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Author Manuscript
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This paper has been peer-reviewed but dos not include the final publisher proof-corrections or journal pagination.

Published in final edited form as:

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serveur académique lausannois

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Faculté de biologie
et de médecine

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Reciprocal Influences of Drinking Motives on Alcohol Use and Related Consequences: A Full Cross-Lagged Panel Study among Young Adult Men

Short running head: Cross-lagged study on drinking motives and alcohol use

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Abstract

Using a full cross-lagged model, this study investigates the extent to which drinking motives predict alcohol use and related consequences, and vice versa. At baseline and 15 months later, 4,575 men (mean age = 19.4) in Switzerland completed a questionnaire assessing drinking motives, average weekly consumption, risky single-occasion drinking, and alcohol-related consequences. Results indicated that social and enhancement motives more strongly influenced alcohol use over time than the other way round. Coping motives predicted an increase in alcohol-related consequences, and vice versa. Higher social motives predicted an increase in coping motives while higher coping motives predicted a decrease in enhancement motives. These results suggest that social and enhancement motives amplify each other in early adulthood and predict increases in risky drinking. Structural measures aimed at reducing opportunities to engage in heavy drinking are recommended. Additionally, the detection of young adult men vulnerable to maladaptive coping behaviors appears important for alcohol prevention strategies.

Introduction

Drinking motives are important for understanding excessive alcohol use and related problems as empirical evidence shows that they are a gateway through which more distal factors are mediated, such as genetic[1,2] and personality factors,[3,4] parental drinking habits[5] and alcohol expectancies.[6,7] According to the Motivational Model of Alcohol Use (MMAU),[8,9] drinking motives can be categorized by valence (positive or negative reinforcement) and source (internal or external), resulting in four drinking motive categories:[10] social (positive, external; e.g., to make social gatherings more fun), enhancement (positive, internal; e.g., to get high), coping (negative, internal; e.g., to forget about problems), and conformity (negative, external; e.g., to fit in with a group).

In a large body of cross-sectional studies, quantity/frequency drinking measures have been found to be generally associated with positive reinforcement motives (social and enhancement), heavy drinking or risky single-occasion drinking (RSOD) with internal motives (enhancement and coping), and alcohol-related consequences with negative reinforcement motives (coping and conformity).[11-14] A couple of longitudinal studies have also shown that drinking motives predict changes in alcohol use over time, e.g., higher enhancement motives predict an increase in RSOD[15,16] and higher enhancement or coping motives predict an increase in alcohol-related problems.[17-19]

The theoretical model of drinking motives assumes that they also depend on reinforcement achieved through feedback loops from past drinking,[8,9,20] i.e., the experience of positive effects of drinking in a group is likely to encourage further drinking for social motives. However, most previous studies did not assess the potential effect of past drinking behavior on drinking motives.

So far, only two studies have used full cross-lagged panel modeling, i.e., including autoregressive and cross-lagged paths simultaneously, to assess the predictive value of drinking motives on future alcohol use and vice versa. In a sample of adolescents (mean age = 14.8; SD = 0.8) in the Netherlands, Schelleman-Offermans et al.[21] did not report any significant prediction of alcohol use on drinking motives one year later. In a sample of middle-aged adults (mean age = 53; SD = 17) in the Netherlands, Crutzen et al.[22] found that higher numbers of drinks on the heaviest drinking day during the past week predicted an increase in enhancement, social and coping motives three months later. The authors argued that, in contrast to findings from Schelleman-Offermans et al.,[21] drinking situations occur more frequently and regularly in adulthood than in adolescence, which may allow for a greater reinforcement of drinking motives.

Additionally, current drinking motives might also depend on reinforcement achieved through feedback loops from previous experiences and motives for drinking,[8,9] e.g., experience of excessive consumption or negative alcohol-related consequences as a social drinker might reduce the motivation to drink for social reasons and instead increase endorsement of coping or conformity motives. In this respect, cross-lagged regression models offer a unique opportunity to assess evolutions, convergences and shifts between drinking motives over time. Schelleman-Offermans et al.[21] reported that higher levels of social motives at baseline predicted an increase in coping motives at follow-up, assuming that younger adolescents might be more sensitive to external social reward than older adolescents. Crutzen et al.[22] found that enhancement and coping motives were interlinked (i.e., there was a positive association in both directions between baseline and follow-up), as were social and conformity motives. Additionally, social motives at baseline were positively associated with enhancement motives at follow-up. The authors

explained that these different associations might reflect different event-level drinking contexts, daily experiences and life events of middle-aged adults.

Although remarkable, the findings from these two studies remain limited for the purposes of drawing a global picture of the prospective associations between alcohol use and drinking motives because the evidence was obtained from very different age groups, using different time lags between baseline and follow-up, and only in the Netherlands. In addition, they do not provide any information on early adulthood. This age group is, however, particularly important because RSOD is more common in late adolescence and early adulthood than in any other period of life, and often leads to injuries and other consequences, making it the leading risk factor for mortality and morbidity in this age group.[23-25] Moreover, the transition from adolescence to adulthood involves multiple lifestyle changes (e.g., finishing education at high or vocational schools, starting university or entering the labor market, moving out of one's parents' house) that are likely to have an impact on alcohol use behaviors and drinking motives[26-28].

The present study therefore aims to extend the existing body of knowledge in three important aspects. Firstly, it will focus on young adults. Secondly, it will investigate the predictive associations between motives and alcohol-related consequences. Despite the close links between coping motives and alcohol-related consequences reported in cross-sectional[29] and longitudinal[17-19] research, and the salience of both in early adulthood, little is known as to whether coping motives predict changes in alcohol-related consequences only, or whether the reverse association is also true. Finally, it will provide evidence outside of the Netherlands by using a nationwide sample of young men in Switzerland.

The analysis will focus on two specific types of cross-lagged associations. Firstly, we will investigate the extent to which alcohol use behaviors can predict changes in drinking motives over time, and vice versa. In case of significant reciprocal associations, we will test which variables are the strongest predictors of change. Secondly, we will investigate whether drinking motives are predictors of change in other drinking motives, as an indication of potential evolution or shifts between motives over time.

Methods

This study uses data from the Cohort Study on Substance Use Risk Factors (C-SURF),[30] an ongoing cohort study following a nationwide sample of the general population of young Swiss adult men. In Switzerland, all males around the age of 19 are mandatorily called to an army recruitment center to determine their eligibility for military or civil service. Because there is no pre-selection for this conscription, a virtual census of the Swiss male population of this age can be obtained at the army recruitment facilities. Between August 2010 and November 2011, 13,245 young men present at three army recruitment centers were asked to participate in the study; 7,563 of them gave their informed written consent. The army environment was used for enrolment purposes only. Questionnaires were sent to the participants' home or email addresses and confidentiality was assured. Follow-up took place around 15 months after baseline using the same questionnaire. Details of the study and the enrolment procedures were published by Studer et al.[31,32] and can be found online (www.c-surf.ch). The protocol was approved by Lausanne University Medical School's Ethics Committee for Clinical Research.

Participant selection

The baseline questionnaire (t_0) was completed by 5,990 participants (response rate: 79.2%) and the follow-up questionnaire (t_1) by 5,223 participants (retention rate: 87.2%). Participants who completed the follow-up questionnaire were slightly younger (mean age = 20.0 vs. 20.2; $t = 5.68_{(df=5986)}$, $p < .001$) and drank about two drinks less per week (mean = 8.1 vs. 10.1; $t = 5.09$, $p < .001$) than those who dropped out. However, they engaged equally often in RSOD (1.5 vs. 1.5; $t = 0.96$, $p = .337$). For the analysis, 529 (10.1%) participants were removed as they had not drunk alcohol in the past 12 months – and therefore did not complete the alcohol module – at either t_0 or t_1, and 119 (2.3%) were removed as figures were missing for alcohol use variables or in more than one item per motive dimension at t_0 or t_1, leaving a final sample of 4,575 young men. At t_0, 33.6% of participants were high-school students (11.4% at t_1), 31.6% (12.2%) vocational school students, 12.6% (29.9%) university students, 12.9% (24.5%) employed, 4.1% (4.6%) looking for employment and 5.1% (1.2%) engaged in another activity such as taking a year out. In addition, 16.2% were in military service at t_1.

Measures

Drinking motives were assessed using the Drinking Motives Questionnaire Revised Short Form (DMQ-R SF).[33] Participants were asked to indicate their frequency of drinking for each of the 12 specific reasons in the last 12 months using a five-point Likert scale ranging from *(almost) never* (coded 1) to *(almost) always* (5). The mean score per motive dimension was used (Cronbach's α varying between 0.82 and 0.87).

Average weekly consumption (AWC) was assessed based on the usual number of drinking days in the past 12 months and on the quantities consumed per drinking day (in units of

10 to 12 grams of pure ethanol). Both measures were assessed separately for week days and weekends.[34]

Risky single-occasion drinking (RSOD) reflected the monthly frequency of drinking six or more drinks (i.e., 60 grams of pure ethanol or more) on a single occasion in the past 12 months.

Alcohol-related consequences (ARC) were assessed using nine items, mentioning alcohol as a cause, from the college health study by Wechsler et al.,[35] such as mental blackouts, doing something that was strongly regretted later, unprotected sexual intercourse, or accidents due to drunkenness. Participants were asked whether or not they had experienced each of these during the past 12 months and the total number of consequences was summed up.

Analytical approach

Descriptive statistics, Pearson's correlations and paired sample *t*-tests were used to describe changes in drinking motives and the three alcohol use indicators (AWC, RSOD, ARC) between baseline (t_0) and follow-up (t_1). Cross-lagged regression models were estimated separately for each alcohol use indicator, with age included as a covariate (Figure 1). In such fully-saturated models, both autoregressive (e.g., $RSOD_{t0} > RSOD_{t1}$) and cross-lagged associations are estimated (e.g., social motives$_{t0} > RSOD_{t1}$). This makes it possible to determine whether associations between motives and alcohol use occur in both directions and whether one of the two directions is stronger than the other, while controlling for the prior level of the construct being predicted. By including autoregressive associations, the cross-lagged associations express the residual variance of the dependent variable at t_1 controlling for its previous level at t_0.[36] Cross-lagged associations may be interpreted as the relative prediction of

change in the dependent variable between t_0 and t_1. For example, a positive path between social motives at t_0 and RSOD at t_1 means that an individual with relatively higher social motives at t_0 will have higher RSOD at t_1 in comparison with the others in the sample. Further, depending on whether the mean of the dependent variable in the sample increases or decreases between t_0 and t_1, a positive coefficient should be interpreted as a greater increase or a smaller decrease, respectively. Likewise, a negative path should be interpreted as a smaller increase or a greater decrease, respectively.

-- insert Figure 1 about here --

The effect sizes of the cross-lagged associations in previous research were modest (magnitude (ß): 0.10-0.15 for Schelleman-Offermans et al.;[21] 0.04-0.11 for Crutzen et al.[22]). Since this study's large sample size resulted in enough power to detect small effect sizes even among reciprocal cross-lagged paths, Wald tests were used to test for significant differences in sets of reciprocal cross-lagged paths (e.g., the path from enhancement motives at t_0 to RSOD at t_1 vs. the path from RSOD at t_0 to enhancement motives at t_1). The three cross-lagged models including Wald tests were estimated in Mplus 7.31. Maximum likelihood robust (MLR) estimation was used to account for a possible non-normal distribution of alcohol outcomes.

Results

Both at t_0 and t_1, social motives were the most often endorsed, followed by enhancement, coping and conformity motives (Table 1). Endorsement of enhancement, coping and conformity motives significantly increased between t_0 and t_1 and autocorrelation was higher for enhancement and social motives than for coping and conformity motives. AWC and RSOD appeared as rather common behaviors at both t_0 and t_1, with participants reporting consumption of about eight

drinks per week on average and almost two RSOD episodes per month. Unlike AWC, frequency of RSOD and ARC slightly decreased over time.

-- insert Table 1 about here --

Table 2 presents path coefficients and 95% confidence intervals of the cross-lagged regression models for each of the three alcohol use indicators as well as the p-value of the Wald-test, testing for differences in sets of reciprocal cross-lagged paths. Except for enhancement motives, for which a higher endorsement at t_0 predicted an increase in all three alcohol use indicators from t_0 to t_1, and vice versa, all models showed different association schemes for the other three motives. Whereas social motives predicted and were predicted by RSOD and ARC, they predicted but were not predicted by AWC. Coping motives significantly predicted and were predicted by ARC only, and conformity motives negatively predicted AWC and were negatively predicted by RSOD.

-- insert Table 2 about here --

When looking at significant differences between sets of cross-lagged associations, enhancement motives at t_0 predicted increases in RSOD and ARC more strongly than these three alcohol use indicators predicted changes in enhancement motives. The same was true for enhancement motives with regard to RSOD and ARC, respectively. Additionally, endorsement of conformity motives at t_0 predicted a decrease in AWC but the reverse association was not significant, while conformity motives at t_1 were negatively predicted by RSOD. Finally, the two cross-sectional associations between coping and ARC were significant, with a higher level of coping motives at t_0 predicting an increase in ARC, and vice versa, but both standardized

regression coefficients were not significantly different from each other, indicating no main direction of the association.

Regarding the prediction of drinking motives at follow-up by motives at baseline, no major difference was found between the three models. A higher endorsement of social motives at t_0 was found to predict an increase in all other motives at t_1. The difference in the cross-lagged associations was significant, however, only for social motives predicting an increase in coping motives. Additionally, coping motives at t_0 predicted a decrease in enhancement motives from t_0 to t_1, whereas the inverse relationship was not significant.

Discussion

The aim of this study was to examine cross-lagged associations between drinking motives, average weekly consumption (AWC), risky single-occasion drinking (RSOD) and alcohol-related consequences (ARC) over a 15-month period in a nationwide sample of young adult men in Switzerland. As is generally the case in cross-sectional research, different association schemes were found between drinking motives and the three alcohol outcomes over time. Positive reinforcement motives (i.e., social and enhancement) predicted changes in RSOD and ARC more strongly than they were predicted by them. These findings corroborate previous evidence showing that alcohol use in early adulthood, a period of life in which people have few adult roles and responsibilities but are able to buy alcohol and enter pubs and clubs, is characterized by a culture of heavy episodic drinking with young people consuming large quantities because they are seeking fun and excitement.[7,37] This study adds the finding that alcohol use and social and enhancement motives mutually reinforce each other in this period of life.

Regarding the associations between coping motives and alcohol outcomes over time, ARC predicted an increase in coping motives as well as being predicted by them. These findings corroborate previous evidence that difficulties in the transition to young adulthood are associated with increased alcohol-related problems and the development of coping motives.[38,39] This suggests the early development of a negative spiral, in which coping motives lead to more risky drinking,[17-19] which in turn leads to a further increase in coping motives. In the short term, even moderate alcohol use may be an effective, although maladaptive, coping strategy for dealing with tasks and transitions between 18 and 21 years of age. In the long run, however, it may cause far more problems than it solves.

Regarding the associations of conformity motives with alcohol outcomes over time, conformity motives negatively predicted AWC and were negatively predicted by RSOD. The former shows that the negative association of conformity motives with alcohol use repeatedly found in cross-sectional studies[10,14,40] is also true over time. This indicates that small amounts of alcohol already fulfill the function of fitting in with a group and not feeling left out; consumption of high amounts on such occasions may actually be counterproductive. RSOD, in contrast, often occurs in social contexts[41], so that there is no need for RSOD drinkers to gain social acceptance through their drinking. This may explain why RSOD predicts a decrease in conformity motives over time.

Three important findings concerning changes within motives over time were found. Firstly, the consistent reciprocal links between social and enhancement motives over time may indicate that drinking for social and enhancement motives is not only strongly correlated in adolescence[10,20,29,40] but that these behaviors also appear to amplify each other during early

adulthood. Secondly, social motives at t_0 predicted an increase in coping motives, indicating a possible transition for some people from drinking mainly at parties, celebrations and social gatherings, the most commonly indicated drinking motive of adolescents,[29,40] to drinking to alleviate problems and worries. Thirdly, coping motives at t_0 predicted a decrease in enhancement motives, suggesting that those who already scored high on coping drinking motives before 20 years of age might lose their enjoyment of drinking over time. The two latter findings corroborate the existence of the aforementioned spiral of increased coping drinking for some men in the transition between adolescence and adulthood. However, more evidence is clearly needed to come to a firmer conclusion about this.

This study has some limitations that need to be acknowledged. Firstly, the sample included only men. Since young adult men tend to endorse enhancement, social and coping motives more strongly than women and the discrepancy between genders tends to increase with age,[10,42,43] our results may not be applicable to women. Secondly, only two waves of assessments were available. More research with at least three waves, possibly at closer intervals, is needed to show the full causal process of the possible negative spiral of coping drinking and to assess whether the present results are limited to young adults or are consistent over longer time periods. Finally, future research must show whether these findings from Switzerland can be replicated in other countries.

Among the strengths of this study are its large nationwide sample and the high rate of compliance with the study protocol, both in terms of retention between baseline and follow-up and the small number of missing figures in the questionnaires.

Conclusions

From a prevention viewpoint, the outcome that social and enhancement motives mutually influence each other over time and predict increases in both heavy drinking and alcohol-related consequences is remarkable. Preventive measures, such as Internet-based, group and emergency-room interventions[44-48] promoting responsible low-level consumption, are needed to increase young adults' awareness of the risks related to frequent and heavy drinking. As a complement to individual-oriented measures, structural measures aimed at reducing opportunities to engage in heavy drinking, such as increasing prices through taxation, limiting availability through restricted opening and selling hours, and staff training to ensure responsible beverage service,[49] might help young drinkers safely get through the period until they decide to drink more responsibly with increasing adult roles and responsibilities.

Finally, the transition from adolescence to adulthood appears to be a critical moment for some young people, with risks of increased RSOD and coping drinking. Detection and support of vulnerable young people, such as alcohol screening and brief interventions,[50] should be included in prevention strategies to prevent the development of a negative spiral of increased coping drinking, alcohol use and related consequences.

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Table 1: Level of endorsement at t_0 and t_1, differences and correlations of drinking motives and alcohol use indicators

	t_0	t_1	T-test	Correlation

	mean (SD)	mean (SD)		$t_0 \leftrightarrow t_1$
Drinking motives				
Social	2.78 (1.06)	2.80 (1.07)	1.93	.63***
Enhancement	2.51 (1.08)	2.63 (1.08)	8.38***	.64***
Coping	1.59 (0.77)	1.63 (0.57)	3.80***	.47***
Conformity	1.25 (0.56)	1.29 (0.57)	3.62***	.38***
Alcohol use indicators				
AWC	8.88 (10.00)	8.65 (9.38)	-1.78	.60***
RSOD	1.91 (3.28)	1.74 (2.86)	-3.52***	.38***
ARC	1.40 (1.73)	1.32 (1.67)	-3.45***	.56***

Note: AWC = average weekly consumption; RSOD = risky single-occasion drinking; ARC = alcohol-related consequences; d.f. for paired sample t-test = 4574; *** $p < .001$.

Table 2: Cross-lagged regression models for drinking motives and alcohol use indicators (Beta,

level of significance, confidence intervals and significance of difference between pairs of

reciprocal paths)

Paths: $t_0 \rightarrow t_1$			AWC			RSOD			
			ß	(95% CI)	Wald test p-value	ß	(95% CI)	Wald test p-value	
Autoregressive path									
Alcohol use	$\rightarrow$	Alcohol use	.551***	(.508, .593)		.327***	(.320, .400)		.
Social	$\rightarrow$	Social	.544***	(.516, .572)		.546***	(.518, .574)		.
Enhancement	$\rightarrow$	Enhancement	.526***	(.198, .554)		.535***	(.508, .563)		.
Coping	$\rightarrow$	Coping	.439***	(.410, .468)		.446***	(.417, .475)		.
Conformity	$\rightarrow$	Conformity	.359***	(.319, .400)		.360***	(.320, .400)		.
Motives and alcohol use									
Social	$\rightarrow$	Alcohol use	.033	(.005, .061)	.057	.082***	(.048, .116)	.000	.
Alcohol use	$\rightarrow$	Social	.034**	(.008, .059)		.031*	(.009, .053)		.
Enhancement	$\rightarrow$	Alcohol use	.075***	(.042, .108)	.000	.092***	(.051, .133)	.000	.
Alcohol use	$\rightarrow$	Enhancement	.054***	(.029, .079)		.033*	(.010, .055)		.
Coping	$\rightarrow$	Alcohol use	.017	(-.011, .045)	.330	.032	(.002, .063)	.074	.
Alcohol use	$\rightarrow$	Coping	.022	(-0.009, .053)		-.017	(-.043, .009)		.
Conformity	$\rightarrow$	Alcohol use	-.038**	(-.063, -.013)	.012	-.004	(-.033, .026)	.887	-.
Alcohol use	$\rightarrow$	Conformity	-.014	(-.046, .018)		-.037**	(-.059, -.015)		-.
Among motives									
Social	$\rightarrow$	Enhancement	.152***	(.124, .181)	.168	.155***	(.126, .184)	.169	.
Enhancement	$\rightarrow$	Social	.116***	(.087, .145)		.119***	(.091, .148)		.
Social	$\rightarrow$	Coping	.070***	(.039, .101)	.000	.072***	(.041, .103)	.000	.
Coping	$\rightarrow$	Social	-.026	(-.049, -.004)		-.022	(-.045, .000)		-.
Social	$\rightarrow$	Conformity	.063**	(.028, .097)	.569	.063**	(.029, .096)	.509	.
Conformity	$\rightarrow$	Social	.009	(-.015, .032)		.008	(-.016, .031)		.
Enhancement	$\rightarrow$	Coping	.011	(-.021, .043)	.003	.022	(-.009, .054)	.004	.
Coping	$\rightarrow$	Enhancement	-.046***	(-.069, -.023)		-.037**	(-.060, -.014)		-.
Enhancement	$\rightarrow$	Conformity	.008	(-.026, .043)	.265	.013	(-.021, .047)	.173	-.
Conformity	$\rightarrow$		-.016	(-.040, .009)		-.018	(-.042, .006)		-.

		Enhancement							
Coping	→	Conformity	.020	(-.013, .052)	.280	.021	(-.011, .053)	.238	
Conformity	→	Coping	-.013	(-.044, .018)		-.015	(-.045, .016)		-
Explained variance									
R^2 Alcohol use t_1			.368***			.175***			.
R^2 Social t_1			.410***			.410***			.
R^2 Enhancement t_1			.422***			.421***			.
R^2 Coping t_1			.230***			.230***			.
R^2 Conformity t_1			.152***			.154***			.

Note: AWC = Average weekly consumption; RSOD = Risky single-occasion drinking; ARC = Alcohol-related consequences; * p<.05; ** p<.01; *** p<.001; A significant Wald test p-value (p < .05) indicates a significant difference between pairs of reciprocal paths. Age included as a covariate. Covariances between variables were included in the model but not reported in the table.
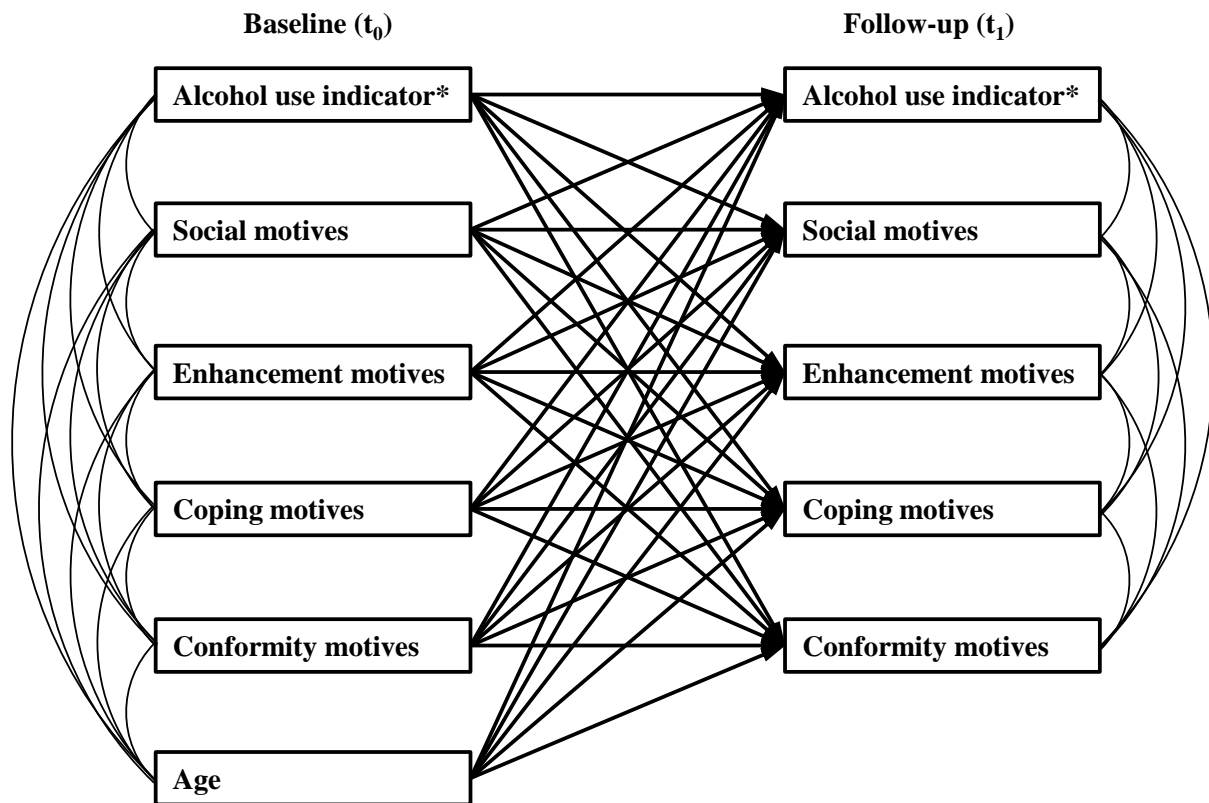
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Figure 1: Sample of the estimated full cross-lagged models including drinking motives and each alcohol use indicator.

Note: * Models estimated separately for average weekly consumption (AWC), risky single-occasion drinking (RSOD) and alcohol-related consequences (ARC). Arrows represent path estimations between baseline and follow-up. Curved lines represent covariance between variables at both baseline and follow-up.