0.01	-0.071**	-0.017*	--	-0.599**
Alcohol Use Severity Slope	-0.021**	0.003*	0.005	0.001	-0.043**	--

Note. Covariances are below the diagonal, standardized covariances (correlations) are above the diagonal.

* $p < .05$, ** $p < .005$.

Figure 1

Standardized Results of the Higher-Order Measurement Model of the Basic Psychological Need Satisfaction and Frustration Scale in Study 1 (n=1,401).

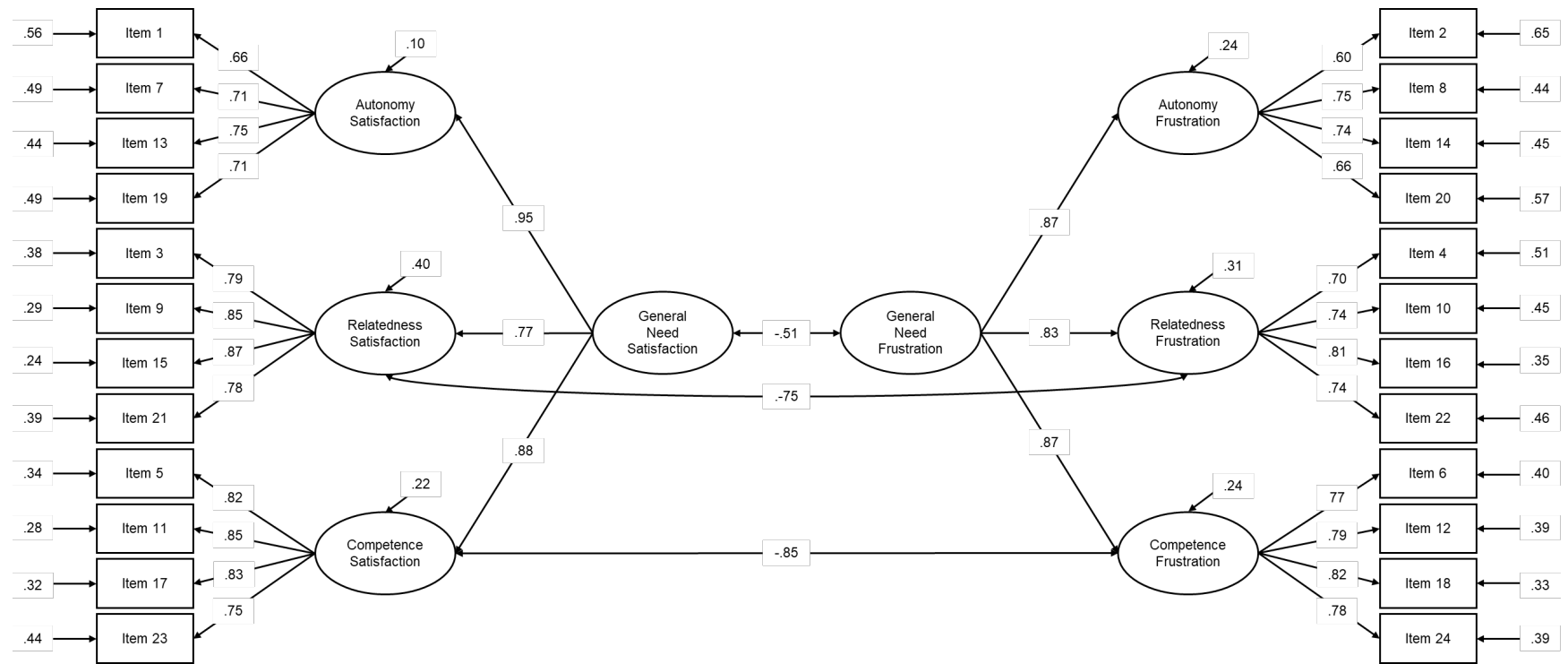
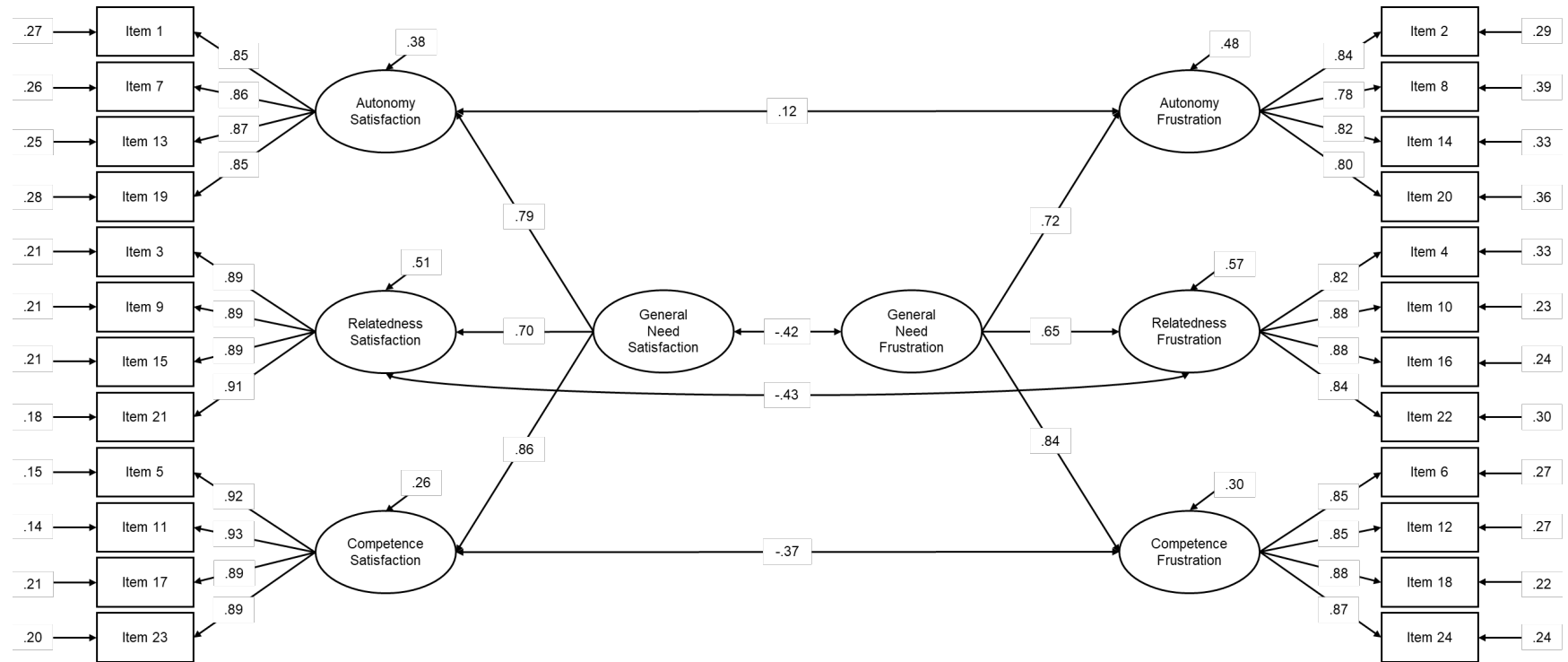


Figure 2

Standardized Results of the Higher-Order Measurement Model of the Basic Psychological Need Satisfaction and Frustration Scale in Study 2 (n=2,199).



Supplementary Table 1*Descriptive Statistics for the Study Variables in Studies 1 and 2.*

Study Variable	Study 1 (n = 1,401)		Study 2 (n = 2,276)	
	M (SD)	Cronbach's α	M (SD)	Cronbach's α
<i>Psychological Needs</i>				
Autonomy Satisfaction	3.69 (0.81)	.80	3.86 (1.04)	-
Autonomy Frustration	2.57 (0.89)	.78	2.60 (1.15)	-
Competence Satisfaction	3.78 (0.86)	.89	3.95 (1.01)	-
Competence Frustration	2.46 (1.02)	.87	2.47 (1.18)	-
Relatedness Satisfaction	4.05 (0.88)	.89	4.07 (1.03)	-
Relatedness Frustration	2.05 (0.93)	.84	1.94 (1.07)	-
<i>Motivation</i>				
Autonomous Motivation	5.20 (1.55)	.90	4.56 (1.79)	.92
Introjected Regulation	5.28 (1.78)	.85	4.11 (2.07)	.85
External Regulation	2.74 (1.63)	.85	2.47 (1.38)	.78
Amotivation	2.84 (1.72)	.71	2.84 (1.69)	.65
<i>Alcohol Outcomes</i>				
Protective Behavioral Strategies	3.80 (0.93)	.92	3.94 (0.89)	.91
Alcohol Use Severity	8.82 (5.86)	.79	9.51 (6.30)	.82
Alcohol Problems	5.99 (4.95)	.91	5.81 (5.36)	.91

Note. Frustration = Basic psychological need frustration/unfulfillment.

Supplementary Table 2

Bivariate Correlations between the Original Six Basic Psychological Need Satisfaction and Frustration Scale Subscales and Alcohol-Related Outcome Variables in Studies 1 and 2.

	Autonomy Satisfaction	Autonomy Frustration	Relatedness Satisfaction	Relatedness Frustration	Competence Satisfaction	Competence Frustration
Study 1 (n = 1,401)						
Autonomous Motivation	.303**	.007	.187**	-.034	.234**	-.026
Introjected Regulation	.205**	.047	.142**	-.005	.135**	.060*
External Regulation	-.061*	.258**	-.116**	.273**	-.090**	.210**
Amotivation	-.169**	.171**	-.112**	.177**	-.117**	.147**
Protective Behavioral Strategies	.230**	-.078**	.225**	-.095**	.190**	-.099**
Alcohol Use Severity	-.101**	.093**	-.095**	.114**	-.061*	.082**
Alcohol Problems	-.128**	.121**	-.166**	.188**	-.121**	.164**
Study 2 (n = 2,276)						
Autonomous Motivation	.164**	.034	.166**	-.041	.132**	.042*
Introjected Regulation	.094**	.098**	.092**	.012	.042*	.113**
External Regulation	-.085**	.169**	-.078**	.202**	-.137**	.191**
Amotivation	-.112**	.096**	-.094**	.153**	-.091**	.123**
Protective Behavioral Strategies	.185**	-.022	.180**	-.088**	.153**	-.019
Alcohol Use Severity	-.110**	.091**	-.065**	.142**	-.068**	.092**
Alcohol Problems	-.125**	.137**	-.077**	.175**	-.086**	.133**

Note. Frustration = Basic psychological need frustration/unfulfillment.

* $p < .05$, ** $p < .001$.

Supplementary Table 3

Means, Standard Deviations, and Bivariate Correlations for the Study Variables Across Time Points (Study 3; n = 1,719).

	Range	Mean	SD	α	Wave 1			Wave 2			Wave 3.			Wave 4			Wave 5	
					Sat.	Frust.	ETOH	Sat.	Frust.	ETOH	Sat.	Frust.	ETOH	Sat.	Frust.	ETOH	Sat.	Frust.
<i>Wave 1</i>																		
Sat.	1-5	3.82	0.72	.91														
Frust.	1-5	2.45	0.91	.91	-.48													
ETOH	0-6	1.37	1.17	.84	-.08	.42												
<i>Wave 2</i>																		
Sat.	1-5	3.83	0.78	.92	.69	-.48	-.09											
Frust.	1-5	2.27	0.93	.92	-.49	.77	.37	-.46										
ETOH	0-6	1.2	1.04	.82	-.11	.35	.75	-.11	.41									
<i>Wave 3</i>																		
Sat.	1-5	3.89	0.72	.92	.72	-.49	-.10	.72	-.52	-.11								
Frust.	1-5	2.26	0.89	.92	-.48	.77	.35	-.51	.81	.34	-.53							
ETOH	0-6	1.09	0.97	.82	-.08	.33	.72	-.07	.34	.76	-.08	.39						
<i>Wave 4</i>																		
Sat.	1-5	3.85	0.79	.92	.67	-.45	-.11	.66	-.52	-.14	.75	-.54	-.10					
Frust.	1-5	2.16	0.88	.92	-.47	.73	.26	-.50	.76	.31	-.57	.80	.29	-.50				
ETOH	0-6	1.05	0.88	.81	-.08	.33	.72	-.06	.32	.70	-.16	.31	.73	-.09	.36			
<i>Wave 5</i>																		
Sat.	1-5	3.87	0.79	.93	.70	-.55	-.19	.67	-.57	-.14	.75	-.62	-.16	.75	-.60	-.17		
Frust.	1-5	2.11	0.88	.92	-.55	.73	.24	-.54	.75	.27	-.59	.79	.28	-.55	.80	.28	-.58	
ETOH	0-6	0.97	0.89	.81	-.09	.30	.68	-.10	.28	.69	-.12	.27	.73	-.12	.25	.69	-.14	.32

Note. Sat. = Basic psychological need satisfaction, Frust. = Basic psychological need frustration/unfulfillment, ETOH = Alcohol use severity.

All correlations with an absolute value of $|\geq .07|$ or greater significant at .05, Holm adjusted;

All correlations at an absolute value of $|\geq .14|$ or greater significant at .001, Holm adjusted.

Supplementary Table 4

Supplementary Table 4 can be found here: <https://osf.io/pm34x>.

Supplementary Table 5*Univariate Growth Models for the Study Variables (Study 3; n = 1,719).*

	Mean	SE	p-value	Variance	SE	p-value
Satisfaction Intercept	3.82	.017	.000	0.38	0.02	<.001
Satisfaction Slope	0.00	0.00	.721	0.006	0.002	.004
Intercept-Slope Correlation	.127	--	.171			
Model Fit						
$\chi^2(10)=14.63, p=.146$						
CFI=.999, TLI=.999, RMSEA=.021, SRMR=.018						
Frustration/Unfulfillment Intercept	2.42	0.02	<.001	0.66	0.03	<.001
Frustration/Unfulfillment Slope	-	0.01	<.001	.006	.002	.002
	0.051					
Intercept-Slope Correlation	-.131	--	.116			
Model Fit						
$\chi^2(10)=32.13, p < .001$						
CFI=.994, TLI=.994, RMSEA=.055, SRMR=.027						
Alcohol Use Severity Intercept	1.354	0.027	<.001	1.050	.065	<.001
Alcohol Use Severity Slope	-	0.006	<.001	0.005	0.004	.211
	0.058					
Intercept-Slope Correlation	-	--	-.599			
Model Fit						
$\chi^2(10)=18.89, p=.042$						
CFI=.995, TLI=.995, RMSEA=.052, SRMR=.036						

Note. All fit statistics are robust statistics (except SRMR, for which there is not a robust variant).