Depressive Symptoms, Alcohol Use and Coping Drinking Motives: Examining Various Pathways to Suicide Attempts Among Young Men

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Abstract

Background. Research has identified several correlates of suicidal behaviors including depressive symptoms, alcohol use and coping drinking motives. However, their associations and their role as possible causal mechanisms in the prediction of suicide attempt are not well understood. In response, this study examined, both cross-sectionnaly and longitudinally, the potential pathways from alcohol use, drinking coping motives, and depression to suicide attempts. **Methods.** Participants ($N = 4,617$) were young Swiss men (mean age = 19.95) participating in the Cohort Study on Substance Use Risk Factors. Measures of depressive symptoms, alcohol use (total drinks per week, heavy episode drinking) and coping drinking motives were used from the baseline and/or 15-month follow-up assessments to predict follow-up suicide attempt. **Results.** Main findings showed indirect associations through depressive symptoms, such that coping drinking motives were positively associated with depressive symptoms, which were in turn positively related to suicide attempts over time (for total drinks per week models, cross-sectional model: $B = 0.131$, $SE = 0.035$, 95% CI $= 0.072, 0.207$; longitudinal model: $B = 0.039$, $SE = 0.013$, 95% CI $= 0.019, 0.069$). **Limitations.** Main limitation includes a low prevalence rate for suicide attempt potentially reducing power effects in the main analyses and our focus on distal—yet not proximal, role of alcohol use on suicide attempt. **Conclusions.** Findings of the current study suggest that young men with depressive symptoms and/or those who use alcohol to cope with negative affect may benefit from programs targeting suicidal behaviors.

Keywords: young adults, alcohol, suicide, depressive symptoms, coping drinking motives

Introduction

Suicide represents a major public health problem in youths. According to the World

Health Organization, suicide is the second leading cause of deaths in youths worldwide (aged 15-

29), with males being at greater risks than females. In high-income countries, suicide accounts

for 17.6% of all deaths in this age group (World Health Organization, 2015). Furthermore, it is

estimated that for every death by suicide, there are up to 20 nonfatal suicide attempts (World

Health Organization, 2014). In response, past research has aimed to identify correlates of young

adult suicidal behaviors (i.e., suicide attempt, death by suicide) in clinical and community

samples. Research findings have consistently shed light on high rates of mental (e.g., depression)

and behavioral (e.g., alcohol use) disorders in youth suicide attempters or completers (Ferrari et

al., 2014).

A Major Depressive Episode is one of the most significant risk factors for suicidal

behaviors (Ferrari et al., 2014; Kessler et al., 1999). Recent epidemiological findings

documented it to be responsible for the largest proportion (i.e., more than 46.1%) of the suicides

attributable to mental and substance use disorders (Ferrari et al., 2014). The role of depression

(i.e., depression diagnoses and symptoms) in suicidal behaviors has been supported by several

studies with youths that have consistently documented significant positive associations between

these two phenomena (Groholt et al., 2005; Kovacs et al., 1993; Lamis et al., 2010; Windle,

2004).

According to the World Health Organization, alcohol use plays a role in up to 22% of all

suicides in high-income countries (World Health Organization, 2015). Research among young

adults has examined level of alcohol use, such as heavy episodic drinking/ risky single occasion

drinking (i.e., HED or risky single occasion drinking, RSOD, reporting > 60gr of pure alcohol on

a single occasion ; Dawson, 2011; Wechsler et al., 1994) and alcohol use disorders, in relation to suicidal behavior. Although not always consistent (Cosgrave et al., 2004; Yoder, 1999), previous research in clinical and community samples of youths (i.e., adolescents, college students, conscripts) has generally documented significant positive associations between alcohol use (i.e., frequency of drinking, HED, drinking while down, alcohol abuse) and suicide attempts in these populations (Bagge and Sher, 2008; Leichliter, 1998; Rossow et al., 1999; Schilling et al., 2009; Windle, 2004).

There is also evidence that depressive symptoms and chronic alcohol use are interconnected, although the complexity of this association is not fully understood (O'Neil et al., 2011); whereas evidence in youths supports an unidirectional association between depressive symptoms and future alcohol use (i.e., alcohol abuse; Crum et al., 2008; Fergusson and Woodward, 2002; McCarty et al., 2012), there is also evidence that alcohol abuse may increase risk for future depressive symptoms (Skogen et al., 2015). Further, past research has shown that depressive episodes may be substance-induced among individuals with alcohol-use disorders (Regier et al., 1990; Schuckit et al., 1997; Widiger et al., 1994) and among young adults who drink to intoxication (Skogen et al., 2015), and that both substance-induced depression and independent depression are positively associated with suicide attempts (Conner et al., 2014).

Surprisingly, little research has simultaneously examined the nature of the relation between depressive symptoms and alcohol use with suicidal behaviors. A study conducted in an adolescent female sample found that the positive association between alcohol abuse and lifetime suicide attempts was no longer significant when controlling for a major depressive episode. However, both alcohol dependence and major depression remained significant when considered simultaneously. These findings suggest that depression may be accounting for associations

between alcohol abuse-suicide attempt relations—(Glowinski et al., 2001). That being said, a study conducted in a sample of college students found that the significant positive association between depressive symptoms and suicide proneness was partially mediated through alcohol use frequency (Lamis et al., 2010).

Next, theoretical work has pointed to the inability to regulate negative affect as an additional predisposing factor to suicidal behavior (Conner et al., 2008). Accordingly, past research examining suicide attempts in youths has found suicide attempters to have greater deficits in problem-solving abilities than non-suicide attempters (Rickelman and Houfek, 1995). Further, two cross-sectional studies of young adults (i.e., college drinkers with a history of suicidal ideation, homeless adolescents/young adults) found positive associations between coping drinking motives (i.e., usually consuming alcohol to avoid, escape, or attenuate negative affects) and severity of suicidal ideation, as well as history of a suicide attempt (i.e., suicidal ideation, history of attempted suicide; Gonzalez et al., 2009; Kidd and Carroll, 2007). Scarce research has examined the interconnection among depressive symptoms, alcohol use, coping drinking motives and suicidal behaviors. One cross-sectional study conducted among college drinkers showed that coping drinking motives mediated the positive association between suicidal ideation and alcohol outcomes even when controlling for depression (Gonzalez et al., 2009), thereby suggesting that associations between alcohol and suicidal ideation may be due to using alcohol to cope/escape distress. Finally, another cross-sectional study among adolescents tested a multivariate path model; findings revealed coping drinking motives to be positively associated with depression and HED, which were in turn positively related to suicide attempt (Windle, 2004).

Research to date provides evidence regarding the interconnection of depressive symptoms, coping drinking motives, alcohol use and suicidal thoughts and behaviors. That being said, the cross-sectional design of these previous studies preclude drawing inferences regarding the temporal associations among these variables. Further, whereas previous literature points to several potential paths linking these variables to suicide attempts, no study has examined these paths simultaneously. This study builds upon previous research by examining, cross-sectionnaly and longitudinally the direct and indirect influences of alcohol use, drinking coping motives, and depression on suicide attempts within a large representative sample of young men in Switzerland. Increasing our understanding of different pathways to suicide attempts can help inform tailored suicide prevention and treatment strategies amongst young adults.

Methods

Study Design and Participants

The current study drew on data from the baseline and 15-month follow-up assessments (hereafter referred as to baseline and follow-up) from the Cohort Study on Substance Use Risk Factors (C-SURF), designed to examine substance-use trajectories in young men in Switzerland. Participants were enrolled between August 2010 and July 2011 in 3 of the 6 army-recruitment centers in the French and German parts of Switzerland (i.e., covering 21 of the 26 Swiss cantons). In Switzerland, army recruitment is mandatory and all men aged 19-20 undergo a recruitment process to evaluate their eligibility for military service. As a result, virtually all men aged 19-20 in the 21 covered cantons were eligible for inclusion in the study. The C-SURF was conducted independently of the army; indeed, participants were enrolled independently of their eligibility for military service and completed questionnaires outside of the army environment (Gmel et al., 2015).

Of the 7,556 participants who provided written informed consent to participate in the parent study, 5,987 (79.2%) filled in the baseline assessment between September 2010 and March 2012; of these, 5,479 (91.5% of the baseline sample) completed the follow-up questionnaire between March 2012 and April 2013. Non-response analysis indicated that non-respondents reported more alcohol use than respondents, when they were alcohol consumers, but non-respondents were less often alcohol users than respondents. The magnitude of these differences was, however, small, indicating a small non-response bias (Studer et al., 2013). Abstainers at the baseline or the follow-up assessment ($n = 568$) were not included in the current study because the questionnaire assessing coping drinking motives was administrated among 12-month drinkers only. Missing values on key variables were listwise deleted ($n = 294$), resulting in a final sample of 4,617 participants (see Figure 1). The research protocol was approved by the Ethics Committee for Clinical Research of the Lausanne University Medical School.

Measures

Socio-demographic variables. Age, level of schooling, and linguistic regions (i.e., French-speaking, German-speaking) were measured at baseline. These measures were used to describe the sample and served as covariates in the analyses.

Suicide attempts. Suicide attempts at follow-up were measured with one item adapted from the College Alcohol Study (Wechsler et al., 1994). Participants were asked to indicate how often they had attempted suicide in the past year on a Likert scale ranging from 1 to 5, where 1 = *never, and* 5 = *10 times or more often*. Answers were dichotomized to yield a 1-year report of at least one suicide attempt, with 0 = no suicide attempt, 1 = at least one suicide attempt. This measure served as the outcome in the analyses.

Depressive symptoms. Severity of depressive state (hereafter referred as to depressive symptoms) was assessed at baseline and at follow-up with the Major Depression Inventory (MDI; Bech et al., 2001), which is a 10-item scale covering the ten ICD-10 symptoms of depression (e.g., feeling lacking in energy and strength, feeling that life wasn't worth living; World Health Organization, 1994). Participants were asked to indicate how often they had been feeling each symptom over the past two weeks on a 6-point Likert scale, where 0 = *at no time* and 5 = *all the time*. Internal consistency was adequate ($\alpha = 0.89$). This measure was treated as a latent variable for ordinal data in the analyses; specifically, each item was constrained to load on its latent variable. Mean score across the ten items was also computed to describe the sample.

Coping drinking motives. Coping drinking motives were measured at baseline and at follow-up with a 3-item subscale of the Drinking Motives Questionnaire Revised Short Form (DMQ-R SF; Kuntsche and Kuntsche, 2009). Participants were asked to consider all the time they had consumed alcohol in the past year and indicate how often they did so for coping drinking motives, using a 5-point Likert scale, where 1 = *never* and 5 = *always*. Coping drinking motives subscale showed adequate consistency ($\alpha = 0.85$). Coping drinking motives were treated as a latent variable for ordinal data in the analyses. Mean score across the 3 items was also computed for descriptive purposes.

Alcohol use. The average number of drinking days and the number of standard drinks (i.e., a standard drink = 10gr of ethanol) consumed per drinking day over the past 12 months were measured at baseline and at follow-up. The average number of drinks per week (total drinks per week) over the past 12 months at baseline and follow-up were computed by multiplying the number of drinking days by the number of drinks per drinking day. The second measure of alcohol use was heavy episode drinking (HED: consuming 60g or more of pure alcohol

consumed quickly on a single, discrete occasion). Participants were asked to indicate how often they drank six or more alcoholic beverages (> 60gr of pure alcohol) on one occasion in the past 12 months with a Likert scale ranging from 0 = *never*, to 5 = *every day or almost every day.* Answers were dichotomized to yield a report of monthly HED, where 0 = *reporting less than 1 HED per month* and, 1 = *reporting one or more HED per month*. Either number of drinks per week or HED were used as mediators and predictors in the analyses.

Statistical Analyses

Descriptive statistics were used to describe the sample. Next, structural equation models (SEMs) were used to examine the path from alcohol use and coping drinking motives at baseline to suicide attempts at follow-up through depressive symptoms at baseline (see model 1, Figure 2). One additional SEM was conducted to examine cross-sectionnaly these paths using measures from the follow-up exclusively (see model 2, Figure 3). A final SEM was conducted to examine simultaneously the paths from depressive symptoms, alcohol use and coping drinking motives at baseline to suicide attempts at follow-up, through alcohol use, coping drinking motives and depressive symptoms at follow-up (see models 3, see Figures 4 and 5). For all SEMs, separate models were conducted for each parametrization of alcohol use (total number of drinks per week and HED). All models were adjusted for demographic covariates on mediators and the main outcome (suicide attempt). Probit regressions with weighted least squares means and variance adjusted (WLSMV) estimation were used (Muthén and Muthén, 1998). WLSMV is a robust estimator and is preferred when estimating models combining dichotomous, ordinal or continuous variables (Brown, 2006; Kline, 2010). To test mediation (indirect effects) bias corrected bootstrap 95% confidence intervals (CI) were computed by means of bootstrap resampling with 5000 draws. A 95% biascorrected CI around the point estimate of the indirect effect that does not cross zero

indicates statistical significance. Model fit was examined using the comparative fit index (CFI)

and the root mean square error of approximation (RMSEA). A CFI higher than .95 and a RMSEA

close to 0.06 or lower indicate of a good fit (Hu and Bentler, 1999). Because of significant

departure from normality distributions, total drink per week variables (from baseline and follow-

up) were log-transformed prior to analyses. Descriptive analyses were conducted on SPSS 23 and

the SEMs on Mplus 7.

Results

Descriptive statistics are presented in Table 1 and bivariate correlations between study

variables are presented in Table 2. Parameters of associations between independent variables to

mediators (i.e., a paths), from mediators to suicide attempts (i.e., b paths), and direct

associa[1]tions (i.e., c' paths) are shown in Figures 2-5. Total associations and tests of mediated

effects (i.e., indirect effects; a X b paths) are displayed in Tables 3-4. Fit indices indicated that

the SEMs achieved a good fit (all CFIs > 0.95; all RMSEAs < 0.06)[1].

**Initial Prospective Models: Baseline Independent Variables Predicting Follow-Up Suicide
Attempt Through Baseline Mediators**

**Model 1: Baseline depressive symptoms as a mediator of the association between
baseline alcohol use and coping drinking motives and follow-up suicide attempt.**

Alcohol use and suicide attempt. The total prospective associations between alcohol use

at baseline and suicide attempts at follow-up were not significant in both models (total drinks per

week, HED, see Figure 2 and Table 3). However, it is possible to have significant mediation

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[1]Complete parallel analysis including non-drinkers were conducted (where non-drinkers were
scored the minimum score on coping drinking motives). Results were similar to the analysis
excluding non-drinkers, thereby excluding potential selection effects.

(indirect effects) in the absence of a total effect (O'Rourke and MacKinnon, 2015). The indirect associations through depressive symptoms did reach significance and were negative in both alcohol parameterization models, such that when controlling for coping drinking motives, alcohol use was negatively associated with depressive symptoms at baseline, which were in turn related to a greater likelihood to report suicide attempt at follow-up. Notably, the observed alcohol effect represents the variance left over after adjusting for coping drinking motives. When coping drinking motives is not included in the model, the indirect association through depressive symptoms is significant and positive: alcohol use is positively related to depressive symptoms which in turn increases risk for follow-up suicide attempt[2].

Coping drinking motives and suicide attempt. In both models (total drinks per week, HED), the total prospective associations between coping drinking motives at baseline and suicide attempts at follow-up were significant. Likewise, the indirect associations through depressive symptoms were significant in both models, indicating that coping drinking motives, after adjustment for usual alcohol use, were positively related to depressive symptoms at baseline, which were in turn associated with a greater likelihood to report suicide attempt at follow-up. As shown in Table 3, for both indirect effects (i.e., alcohol through depression and coping through depression), significance was not consistent across standardized and unstandardized estimates. Given that parameter estimates standard errors and that standardized standard errors are not rescaled, confidence intervals may slightly differ for raw unstandardized and standardized coefficient (Muthén and Muthén, 1998). Notably, both indirect effect sizes were small, indicating that findings must be interpreted with caution.

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[2] Results of model 2 without coping drinking motives are presented as supplementary material (i.e., Table S2, Model 1).

Complementary analysis examining depressive symptoms at baseline to suicide attempt at follow-up through alcohol use and coping drinking motives at baseline were conducted and are presented as supplementary material (i.e., Table S1). Findings indicated that the specific indirect association of depressive symptoms with suicide attempts through total drinks per week and HED did not reach significance, whereas there was a significant mediated (indirect) effect through coping drinking motives.

Cross-sectional Models Measured at Follow-Up: Independent Variables Predicting Suicide Attempt Through Mediators

Model 2: Depressive symptoms as a mediator of the associations of alcohol use and coping drinking motives with suicide attempts.

Alcohol use and suicide attempts. In both models, the total cross-sectional associations between alcohol use and suicide attempts were not significant. As shown in Figure 3 and Table 3, the indirect associations through depressive symptoms were significant and negative. These findings indicate that, although alcohol use was not significantly related to suicide attempt (total association), there was a significant negative indirect (mediated) effect through depressive symptoms, such that alcohol use was negatively associated with depressive symptoms, which were in turn positively related to suicide attempts, when adjusting for coping motives for drinking. Notably, and similar to Model 2, effect size was small and when coping motives are not included in these models, the indirect association through depressive symptoms is significant and positive[3].

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[3] Results of model 4 without coping drinking motives are presented as supplementary material (i.e., Table S1, Model 2).

Coping drinking motives and suicide attempts. The total cross-sectional associations between coping drinking motives and suicide attempts, as well as the indirect associations through depressive symptoms, were significant in both models.

Complementary analysis examining cross-sectionnaly depressive symptoms to suicide attempt through alcohol use and coping drinking motives were conducted and are presented as supplementary material (i.e., see Table S1). Findings indicated that neither the specific indirect associations through alcohol nor coping drinking motives reached statistical significance and thus alcohol and coping drinking motives did not mediate these associations.

Full Prospective Models: Baseline Independent Variables Predicting Follow-Up Suicide Attempt Through Follow-Up Mediators

Model 3: Follow-up depressive symptoms, alcohol use and coping drinking motives as mediators of the associations between baseline depressive symptoms, alcohol use and coping drinking motives and future suicide attempts.

Depressive symptoms to suicide attempt at follow-up. The total associations between depressive symptoms at baseline and suicide attempts at follow-up were significant in both models (total drinks per week, HED; see Table 4; Figures 4 and 5). The specific indirect associations through alcohol use and coping drinking motives at follow-up did not reach significance, whereas it was significant through depressive symptoms; these findings indicate that only depressive symptoms at baseline was related to increased depressive symptoms at follow-up, which were in turn associated with a greater likelihood to report a suicide attempt at follow-up.

Alcohol use to suicide attempts at follow-up. As shown in Table 4, and Figures 4 and 5, the total associations between alcohol use at baseline and suicide attempts at follow-up were not significant in both models. There was, however, a significant negative specific indirect effect of alcohol use at baseline through depressive symptoms at follow-up, such that alcohol use at baseline was associated with decreased depressive symptoms at follow-up, which were in turn positively related to suicide attempts at follow-up. As previously, effect size was small, and when coping motives and depressive symptoms at baseline are not included in the model, the indirect association through depressive symptoms is positive[4].

Coping drinking motives to suicide attempts at follow-up. The total associations between coping drinking motives at baseline and suicide attempts at follow-up were not significant in both models. The specific indirect associations through alcohol use and coping drinking motives at follow-up were not significant in both models, but there was a significant specific indirect association through depressive symptoms at follow-up. Although effect size was small, these findings indicate that coping drinking motives at baseline were significantly related to increased depressive symptoms, which were in turn related to a greater likelihood to report suicide attempt at follow-up.

Discussion

The current study aimed to examine, both cross-sectionnaly and longitudinally the potential pathways from alcohol use, drinking coping motives, and depression to suicide attempts within a large representative sample of young men in Switzerland. Our main findings indicated

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[4] Results of Model 5 without drinking motives at baseline are presented as supplementary material (Table S2 Model 5).

significant indirect associations between coping drinking motives and suicide attempts through

depressive symptoms, such that baseline coping drinking motives were positively related to

baseline depressive symptoms, which were in turn related to greater likelihood to report suicide

attempt at follow-up (Model 1). The same findings were yielded when examined cross-

sectionnaly (i.e., Model 2). Finally, main findings of the full model (Model 3) showed that when

all constructs were considered simultaneously, baseline depressive symptoms and coping

drinking motives were indirectly associated with suicide attempts through follow-up depressive

symptoms.

Unlike depressive symptoms and coping drinking motives, the role of quantity/frequency

of alcohol use in future suicide attempts was not supported by our findings. Specifically, we did

not find an overall association, whether cross-sectionnaly or prospectively, between alcohol use

and suicide attempts. The current study's finding of no bivariate association between alcohol use

quantity and HED with suicide attempts are in line with past time series analyses that reported no

significant associations between per capita alcohol use and suicides in certain "wet" countries,

including Switzerland (Gmel et al., 1998). Our findings suggest that social and cultural factors

may influence the association between quantity/frequency of alcohol use and suicidal behaviors

(Gmel et al., 1998; Ramstedt, 2001). It has been argued that the lack of an association in certain

"wet" countries such as Switzerland may pertain to a higher acceptance level of alcohol abuse,

potentially leading to a reduced level of stigmatization of alcohol abusers (Gmel et al., 1998).

Further, findings revealed a positive indirect path from alcohol use to suicide attempts, through

depression, when models did not adjust for coping reasons for consumption (see Supplementary

Models, Table S2). However, when adjusting for coping reasons for drinking, the indirect path

became negative such that *less* drinking was related to more depression, which in turn increased

risk for suicide attempt. This shows that it is not alcohol use *per se* that can indirectly pose increased risk for suicide attempt, but rather drinking to cope. Our findings suggest that future research and preventive interventions targeting suicidal behaviors should take cultural factors into account when designing studies and strategies. Whereas it may be relevant to prioritize an alcohol quantity/frequency construct into programs targeting suicidal behaviors in "dry" countries, such constructs may not be as beneficial in "wet" countries.

Importantly, our findings that depressive symptoms and coping drinking motives were positively related to suicide attempts are congruent with past suicidality research (Groholt et al., 2005; Kidd and Carroll, 2007; Kovacs et al., 1993; Lamis et al., 2010; Windle, 2004), and show that they represent risk factors for suicide attempts among Swiss young adult males. Previous research has shed light on particularly risky drinking settings among young adults, such as solitary heavy drinking, drinking while feeling down and drinking to cope with negative affect that were found to be positively associated with suicidal behaviors (Gonzalez, 2012; Gonzalez et al., 2009; Schilling et al., 2009). Accordingly, our findings indicated that coping drinking motives were involved with depressive symptoms and suicide attempts. Specifically, we found that depressive symptoms at follow-up mediated the associations between baseline depressive symptoms and coping drinking motives and future suicide attempts. It is yet important to note that the size of the indirect effect of depression on the association between coping and suicide attempt was rather small when examined longitudinally (i.e., models 1 and 3). A potential explanation may be that our models were inclusive of a wide range of measures, which may have diluted the overall effect sizes. That said, although future research further confirming these findings are needed, our results are supported by the fact that this indirect effect was consistently significant across all models.

Our findings are in line with Windle and colleagues cross-sectional study (2004) that showed coping drinking motives was positively related to depression, which in turn was related to increased risk for suicide attempts among adolescents. Importantly, the longitudinal design of the current study adds to the literature in clarifying the temporal association between depressive symptoms, coping drinking motives and suicide attempts. Specifically, findings show that coping drinking motives predict depressive symptoms and that suicide attempts occur while experiencing depressive symptoms. Additionally, our findings that depressive symptoms and coping drinking motives were consistently positively associated with one another when examined cross-sectionnaly indicate that both phenomena may reinforce each other and contribute to a higher risk for suicide attempts. Thus, it would be beneficial for practitioners to not only ask individuals about their level of depressive symptoms, but also to inquire whether individuals use alcohol to cope to increase early identification of those at increased risk of suicidal behaviors. Taken together, our findings suggest that young adults with depressive symptoms and/or those using alcohol to cope with negative affect may benefit from programs targeting suicidal behaviors and that such programs should include interventions aiming to enhance adaptive skills to cope with negative affect.

Limitations and future directions

Although the major strengths of this study are its longitudinal design and its large sample size, it is not without limitations. First, the sample included a representative sample of young Swiss men, which precludes generalizing findings to other populations (i.e., females; older individuals). Replication of the study with a sample including females and older males is therefore needed. Second, diagnoses (e.g. alcohol use disorders and major depression) were not assessed within this study. Given that strong and consistent associations have been found for

alcohol use disorders (especially severe alcohol use disorders), compared to alcohol use, in its

relation with suicidal behaviors (Borges & Loera, 2010), future research is needed to further

examine pathways involving alcohol use disorders, major depression, suicidal behaviors, as well

as other substance use. Third, our prevalence rate for past year attempt was ~1% and thus we had

reduced power to detect effects in our most complex model (i.e., Model 5; where all constructs

were considered simultaneously). However, it is important to highlight that we did obtain similar

results between our most restrictive model and our less restrictive preliminary models.

Additional limitations include the short time of follow-up and the temporal sequencing of

the predictors. Whereas alcohol use and coping drinking motives were assessed over the past 12

months, depression covered the past 2 weeks, raising issues in model 3 (including depression at

follow up as the mediator of the association between predictors at baseline and suicide attempt at

follow-up). That said, it is important to note that our main findings were consistent across our

different models and thereby across different temporal sequences. Next, the current study

focused on the distal/chronic (e.g., 12-month quantity/frequency patterns) role of alcohol use—

and did not assess the proximal (acute effects soon after drinking) role of alcohol use on risk for

suicide attempt. Future work including assessment of proximal (event-based) indices (alcohol

use, coping drinking motives, and level of depression) on the day of the attempt would help to

disentangle distal/acute effects of alcohol use in relation to suicidal behavior. This would be

especially beneficial considering the robustness of the association between proximal alcohol use

and suicidal behaviors (Bagge and Borges, 2017), that during intoxication alcohol can acutely

increase depressonegic effects (see Bagge & Sher, 2008), and that people have different motives

for drinking immediately prior to their attempt (See Bagge et al., 2015). Finally, although socio-

demographic characteristics were added as covariates, main analysis were not controlled for other potential confounders (e.g., child abuse, family dysfunction).

Despite these limitations, we believe that the current study contributes to the literature by further clarifying the roles of depressive symptoms, alcohol use and coping drinking motives in future suicide attempts among young adults. The most striking finding of this study was that depressive symptoms had a mediating effect on the association between coping drinking motives and suicide attempts, such that endorsing high coping drinking motives was positively related to subsequent depressive symptoms, which was in turn associated with greater likelihood to make a suicide attempt. Although future research is needed to confirm these results, our findings suggest that it is using alcohol to cope with negative affect (rather than the quantify-frequency of consuming alcohol *per se)* that increases depressive symptoms and places young adults at greater risk for suicide attempts. Additional findings revealed consistent cross-sectional associations between depressive symptoms and coping drinking motives, suggesting that both phenomena may reinforce each other and contribute to a higher risk for suicide attempts. Taken together, these findings suggest that young adults with depressive symptoms and/or those who use alcohol to cope with negative affect should be considered for prevention and intervention programs aimed at reducing suicidal behaviors.

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Table 1

Descriptive Statistics of Demographic and Key Variables at Baseline and 15-month Follow-up (N = 4617)

Variables	*M / %*	*SD*
Demographic variables		
Age	19.95	1.19
Levels of schooling[1]		
Level 1	49.0%	
Level 2	28.2%	
Level 3	22.8%	
Linguistic regions		
French-speaking	54.5%	
German-speaking	45.5%	
Suicide attempts[2]		
Report of at least one suicide attempt at 15-months	0.9%	
Alcohol use		
Total drinks per week at baseline	9.94	10.14
Total drinks per week at 15 months	8.70	9.43
At least one HED in the past month at baseline	50.5%	
At least one HED in the past month at 15 months	48.3%	
Depressive symptoms[2]		
Depressive symptoms at baseline	0.69	0.68
Depressive symptoms at 15 months	0.78	0.68
Coping motives[3]		
Coping drinking motives baseline	1.59	0.77
Coping drinking motives at 15 months	1.63	0.78

Note. [1]Primary school: level 1 = obligatory school (i.e., 8-10 years), level 2 = obligatory school plus basic apprenticeship or vocational school (i.e., 12 years), level 3 = completed vocational school diploma, high school diploma or bachelor. [2]Percentage of participants

reporting a suicide attempt over the past year. [2]Mean score of 10-item of the MDI, ranging from 0-5. [3]Mean score of 3-item subscale of the DMQ-R SF ranging from 1 to 5; HED = heavy episode drinking.

Table 2.

Bivariate Correlations among Study Variables at Baseline and Follow-up

Variable	Correlation[a]								
	1	2	3	4	5	6	7	8	9
Suicide attempt									
1. 15 months[b]	-								
Alcohol use									
2. Total drinks/week baseline	0.01	-							
3. Total drinks/week follow-up	0.02	0.68***	-						
4. HED baseline[c]	0.00	0.69***	0.54***	-					
5. HED 15 months[c]	-0.01	0.55***	0.70***	0.53***	-				
Depressive symptoms									
6. Baseline	0.04**	0.08***	0.04**	0.07***	0.04**	-			
7. 15 months	0.11***	0.03*	0.06***	0.03	0.04**	0.51***	-		
Coping motives									
8. Baseline	0.05**	0.36***	0.28***	0.27***	0.23***	0.32***	0.25***	-	
9. 15 months	0.07***	0.27***	0.34***	0.20***	0.27***	0.20***	0.31***	0.48***	-

Note. [a]Spearman rank-order correlations. [b]Report of at least one suicide attempt over the past 12 months. [c]Report of at least one HED (heavy episode drinking) in the past month.

Table 3

Mediated (Indirect) Effects from Structural Equation Models 1-2

	Alcohol use							
	Total drinks per week				HED			
Associations	β	B	SE	[95%CI]	β	B	SE	[95%CI]
Model 1: alcohol/coping (baseline) to suicide attempt (15mo)								
Alcohol total association	-0.119	-0.096	0.068	[-0.222, 0.044]	-0.060	-0.131	0.134	[-0.395, 0.130]
Coping total association	**0.281**	**0.119**	0.037	[0.050, 0.197]	**0.246**	**0.103**	0.034	[0.040, 0.172]
Specific indirect associations through baseline depression								
Alcohol through depression (a^1 x b^1)	-0.024	**-0.019**	0.010	[-0.043, -0.002]	-0.011	**-0.025**	0.014	[-0.060, -0.004]
Coping through depression (a^2 x b^2)	0.090	**0.038**	0.020	[0.002, 0.080]	**0.087**	**0.036**	0.018	[0.004, 0.074]
Model 2 : alcohol/coping (15mo) to suicide attempt (15mo)								
Alcohol total association	-0.086	-0.081	0.077	[-0.218, 0.080]	-0.114	-0.287	0.181	[-0.664, 0050]
Coping total association	**0.339**	**0.175**	0.044	[0.092, 0.264]	**0.336**	**0.173**	0.046	[0.087, 0.263]
Specific indirect associations through baseline 15mo								
Alcohol through depression (a^1 x b^1)	**-0.066**	**-0.062**	0.018	[-0,103, -0.033]	**-0.045**	**-0.113**	0.035	[-0.192, -0.057]
Coping through depression (a^2 x b^2)	**0.252**	**0.130**	0.035	[0.072, 0.207]	**0.237**	**0.122**	0.033	[0.066, 0.194]

Note. β, standardized slopes ; *B*, unstandardized slopes; SE, standard error of *B*. Latent variables were created for depressive symptoms and coping drinking motives. The confidence interval reflects the 95% bias-corrected bootstrap confidence interval. The letters refer to Figures 2-3.

[1]Depressive symptoms. Statistically significant parameters (based on bootstrap CI not shown here for visual clarity) are shown in bold. HED = heavy episode drinking. Mo = months.

Table 4

Mediated (Indirect) Effects from Structural Equation Model 3

Associations	Alcohol use							
	Total drinks per week				HED			
	β	B	SE	[95%CI]	β	B	SE	[95%CI]
Model 3 : Depression, alcohol and coping (baseline) and suicide attempt (15mo)								
Depression total association	0.189	**0.171**	0.089	[0.012, 0349]	0.191	**0.174**	0.091	[0.012, 0.359]
Alcohol total association	-0.049	-0.063	0.104	[-0.266, 0.148]	-0.049	-0.124	0.167	[-0.443, 0.212]
Coping total association	0.166	0.091	0.049	[-0.005, 0.186]	0.158	0.088	0.046	[-0.005, 0.176]
Specific indirect associations through 15mo depression, alcohol and coping								
Indirect effect: depression through depression (a^1 x b^1)	**0.305**	**0.276**	0.075	[0.148, 0.423]	**0.303**	**0.276**	0.077	[0.147, 0.427]
Indirect effect: depression through alcohol (a^2 x b^2)	0.000	0.000	0.005	[-0.011, 0.009]	0.008	0.007	0.009	[-0.006, 0.030]
Indirect effect: depression through coping (a^3 x b^3)	0.000	0.000	0.003	[-0.004, 0.010]	0.001	0.001	0.004	[-0.004, 0.013]
Indirect effect: alcohol through depression (a^4 x b^1)	**-0.042**	**-0.054**	0.019	[-0.097, -0.024]	**-0.030**	**-0.077**	0.031	[-0.143, -0.029]
Indirect effect: alcohol through alcohol (a^5 x b^2)	0.006	0.008	0.093	[-0.166, 0.199]	-0.067	-0.171	0.186	[-0.562, 0.167]
Indirect effect: alcohol through coping (a^6 x b^3)	0.001	0.002	0.007	[-0.010, 0.020]	0.002	0.005	0.012	[-0.012, 0.042]
Indirect effect: coping through depression (a^7 x b^1)	**0.071**	**0.039**	0.013	[0.019, 0.069]	**0.060**	**0.033**	0.012	[0.015, 0.060]
Indirect effect: coping through alcohol (a^8 x b^2)	0.001	0.000	0.003	[-0.007, 0.008]	-0.022	-0.012	0.014	[-0.043, 0.012]
Indirect effect: coping through coping (a^9 x b^3)	0.024	0.013	0.045	[-0.082, 0.096]	0.046	0.026	0.050	[-0.078, 0.120]

Note. β, standardized slopes ; *B*, unstandardized slopes; SE, standard error of *B*. Latent variables were created for depressive symptoms and coping drinking motives. The confidence interval reflects the 95% bias-corrected bootstrap confidence interval. The letters refer to Figures 4-5. [1]Depressive symptoms. Statistically significant parameters are shown in bold. HED = heavy episode drinking. Mo = months.
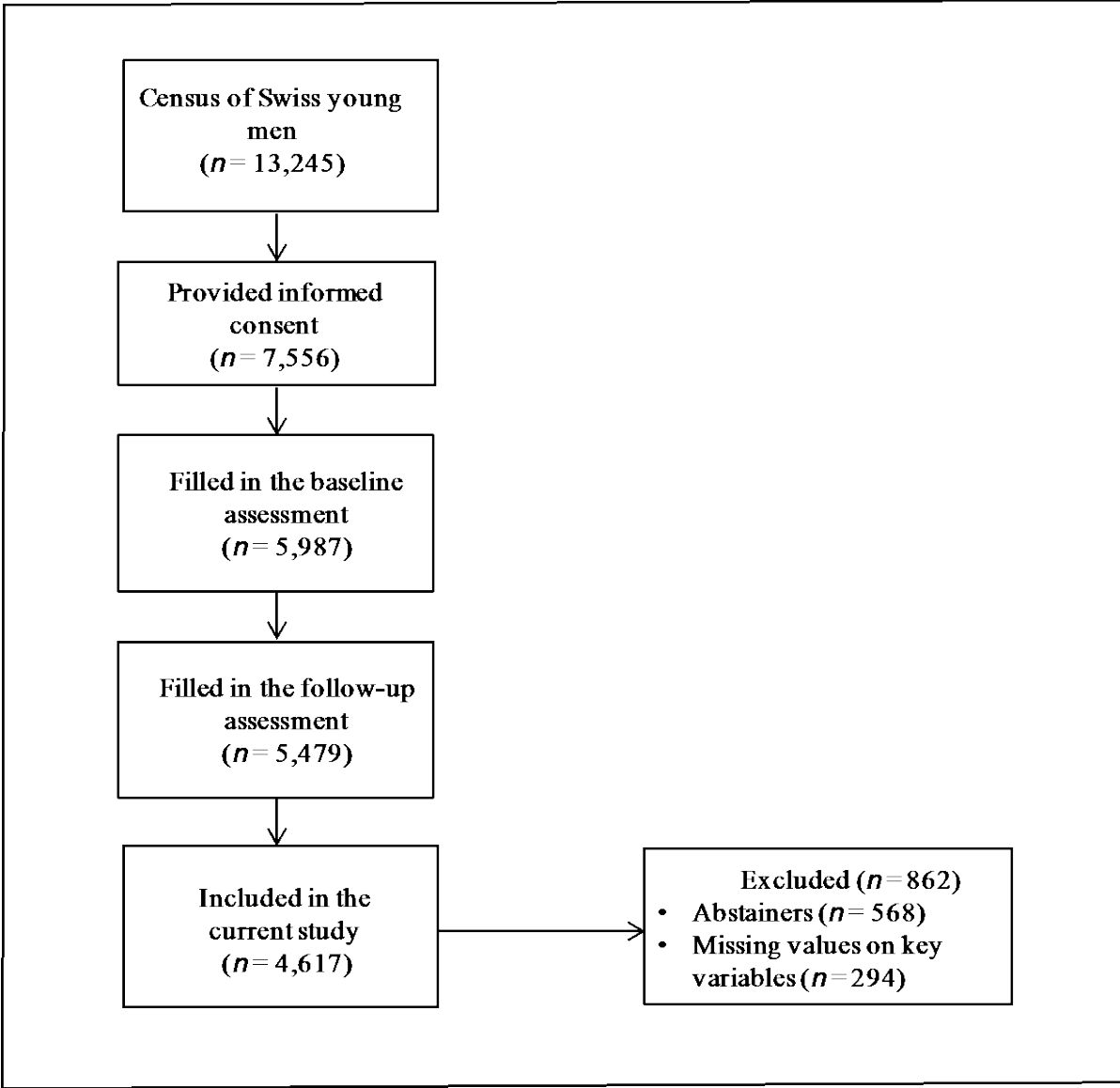
Figure 1. Flow diagram documenting participants' progression from recruitment to participation in the current study
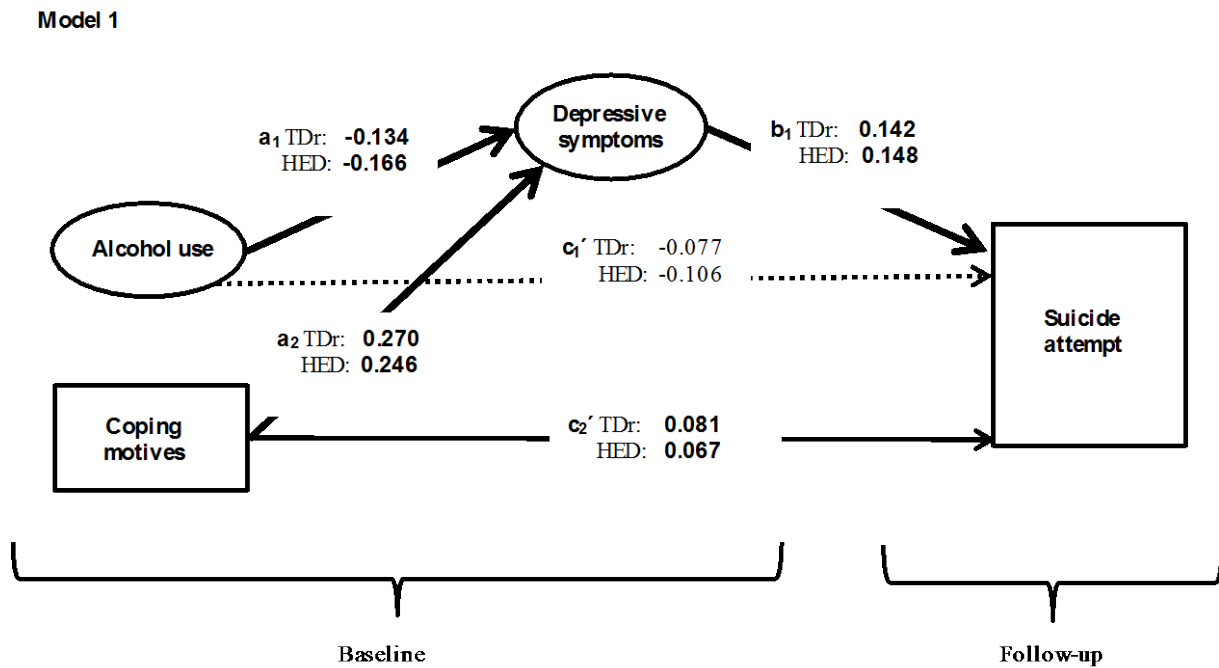
Figure 2. Representation and results of the structural equation models of alcohol use and coping drinking motives at baseline related to suicide attempts at follow-up directly and indirectly through depressive symptoms at baseline (model 1). Significant and non-significant associations are represented with bold and dotted lines, respectively.

Note. Significance is based on the 95% bias-corrected bootstrap confidence interval. Confidence intervals, covariance between the independent variables, correlations between the mediator(s)' disturbance terms, and adjustment by demographic covariates on mediator(s) and the main outcome (suicide attempt) were omitted from the figure for visual clarity. TDr = total drinks per week; HED=heavy episodic drinking.
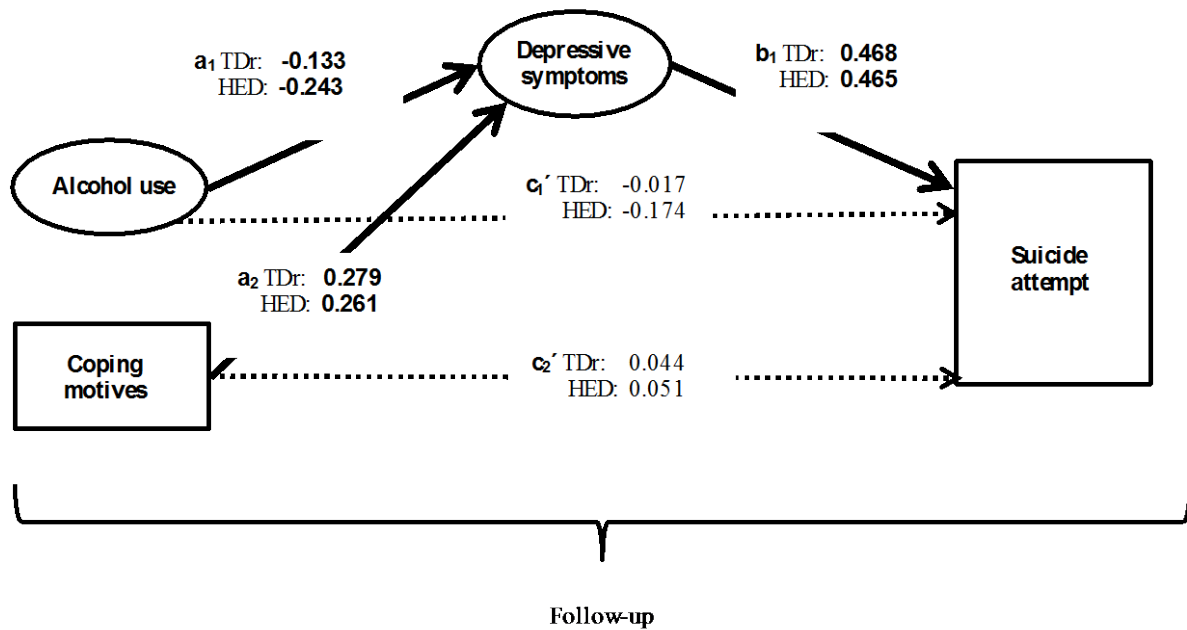
Model 2

Figure 3. Representation of the structural equation models of alcohol use and coping drinking motives related to suicide attempts directly and indirectly through depressive symptoms at baseline (model 2). Models 2 used measures from the follow-up assessment. Significant and non-significant associations are represented with bold and dotted lines, respectively.

Note. Significance is based on the 95% bias-corrected bootstrap confidence interval. Confidence intervals, covariance between the independent variables, correlations between the mediator(s)' disturbance terms, and adjustment by demographic covariates on mediator(s) and the main outcome (suicide attempt) were omitted from the figure for visual clarity. TDr = total drinks per week; HED=heavy episodic drinking.
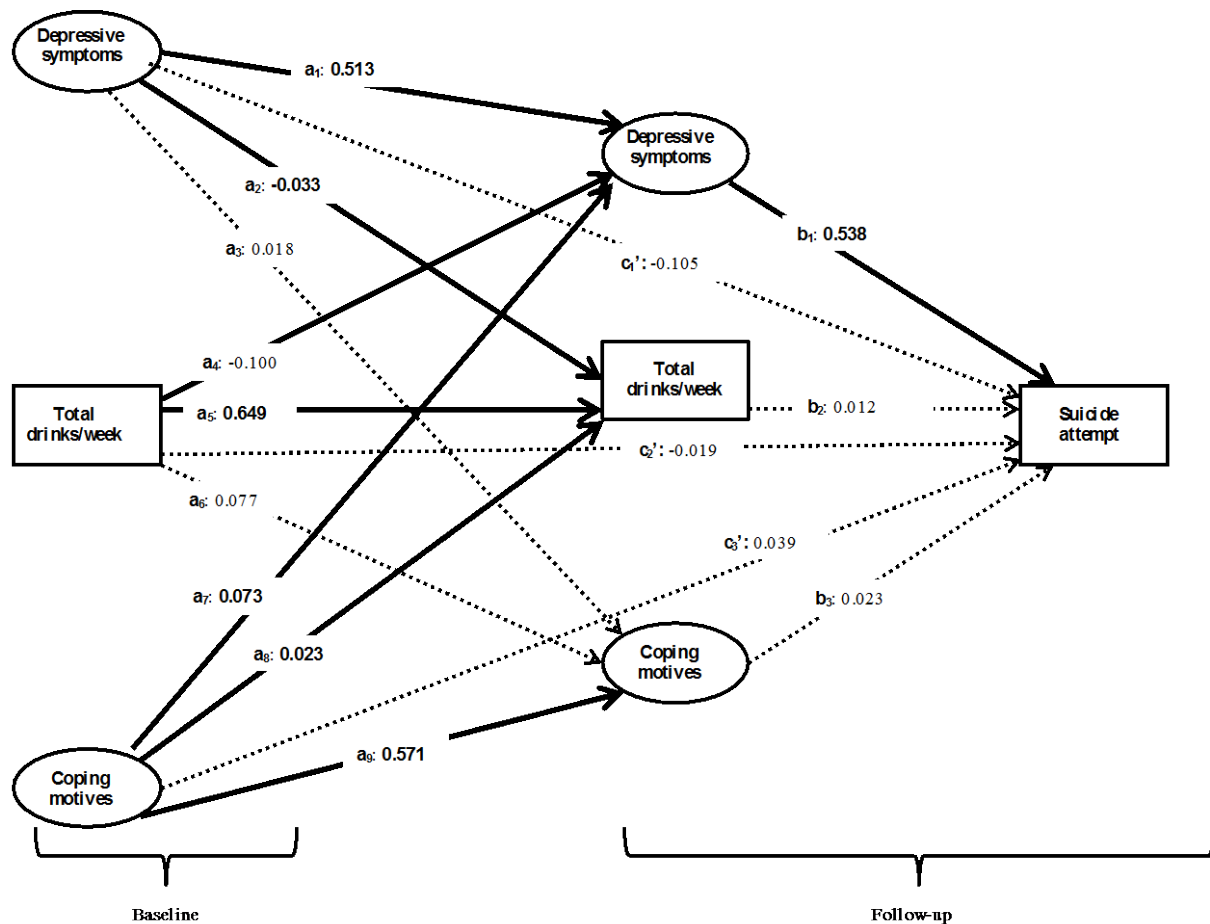
Figure 4. Representation and results of the full structural equation model (model 3) of baseline depressive symptoms, alcohol-(total drinks per week) and coping drinking motives associated with follow-up suicide attempts directly, and indirectly through depressive symptoms, total drinks per week and coping motives at follow-up. Significant and non-significant associations are represented with bold and dotted lines, respectively.

Note. Significance is based on the 95% bias-corrected bootstrap confidence interval. Confidence intervals, covariance between the independent variables, correlations between the mediator(s)' disturbance terms, and adjustment by demographic covariates on mediator(s) and the main outcome (suicide attempt) were omitted from the figure for visual clarity. TDr = total drinks per week.
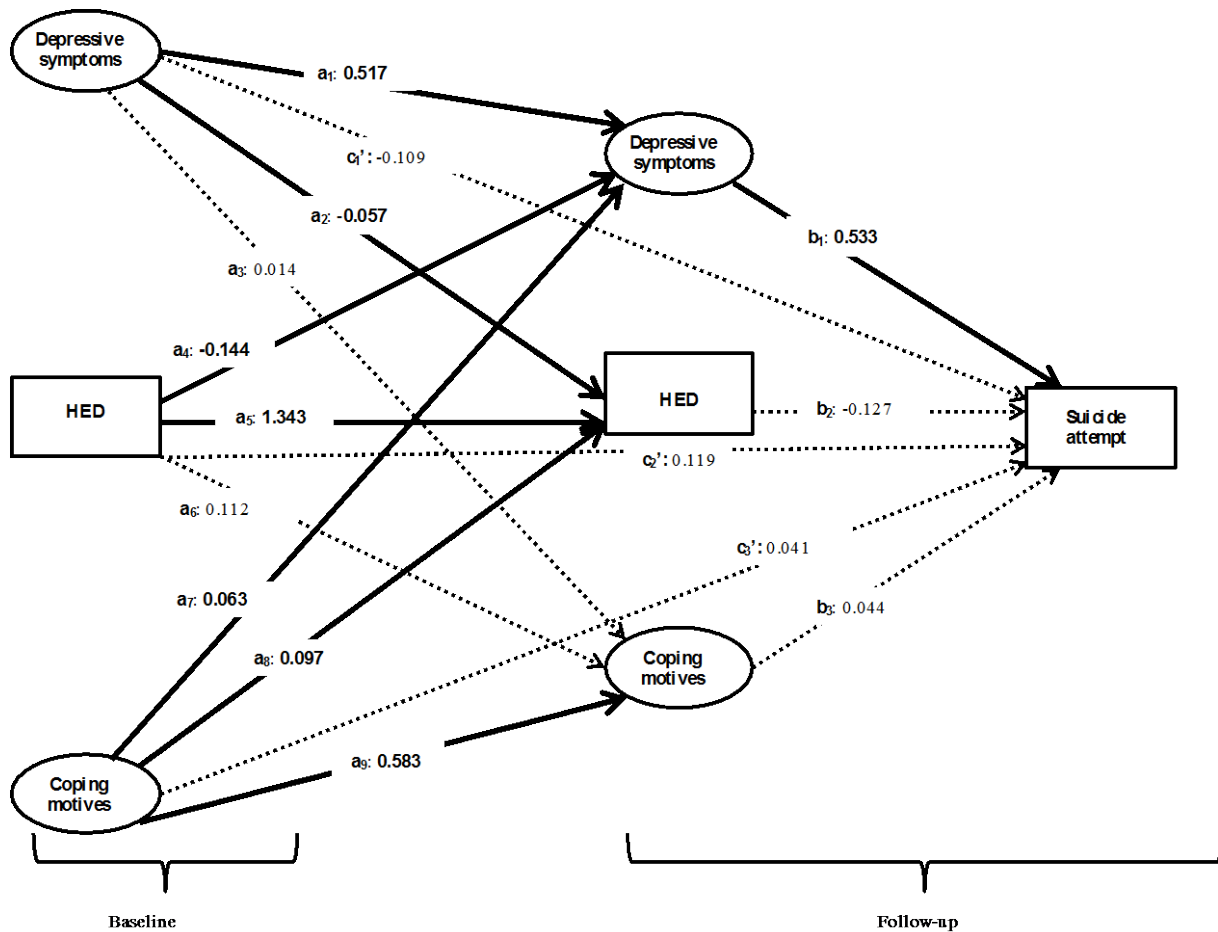
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Figure 5. Representation and results of the full structural equation model (model 3) of baseline depressive symptoms, alcohol (heavy episodic drinking [HED]) and coping drinking motives associated with follow-up suicide attempts directly, and indirectly through depressive symptoms, HED and coping motives at follow-up. Significant and non-significant associations are represented with bold and dotted lines, respectively.

Note. Significance is based on the 95% bias-corrected bootstrap confidence interval. Confidence intervals, covariance between the independent variables, correlations between the mediator(s)' disturbance terms, and adjustment by demographic covariates on mediator(s) and the main outcome (suicide attempt) were omitted from the figure for visual clarity. HED=heavy episodic drinking.