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## Meaning in life: investigating protective and risk factors for harmful alcohol consumption

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### ABSTRACT

**Background:** Individuals with greater meaning in life tend to consume less alcohol. However, research elucidating pathways through which meaning in life influences consumption is lacking. Behavioral economic theories posit that distortions in valuation processes, whilst negative reinforcement models posit that avoidance or regulation of negative internal states, are central in decisions to consume alcohol.

**Method:** Pre-registered, cross-sectional design. Five hundred forty-six regular alcohol consumers ( $\geq 18$  years old) completed an online questionnaire which asked about alcohol use, meaning in life, alcohol-free reinforcement, alcohol value, depressive symptoms, and drinking to cope motives.

**Results:** Presence of meaning had a significant negative association with AUDIT scores ( $\beta = -.26$ ,  $p < .001$ ), but neither search for meaning nor alcohol-free reinforcement were significant predictors ( $ps > .53$ ). Subsequent path analyses revealed a significant indirect effect of presence of meaning on AUDIT scores through lower alcohol value (95% CI =  $-.17$  to  $-.08$ ) and drinking to cope (95% CI =  $-.07$  to  $-.00$ ), and a serial mediation effect through both lower depressive symptoms and drinking to cope (95% CI =  $-.09$  to  $-.04$ ). Although search for meaning was not a direct predictor of AUDIT scores, there was a significant indirect effect through greater drinking to cope (95% CI =  $.01$  to  $.06$ ) and a serial mediation effect through both greater depressive symptoms and drinking to cope (95% CI =  $.01$  to  $.04$ ).

**Conclusions:** Meaning in life subscales predict alcohol consumption indirectly via individual differences in alcohol value, depressive symptoms, and drinking to cope.

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Alcohol-free reinforcement; depressive symptoms; drinking to cope; meaning in life; alcohol value

### Introduction

Excessive alcohol consumption results in an array of adverse social and economic outcomes (Rehm and Imtiaz 2016). Meaning in life (i.e. a life characterized by comprehension and significance; George and Park 2013) is often divided into two subscales (Steger et al. 2006): ‘presence’ reflects the extent to which a person currently experiences life meaning and ‘search’ reflects the extent to which a person is actively seeking life meaning. Research reliably demonstrates that presence of meaning in life is inversely associated with alcohol consumption (Robinson et al. 2007; Schnitzer et al. 2013; Krentzman et al. 2017; Copeland et al. 2020; Csabonyi and Phillips 2020), however the relationship between search for meaning in life and alcohol consumption is less clear: one study found a positive association (Copeland et al. 2020) whilst another study found no significant association (Csabonyi and Phillips 2020) between the two. Put another way, some evidence shows that elevated search for meaning in life is characterized by higher levels of alcohol


consumption, which may in part be due to frustration or disappointment (e.g. if a person is searching for meaning but not attaining it; Watson et al. 2020), however this finding is not consistently reported in the literature. Less is currently understood about what characterizes a meaningful life and how this construct in turn influences alcohol consumption.

Behavioral economic theories emphasize that harmful alcohol consumption and dependence arise from, and are maintained by, excessive valuation of alcohol relative to alcohol-free alternative reinforcers (Bickel et al. 2014; Hogarth and Field 2020). Alcohol’s reinforcing value (also termed *demand*) is commonly measured using hypothetical purchase tasks which instruct participants to estimate consumption of alcohol across a set of prices that gradually increase (Murphy and MacKillop 2006; Owens et al. 2015). Alternatively, alcohol-free reinforcement is often measured using reinforcement surveys which capture the frequency of participation in, and enjoyment derived from, activities that do not involve consuming alcohol (Murphy et al. 2005).

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There is robust evidence to show that alcohol value is positively associated (Martínez-Loredo et al. 2021), whilst alcohol-free reinforcement is negatively associated (Acuff et al. 2019) with harmful alcohol consumption. To date few studies have attempted to link these behavioral economic constructs with research on meaning in life.

One recent cross-sectional study found that people with high presence of meaning have lowered behavioral economic demand for alcohol and lower scores on the alcohol use disorders identification test (AUDIT; Copeland et al. 2020), which may in part be due to elevated alcohol-free alternative reinforcement. Different factors may contribute to increasing alcohol-free reinforcement, one of them being age. To elaborate, age-related declines in alcohol consumption are common (Britton et al. 2015), and alongside age, presence of meaning increases whilst search for meaning decreases (Steger et al. 2009), an observed pattern which may be attributable to shifts to more alcohol-free reinforcement. For example, ‘maturing-out’ (O’Malley 2004) of alcohol use is often accompanied by the acquisition of adult roles that are incompatible with heavy drinking (e.g. parenthood and employment; Staff et al. 2010, 2014), but that might lead to increased opportunity to derive reinforcement from alcohol-free activities (e.g. after becoming a parent a person might enjoy spending more time with family).

Further evidence for the tentative link between meaning in life and alcohol-free reinforcement stems from research by Steger et al. (2013) who asked people to take photos of and write about things that made their life feel meaningful, and subsequently categorized these images to reflect different sources of meaning. Although multifaceted in nature, many categories of meaning were compatible with elevated alcohol-free reinforcement: work/occupation, relationships with others (e.g. family), engaging with hobbies (e.g. art/exercise/gardening) and activities (e.g. volunteering), were among the categories, for example. This is broadly consistent with other research that has aimed to identify important sources of meaning in life (Debats 1999; Hill et al. 2013; Glaw et al. 2017). In line with behavioral economic accounts (Murphy, MacKillop, et al. 2012) then, it may be that as a person increases reinforcement from alcohol-free activities that provide a sense of meaning, alcohol becomes less valuable as the perceived costs of harmful alcohol consumption (such as being hungover for childcare or work) increase and/or the benefits (such as intoxication) decrease.

Depression may be another important factor within the relationships between meaning in life and alcohol consumption. Elevated depressive symptoms are negatively correlated with presence of meaning and positively correlated with search for meaning (Steger et al. 2009), and a longitudinal study found that increased presence of meaning in life predicted decreased depressive symptoms over a 6-month period (Disabato et al. 2017). Furthermore, depressive symptoms are positively associated with alcohol consumption (Graham et al. 2007; Brière et al. 2014; Lai et al. 2015; Pedrelli et al. 2016). Negative reinforcement models are not incompatible with behavioral economic accounts, but differ on their relative point of emphasis in that they posit that

people are likely to consume alcohol to avoid or regulate negative internal states (Cooper et al. 1995; Baker et al. 2004; Blevins et al. 2016). Indeed, drinking to cope (i.e. consuming alcohol to relieve negative affective states) is consistently associated with alcohol consumption and problems (Cooper et al. 2016). The cross-sectional and longitudinal associations between depressive symptoms and drinking to cope (Holahan et al. 2003; Grant et al. 2009; Kenney et al. 2015; Bravo et al. 2018) suggest that alcohol may be a crucial coping mechanism for people with elevated levels of depression. Interestingly, meaning in life plays an important role in a person’s ability to cope with stressful or demanding situations (Ostafin and Proulx 2020), and promotes adaptive coping strategies such as positive reframing (Frankl 1985; Park et al. 2008; Hooker et al. 2018; Miao and Gan 2019). Therefore, presence of meaning is associated with reduced levels of depression and increased adaptive coping which may represent a potential pathway through which meaning protects against harmful alcohol consumption, however this has not yet been explored.

In summary, a wealth of research demonstrates that presence of meaning in life is associated with reduced alcohol consumption. However, findings regarding the role of search for meaning in life are mixed (e.g. Copeland et al. 2020; Csabonyi and Phillips 2020). A body of theoretical and empirical work highlight the importance of alcohol value, alcohol-free reinforcement, depressive symptoms, and drinking to cope within decisions to consume alcohol. However, relationships between these constructs and meaning in life remains relatively unexplored. Therefore, the aim of this study is twofold: (1) attempt to replicate and extend findings from Copeland et al. (2020) to clarify the role of search for meaning in life, and (2) explore the mediating effects of alcohol-free reinforcement, alcohol value, depression, and drinking to cope within the relationships between meaning in life subscales and AUDIT scores. Design, hypotheses, and analysis strategy were pre-registered before data collection commenced (<https://aspredicted.org/3h8xb.pdf>). Specifically, we hypothesized that:

1. Elevated AUDIT scores will be significantly negatively associated ( $p < .05$ ) with presence of meaning in life, but significantly positively associated with search for meaning in life. We also hypothesize that elevated AUDIT scores will be significantly negatively associated with alcohol-free reinforcement.<sup>1</sup>
2. There will be significant indirect effects of meaning in life subscales (presence of meaning and search for meaning) on AUDIT scores through alcohol-free reinforcement, depressive symptoms, drinking to cope, and alcohol value.

<sup>1</sup>This hypothesis reflects our pre-registered focus on whether alcohol-free reinforcement can account for additional variance beyond meaning in life variables. We made a minor deviation from our pre-registration by entering average alcohol-free reinforcement instead of frequency and enjoyment subscales (this does not change the interpretation of results; see [supplementary materials](#) for justification).

## Methods

### Participants

An initial 959 volunteers accessed the study link; however, the final analytical sample comprised 546 volunteers (see [supplementary materials](#)). For structural equation modeling (SEM), it has been recommended that the sample size is a minimum of 200 (Kline 2005) however we aimed for a minimum sample size of 400. We oversampled because our recruitment target was reached prior to the end of our testing period, and this allowed us to increase the robustness of our parameter estimates. Ages ranged from 18 to 75 years old (mean = 32.95, SD = 14.22), 351 volunteers were female, 190 were male, 3 were non-binary, and 2 did not disclose their gender. The inclusion criterion was consumption of alcohol (at least one occasion per week), and the exclusion criterion was any history of treatment for alcohol use disorder. Data were collected between November 2020 and January 2021. Participants were recruited via social media platforms and an online research participation system (ORPS) for undergraduate students. There was no financial reimbursement for participation, however undergraduate students who took part through ORPS ( $n = 49$ ) were reimbursed with a course credit. There were four attention checks in total, and all participants passed at least 75% of these which was our pre-registered criterion. The study was approved by the University of Sheffield research ethics committee, and all volunteers provided informed consent.

### Materials

*Alcohol Use Disorders Identification Test* (AUDIT; Saunders et al. 1993): This 10-item scale is used to detect patterns of alcohol consumption that are harmful or hazardous to health. Total scores range between 0 and 40. The AUDIT had acceptable internal reliability in the current study, McDonald's  $\omega = .79$  (McDonald 1970, 1999).

*The Meaning in Life Questionnaire* (MLQ; Steger et al. 2006): This 10-item scale is used to measure (1) presence (how much meaning people perceive their life to have), and (2) search (how much people are striving to find meaning in their life) for meaning in life. Each construct is evaluated by 5 items and participants responded on a scale ranging from 1 (absolutely untrue) to 7 (absolutely true). Total scores on each subscale range from 5 to 35, with higher scores indicating higher presence of meaning and search for meaning. Both subscales had excellent internal reliability in this study; presence subscale  $\omega = .92$ , search subscale  $\omega = .91$ .

*Personal Health Questionnaire Depression Scale* (PHQ-8; Kroenke et al. 2009): This 8-item scale is used to measure depressive symptoms. Participants rated how often they experienced each item in the past two-weeks on a scale ranging from 0 (not at all) to 3 (nearly every day). Total scores range from 0 to 24. The PHQ-8 had good internal reliability in this study,  $\omega = .89$ .

*Activity Level Questionnaire* (ALQ; based on Meshesha et al. 2020): This modified 17-item measure was used to assess past-month reinforcement derived from alcohol-free

activities only. Past month ratings of frequency of engagement in each activity were made on a scale ranging from 0 (0 times in the past month) to 6 (several times per day) and enjoyment on a scale ranging from 0 (unpleasant or neutral) to 4 (extremely pleasant). Participants were explicitly instructed to only consider activities that did not involve alcohol when responding to the items. We modified this measure by extending the range of response options for frequency, reducing the number of items to reduce participant burden, and updating content to reflect currently common activities (see [supplementary materials](#)). The frequency and enjoyment ratings were multiplied to obtain cross-product scores (range = 0–24 for each item) which reflected overall activity reinforcement. The cross-product scores were then averaged across all activities to compute a mean alcohol-free reinforcement score for each participant. This approach to measuring and calculating alcohol-free reinforcement is similar to that of previous research (Murphy, Dennhardt, et al. 2012).

*Drinking Motives Questionnaire - Revised* (DMQ-R; Cooper 1994): We administered the 5-item coping subscale to measure participants' coping motives for alcohol use. Participants responded on a scale ranging from 1 (almost never/never) to 5 (almost always/always). The coping subscale had good internal reliability in this study,  $\omega = .83$ .

*Brief Assessment of Alcohol Demand* (BAAD; Owens et al. 2015): This 3-item scale is used to measure three indices of alcohol demand. Intensity represents alcohol consumption independent of price ('If drinks were free, how many would you have?') with responses ranging from 0 to 10 drinks.  $O_{\max}$  represents the maximum expenditure a person is willing to spend on alcohol ('What is the maximum total amount you would spend on drinking during that drinking occasion?') with responses ranging from £0 to £30. Breakpoint represents the first price that suppresses consumption to zero ('What is the maximum you would pay for a single drink?') with responses ranging from £0 to £15.

*Demographic questions*: Participants answered questions about their age (continuous), gender (male/female/non-binary/prefer not to say), ethnic group (multiple options), and highest educational attainment (multiple options).

### Data preparation

We pre-registered that if the BAAD indices were significantly intercorrelated they would be combined into a proxy of alcohol value in line with previous research (Copeland et al. 2020), however this was not the case in the present study (breakpoint and intensity,  $r(544) = -.02$ ,  $p = .58$ ; intensity and  $O_{\max}$ ,  $r(544) = .48$ ,  $p < .001$ ;  $O_{\max}$  and breakpoint,  $r(544) = .40$ ,  $p < .001$ ). Similar to other research (Rose et al. 2018; Hardy et al. 2021), we used intensity to represent alcohol value which is a reliable index of demand (Acuff and Murphy 2017). See [supplementary file](#) for analyses repeated with  $O_{\max}$  and breakpoint.

## Data analysis

Hierarchical regression was used to investigate whether the associations between meaning in life subscales and AUDIT scores from Copeland et al. (2020) could be replicated. We expanded by including alcohol-free reinforcement as an additional step in the model to explore whether this can predict additional variance in AUDIT scores. Age and gender were adjusted for because they are associated with alcohol use (Chaiyasong et al. 2018). Gender was entered into the model as a dichotomous variable (comprising male and female), meaning that participants who identified as non-binary or preferred not to say were excluded from the analysis, however this was only a small subset of the sample (0.9%;  $n = 5$ ).<sup>2</sup>

SEM was used to explore relationships between meaning in life subscales and alcohol value, alcohol-free reinforcement, depressive symptoms, drinking to cope, and AUDIT scores. Maximum likelihood estimation was used to test the hypothesized model. Multiple indices of model fit were calculated. Normed chi-square values up to 5 are indicative of acceptable model fit (Schumacker and Lomax 2004). Standardized root mean residual (SRMR) values under .08 are indicative of a good model fit, and Tucker-Lewis index (TLI) values of above .90 are considered acceptable (Hu and Bentler 1999). Additionally, comparative fit index (CFI) values of .90 or greater are considered acceptable, while root mean square error of approximation (RMSEA) values of lower than .08 indicate an acceptable fit (Browne and Cudeck 1993). Following inspection of the modification indices, where appropriate covariance pathways were added between error terms to improve model fit. The relationships within the model were described using standardized regression coefficients and bias-corrected bootstrapping (5000 times) was used to generate confidence intervals (95% CI) for all regression coefficients and indirect effects in the structural model.

We conducted correlational analyses on the variables captured in the present study for exploratory purposes; these are placed in the [supplementary materials](#). Statistical analyses were conducted in RStudio version 4.0.2 (R Core Team 2020). For the SEM, we used the 'lavaan' package (Rosseel 2012). Data and analysis scripts are available and can be found here: <https://researchbox.org/677>.

## Results

### Pre-registered analyses

See Table 1 for descriptive statistics.<sup>3</sup> To test our first hypothesis, we conducted a hierarchical regression. The overall regression model significantly predicted approximately 12% of variance in AUDIT scores ( $R^2 = .12$ ,  $F(5, 535) = 14.25$ ,  $p < .001$ ). Age and gender predicted

**Table 1.** Descriptive statistics (mean, standard deviations (SD) and range) of the total sample ( $n = 546$ ).

	Mean (SD, range)
AUDIT	10.83 ( $\pm 5.80$ ; 1–31)
Alcohol-free reinforcement	6.19 ( $\pm 2.62$ ; 0–19.06)
Presence	23.76 ( $\pm 7.02$ ; 5–35)
Search	21.08 ( $\pm 7.38$ ; 5–35)
Depressive symptoms	6.57 ( $\pm 5.39$ ; 0–24)
Drinking to cope	1.80 ( $\pm 0.73$ ; 1–4.80)
Alcohol value (intensity)	5.68 ( $\pm 2.65$ ; 1–10)

Two-thirds of the sample ( $n = 364$ ; 66.67%) were likely hazardous or harmful drinkers ( $AUDIT \geq 8$ ). AUDIT = Alcohol Use Disorders Identification Test (alcohol use and related problems; 1 UK unit = 8 g of alcohol; possible range of values = 0 to 40). Presence = presence of meaning in life; Search = search for meaning in life (possible range of values = 5 to 35). Alcohol value (intensity) = how many drinks would be consumed if they were free (possible range of values = 0 to 10). Alcohol-free reinforcement (possible range of values = 0 to 24). Depressive symptoms (possible range of values = 0 to 24). Drinking to cope (possible range of values = 1 to 5).

approximately 6% of variance in AUDIT scores. After adjusting for age and gender, presence of meaning and search for meaning in life predicted a further 6% of variance in AUDIT scores. The addition of alcohol-free reinforcement did not account for any additional variance in AUDIT scores (see Table 2). Multi-collinearity indices were low ( $VIFs < 1.29$ ).

### Structural model

To explore our second hypothesis, we conducted a SEM to investigate whether some of the variance in the relationship between meaning in life and AUDIT scores could be accounted for by individual differences in alcohol value, alcohol-free reinforcement, depressive symptoms, and drinking to cope.

**Model fit.** Modification indices suggested covariances needed to be added (alcohol value and drinking to cope, and alcohol-free reinforcement and depressive symptoms) which led to a notable improvement in model fit.<sup>4</sup> After adding covariances, the hypothesized structural model proved to be a good fit of the data (SRMR = .03; CFI = .99; TLI = .92; RMSEA = .08 (90% CI = .03 to .14);  $X^2/df = 4.65$ ) and the overall model predicted approximately 43% of variance in AUDIT scores ( $R^2 = .43$ ).

### Model evaluation (Figure 1)

#### Direct effects

Presence of meaning had a significant positive association with alcohol-free reinforcement (95% CI = .19 to .36), and a significant negative association with alcohol value (95% CI =  $-.36$  to  $-.18$ ), depressive symptoms (95% CI =  $-.54$  to  $-.40$ ) and drinking to cope (95% CI =  $-.21$  to  $-.02$ ). The direct effect of presence of meaning on AUDIT scores was not statistically significant (95% CI =  $-.16$  to .01).

<sup>2</sup>These participants were not excluded from the SEM as gender was not included as a covariate in the model.

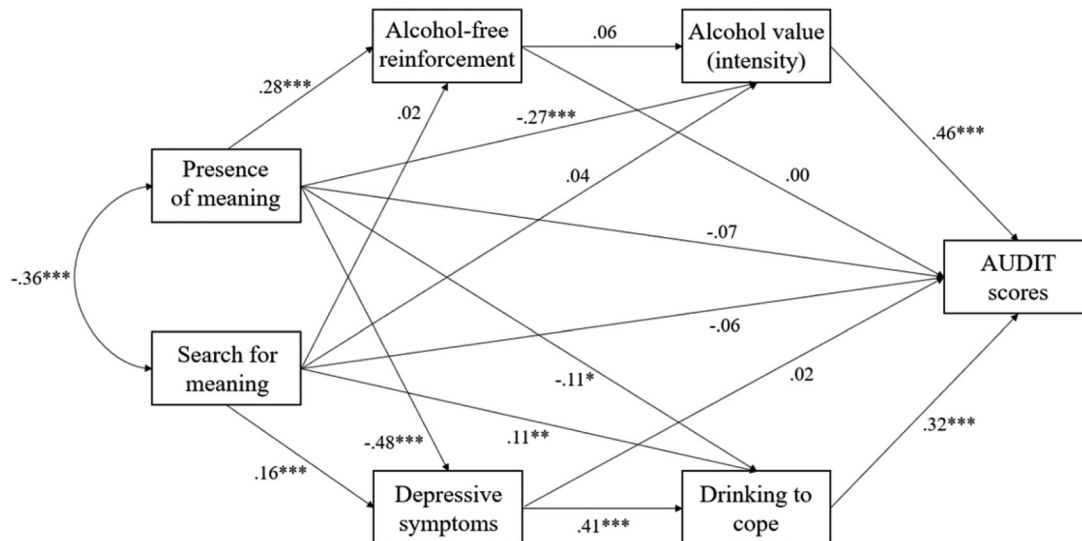
<sup>3</sup>For interested readers, for frequency of alcohol consumption derived from the AUDIT item 1 the mean is 2.88 (SD = .80) and for quantity of alcohol consumption derived from AUDIT item 2 the mean is 1.86 (SD = 1.34).

<sup>4</sup>Prior to the implementation of modifications, not all model fit indices of the hypothesized structural model were a good fit of the data (SRMR = .06; CFI = .95, TLI = .73, RMSEA = .15 (90% CI = .11 to .18);  $X^2/df = 12.71$ ).

**Table 2.** Hierarchical regression predicting AUDIT scores, predictor variables are presence of meaning, search for meaning, and average alcohol-free reinforcement after controlling for age and gender.

Variable	Cumulative		Simultaneous			
	R <sup>2</sup> -change	F-change	B	B(SE)	$\beta$	p
<i>Step 1</i>						
Age	.06	F(2, 538) = 15.56***	-.07	.02	-.18	p < .001
Gender			.23	.51	.02	p = .65
<i>Step 2</i>						
Presence	.06	F(2, 536) = 18.96***	-.22	.04	-.26	p < .001
Search			-.02	.04	-.03	p = .53
<i>Step 3</i>						
Alcohol-free reinforcement	.00	F(1, 535) = .21	-.04	.10	-.02	p = .65

Presence = presence of meaning in life; Search = search for meaning in life; Alcohol-free reinforcement = overall alcohol-free reinforcement (cross-product scores averaged across all activities). \*\*\*p < .001.



Standardized parameter estimates are presented. Age is not modeled as a covariate; when we repeated the analyses with age included as a covariate this did not alter model fit or the nature of the regression coefficients (this is placed in the supplementary materials). p < .001, p < .01, p < .05.

**Figure 1.** Direct and indirect relationships between meaning in life, alcohol consumption, alcohol-free reinforcement, alcohol value, depressive symptoms, and drinking to cope.

Search for meaning had a significant positive association with depressive symptoms (95% CI = .09 to .24) and drinking to cope (95% CI = .03 to .19). However, there were no significant associations between search for meaning and alcohol-free reinforcement (95% CI = -.07 to .12), alcohol value (95% CI = -.05 to .13), and AUDIT scores (95% CI = -.14 to .01).

Depressive symptoms had a significant positive association with drinking to cope (95% CI = .31 to .51) and drinking to cope had a significant positive association with AUDIT scores (95% CI = .22 to .41). Alcohol-free reinforcement had no significant association with alcohol value (95% CI = -.03 to .14), but alcohol value had a significant positive association with AUDIT scores (95% CI = .39 to .53). Neither alcohol-free reinforcement (95% CI = -.06 to .07) or depressive symptoms (95% CI = -.08 to .12) had any significant association with AUDIT scores.

#### Indirect effects

There was a significant indirect effect of presence of meaning on AUDIT scores through lower alcohol value and

drinking to cope. Depressive symptoms alone were not a significant mediator within the relationship between presence of meaning and AUDIT scores, however there was a serial mediation effect through both lower depressive symptoms and drinking to cope.

There was a significant indirect effect of search for meaning on AUDIT scores through greater drinking to cope. Similarly, depressive symptoms alone were not a significant mediator within the relationship between search for meaning and AUDIT scores, however there was a serial mediation effect through both greater depressive symptoms and drinking to cope (see Table 3 for parameter estimates, p-values, and 95% confidence intervals).

#### Discussion

The aim of this study was to clarify the relationships between presence of and search for meaning in life and AUDIT scores (hazardous drinking), and to elucidate potential pathways that can explain variance in these associations. Our finding that presence of meaning in life is inversely associated with AUDIT scores aligns with previous

**Table 3.** Indirect effects from the structural equation model.

Association	$\beta$	$p$ -value	95% Confidence Interval
Presence → alcohol-free reinforcement → AUDIT	.00	$p = .95$	-.02 to .02
Presence → alcohol value → AUDIT	-.13	$p < .001$	-.17 to -.08
Presence → alcohol-free reinforcement → alcohol value → AUDIT	.01	$p = .20$	-.00 to .02
Presence → depressive symptoms → AUDIT	-.01	$p = .68$	-.06 to .04
Presence → drinking to cope → AUDIT	-.04	$p = .01$	-.07 to -.00
Presence → depressive symptoms → drinking to cope → AUDIT	-.06	$p < .001$	-.09 to -.04
Search → alcohol-free reinforcement → AUDIT	.00	$p = .95$	-.00 to .00
Search → alcohol value → AUDIT	.02	$p = .35$	-.02 to .06
Search → alcohol-free reinforcement → alcohol value → AUDIT	.00	$p = .64$	-.00 to .01
Search → depressive symptoms → AUDIT	.00	$p = .68$	-.01 to .02
Search → drinking to cope → AUDIT	.04	$p = .01$	.01 to .06
Search → depressive symptoms → drinking to cope → AUDIT	.02	$p < .001$	.01 to .04

Standardized parameter estimates are presented. Presence = presence of meaning in life; Search = search for meaning in life. AUDIT = Alcohol Use Disorders Identification Test.

correlational and longitudinal research conducted across diverse samples, including young adults (Csabonyi and Phillips 2020), students (Schnitzer et al. 2013), general populations (Copeland et al. 2020), and people receiving treatment for alcohol use disorder (Robinson et al. 2007; Roos et al. 2015).

We also found that search for meaning in life was not a significant predictor of AUDIT scores, and therefore we did not replicate findings from Copeland et al. (2020). Nevertheless, these findings are in line with Csabonyi and Phillips (2020) and add to a mixed evidence base, supporting the notion that search for meaning in life is not a robust predictor of elevated AUDIT scores. A potential explanation for these mixed findings may be due to the idiosyncratic nature of what it means to be searching for meaning, in that this construct may be experienced differently across individuals (Steger et al. 2008). To elaborate, for some people, searching for meaning may symbolize something that is negative while for other people this might symbolize something that is positive, promoting active seeking of meaning (Watson et al. 2020) and this may in turn differentially impact alcohol consumption. Another possible explanation may be due to subjectivity—many common self-report measures of meaning in life require participants to interpret question items with the words ‘meaning’ and ‘meaningful’ for themselves (Prinzing et al. 2022). Lack of understanding about search for meaning in life specifically may be exacerbated through the scarcity of research exploring this construct: many existing measures utilized in alcohol-related research only explore presence of, as opposed to search for, meaning in life (Robinson et al. 2007; Martin et al. 2011; Schnitzer et al. 2013). To the best of our knowledge, this is only the third study to explore the relationship between search for meaning and alcohol consumption.

Unexpectedly we observed that greater reinforcement derived from alcohol-free activities was not significantly associated with lower AUDIT scores. A wealth of evidence demonstrates inverse associations between alcohol-free reinforcement and substance use (Correia et al. 2005; Bickel et al. 2014). For example, Acuff et al. (2019) conducted a systematic review of the existing literature and concluded that across a diverse range of studies, engagement with substance-

free alternative activities is protective against harmful consumption. However, it is difficult to directly reconcile our findings with existing behavioral economic literature because the current study did not compute a *proportionate* measure of alcohol-free reinforcement (i.e. the relative reinforcement derived from alcohol-free activities as relative to alcohol-related activities). In line with Hallgren et al. (2016), these findings highlight the complexity of alcohol-free reinforcement measurement and the subsequent associations with AUDIT scores. The context by which the study took place is also of importance, in that COVID-19 lockdown regulations likely meant that access to many sources of substance-free reinforcement that compete with harmful alcohol consumption had been restricted (Acuff et al. 2021), and therefore the reported pattern of reinforcement may not have been reflective of a person’s typical pattern (i.e. their pattern of reinforcement prior to the pandemic). Alternatively, it may be that regular sources of alcohol-free reinforcement have become unavailable due to lockdown restrictions (Coughlin et al. 2021) and consequently reinforcement may have shifted to activities in the home that are not so incompatible with harmful drinking (e.g. watching TV or virtual socializing; Boursier et al. 2021; Nguyen et al. 2020).

Our structural model revealed interesting insights into the potential pathways through which presence of meaning in life is negatively associated with AUDIT scores. The mediating effect of alcohol value aligns with existing research (Copeland et al. 2020) which also found that people with higher presence of meaning attach less value to alcohol, and in turn have lower AUDIT scores. Theoretical accounts emphasize the importance of valuation processes within decisions to consume alcohol (Field et al. 2020; Hogarth and Field 2020) and a recent meta-analysis revealed robust associations between indices of alcohol value (e.g. intensity) and alcohol consumption ( $r = .49$ , 95% CI = .46 to .53; Martínez-Loredo et al. 2021). The extent to which alcohol is highly valued is therefore likely a key mechanism within the relationship between presence of meaning in life and AUDIT scores. Perhaps as a person acquires life meaning, this provides structure that exacerbates the costs of drinking relative to the benefits, and this in-turn alters the value that people ascribe to alcohol. Indeed, people with presence of



meaning in life experience an increased sense of structure and order (Stavrova et al. 2020) and it may be that sources of meaning that provide such structure (e.g. employment, volunteering, or parenting) are prioritized over consuming alcohol. For example, a study in a student population found that they valued alcohol less when their daily structure or routine encompasses some form of next day responsibility, specifically those which require an early waking routine (Gilbert et al. 2014). Accordingly, alcohol may decrease in value as the costs become more significant (e.g. being hung-over when you need to wake up early for work or childcare), whereas this is potentially absent in people who are searching for meaning in life. Another potential explanation in light of COVID-19 may be that alcohol has become a valuable way of managing acute mood states, such as boredom (Lunnay et al. 2021), and it may be that people with presence of meaning are less likely to experience this increase in alcohol value because there are other meaningful activities for them to engage in. Interestingly from a behavioral economic perspective, although presence of meaning is characterized by greater alcohol-free reinforcement, findings from this study demonstrate that it is the reinforcing value of alcohol that has a crucial mediating effect in the link between presence of meaning and AUDIT scores.

Our findings also extend prior research by demonstrating—for the first time—the indirect effect of presence of and search for meaning in life on AUDIT scores via drinking to cope. These findings are particularly interesting because although search for meaning did not directly predict AUDIT scores, our structural model revealed a mediating effect via drinking to cope. Indeed, drinking to cope is a robust predictor of increased alcohol consumption (Cooper et al. 2016) which has emerged as a salient motive during the COVID-19 pandemic (McPhee et al. 2020; Rogers et al. 2020; Irizar et al. 2021). Similar to previous research (Holahan et al. 2003; Grant et al. 2009; Kenney et al. 2015; Bravo et al. 2018; Magee and Connell 2021) we found a positive association between depressive symptoms and drinking to cope, and although depressive symptoms alone were not a significant mediator within the relationships between meaning in life subscales and AUDIT scores, there was a serial mediation effect through both depressive symptoms and drinking to cope. These findings can be interpreted in line with negative reinforcement and motivational models that posit substances are used in attempt to ameliorate negative mood states (Cooper et al. 1995; Blevins et al. 2016). More specifically, our finding that presence of meaning is negatively correlated, while search for meaning in life is positively correlated with depressive symptoms aligns with existing research (Steger et al. 2009; Disabato et al. 2017). Given that experiencing meaning in life is protective against psychological distress and negative thinking following aversive events (Ostafin and Proulx 2020), it may therefore be that people with greater meaning in life are less likely to consume alcohol to cope with depressive symptoms, whereas people who are searching for meaning in life may be more likely to drink for this reason. Instead, acquiring meaning may enable people to implement forms of coping that are adaptive, such as implementation of strategies that enable positive

reframing and acceptance, alongside engagement in healthy alternative behaviors such as exercise (Cairney et al. 2014; Hooker and Masters 2016; Hooker et al. 2018).

There were some limitations to the present study. First, it was conducted during a global pandemic, and with a sample that consume alcohol at least once per week, thereby limiting the generalizability of these findings to other time-periods and people who consume alcohol less frequently or abstain altogether. Second, there is likely a reasonable degree of measurement error in the quantification of alcohol-free reinforcement and other variables that may impact alcohol-free reinforcement, such as income, were not measured. Third, the data were cross-sectional which means it is not possible to establish causal relationships between the variables, and mediation analyses on cross-sectional data should be interpreted with caution (Fairchild and McDaniel 2017). Finally, although we exceeded the minimum recommended sample size for SEM (Kline 2005), we did not conduct an *a priori* power analysis (Wang and Rhemtulla 2021).

Future research may address these limitations by computing a proportionate alcohol-free reinforcement score alongside the continued refinement of question items to work toward developing accurate measurements of retrospective activity enjoyment and frequency, but also map changes in value, meaning in life, and alcohol consumption longitudinally. Future studies could also further explore the idiosyncratic nature of search for meaning in life, such as through the use of qualitative research, to better understand how this construct relates to patterns of alcohol consumption across different people. Interestingly, Sliedrecht et al. (2022) prospectively followed up a clinical sample of people in treatment for alcohol use disorder (AUD) and found no significant associations between meaning in life and levels of craving or alcohol relapse. It is important to note that previous research on recovery (e.g. Roos et al. 2015) used measures that capture ‘purpose in life’ which may be conceptually distinct from meaning in life (Martela and Steger 2016): goals, aims, and direction in life are related to purpose, whereas comprehension and significance in life are related to meaning (George and Park 2013). Theoretically, then, it may be that meaning in life is inversely associated with hazardous patterns of alcohol consumption, whereas purpose in life may be positively associated with recovery from AUD. This is an interesting avenue for future research to explore, alongside the exploration of whether people with higher in presence of meaning in life are more likely to voluntarily abstain from alcohol, independently of their personal history of AUD.

To conclude, this study adds to a robust body of evidence demonstrating an inverse relationship between presence of meaning in life and AUDIT scores, but we were unable to replicate or reconcile recent findings regarding search for meaning in life. In regular alcohol consumers, presence of meaning appears to exert its protective effect via lower alcohol value, depressive symptoms, and drinking to cope, whereas search for meaning appears to be a risk factor only indirectly via greater depressive symptoms and drinking to cope. These findings contribute toward bridging the gap between behavioral economic and meaning in life research,

and in doing so, elucidate potential pathways through which acquiring life meaning may in turn influence alcohol use and related problems. Increasing the perception of life as meaningful should be a core target for treatment interventions for those who consume alcohol regularly and are trying to reduce hazardous patterns of alcohol consumption which in turn may help people to value alcohol less and find other healthy ways to cope that do not involve alcohol.

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No potential conflict of interest was reported by the author(s).

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## Data availability statement

Data and analysis scripts are available and can be found on Research Box: <https://researchbox.org/677>

## Open Scholarship



This article has earned the Center for Open Science badges for Open Data and Preregistered through Open Practices Disclosure. The data and materials are openly accessible at <https://researchbox.org/677> and <https://aspredicted.org/3h8xb.pdf>.

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