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Associations between emotional distress and heavy drinking among young people: A longitudinal study

Hilde Pape & Thor Norstrøm

Correspondence to: Hilde Pape, Norwegian Institute for Alcohol and Drug Research, Pb 0565 Sentrum, Oslo 0105, Norway. E-mail: hp@sirus.no

Associations between emotional distress and heavy drinking among young people: A longitudinal study

Hilde Pape & Thor Norström

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Introduction and Aims. *This study adds to the meagre body of longitudinal research on the link between emotional distress and alcohol use among young people. We address these research questions: Are symptoms of anxiety and depressed mood likely to be causally related to heavy episodic drinking (HED), and does the association change as individuals move from adolescence to early adulthood?*

Design and Methods. *Data stemmed from a national sample of young people in Norway that was assessed in 1992 (T1; mean age= 14.9 years), 1994 (T2), 1999 (T3), and 2005 (T4) (response rate: 60%, n=2 171). We applied fixed-effects modelling, implying that intra-individual changes in the frequency of HED were regressed on intra-individual changes in emotional distress. Hence, confounding due to stable underlying influences was eliminated. Self-perceived loneliness was included as a time-varying covariate.*

Results. *Emotional distress was unrelated to HED in adolescence (T1 to T2). In the transition from adolescence to early adulthood (T2 to T3), changes in depressiveness were positively and independently associated with changes HED, while changes symptoms of anxiety were not. A similar pattern emerged in early adulthood (T3 to T4).*

Discussion and Conclusions. *The potential causal relationship between emotional distress and heavy drinking did not manifest itself in adolescence, but increased symptoms of depressiveness were related to more frequent HED in subsequent periods of life. Hence, this study provides conditional support to the notion that emotional distress and HED may be causally related, and indicates that the association among young people may be specific to depressiveness.*

Key words: Anxiety, depressed mood, emotional distress, heavy drinking, adolescence, early adulthood.

Introduction

Depression has generally been found to be associated with heavy drinking and alcohol use disorders [1-4]. There is also evidence of a link between anxiety and extensive use of alcohol [5-8], but this association has been less extensively scrutinized and the findings seem less clear. Thus, some studies of young people report null-findings [9] or a link between anxiety and heavy drinking that is attributable to concurrent symptoms of depression and/or other confounding factors [10-12].

The bulk of previous studies focus on severe forms of internalizing problems and harmful drinking, and have typically relied on diagnoses or other dichotomous measures. Obviously, such research may be of clinical significance, yet the findings do not necessarily apply to mild forms of emotional distress and non-pathological drinking [13]. To address subclinical conditions is important in its own right, not least because they may contribute to the total burden of harm and social cost at least as much as the clinical ones – simply by being far more prevalent.

Furthermore, studies of adult samples predominate in the field, and the association between emotional distress and heavy drinking may be different among young people. The onset of drinking typically occurs in adolescence, and the consumption of alcohol and related harm escalate during the late teens and reaches a peak in early adulthood [14, 15]. Problems related to mood and emotions also tend to increase in this period of life [16]. Moreover, it has been hypothesized that risk factors related to mental health may become increasingly important in influencing drinking behaviour as individuals approach adulthood, reflecting the challenges of leaving a protected environment, and entering an independent adult role [17].

Indeed, a recent study showed that the association between depression and alcohol use disorders was stronger in early adulthood than in adolescence [18]. The present paper pursues this issue further by analysing four-wave panel data on less severe forms of emotional distress and heavy drinking from a general population study of young people.

Causality and directionality

Associations between internalizing problems and heavy drinking may in part reflect causality, or they may arise solely because of shared underlying influences. A range of factors may indeed confound these associations, including genetic susceptibility, disadvantaged upbringing conditions and poor social integration [1, 5]. A number of such likely confounders have been accounted for in previous research, but one and the same study cannot possibly control for all conceivable sources of confounding.

Fixed-effects modelling may substantially reduce the problem of unmeasured common influences because it eliminates bias due to temporally stable covariates [19, 20]. Despite its merits, Fergusson et al. [21] seem to be the only ones that have applied this method in relation to the topic at issue. They focused on symptoms of major depression and alcohol use disorder, and concluded that such problems seem to be causally related. However, the issue of causality is still far from settled, and the directionality of the potential causal effect is also not clear.

The self-medication hypothesis has been invoked as a possible causal explanation for the high comorbidity of mental illness and pathological drinking, and for associations between subclinical forms of such problems [22-24]. Indeed, there is ample evidence that negative affectivity is linked to self-medication motives for using alcohol [25-27], which in turn are predictive of heavy and harmful drinking [28-31]. Moreover, a study of undergraduate women recently showed that minor symptoms of depressed mood predicted heavy episodic drinking (HED) over one week intervals, while there was no effect of HED on subsequent depressiveness [32]. Another study found that adolescents whose first-time drinking episode was motivated by a wish to relieve sadness had an elevated risk of involvement in heavy drinking [33]. Two recent studies of adults provide additional evidence that subclinical symptoms of anxiety and/or depression may impact on alcohol use but not *vice versa* [34, 35]. Hence, the present study relies on the assumption that the main effect goes from emotional distress to heavier drinking rather than the other way around.

The present study

While most previous studies on the topic at issue have focused on either depression or anxiety, we analyse data on both kinds of emotional distress and examine whether they are related independently to heavy drinking. In addition, we apply a compound index for emotional distress. Further, by using fixed-effects modelling, we eliminate confounding due to stable covariates. This method does not remedy bias due to time-varying shared influences, and we include loneliness as such a potential confounder. Feeling lonely is indicative of a lack of support and emotional closeness to others, and such feelings are related to both anxiety and depression [36-38]. Associations with heavy drinking have also been found, yet some studies indicate that loneliness is inversely related to alcohol use [39, 40], while others have found a positive correlation between the two [41, 42].

We address the following research questions: Are symptoms of anxiety and depressed mood likely to be causally related to heavy episodic drinking among young people, and does the association change as individuals move from adolescence to early adulthood?

Methods

Data stemmed from the Young in Norway Longitudinal Study, which has been described in detail elsewhere [43, 44]. A cohort of young people was assessed in 1992 (T1), 1994 (T2), 1999 (T3) and 2005 (T4). The T1 survey comprised students attending junior high school (grades 8-10) and senior high school (grades 11-13), and the sample was selected to yield a national representative cross-section of this student population (response rate: 97%). At T2, students who were still in their original school filled in questionnaires in the classroom – as they did at T1. Those who had graduated from either junior or senior high school since the initial assessment received postal questionnaires. Only the former group achieved a high response rate (92%). Therefore, all subsequent follow-ups were restricted to students who attended the same school at T1 and T2 (i.e. the 8th and 11th graders at T1). The majority (91%)

of these students consented at being traced for future participation in the study, of which 84% responded at T3 and 82% responded at T4. The cumulative response rate was 60%. The study was conducted in accordance with the National Guidelines for Research Ethics in the Social Sciences and approved by the Norwegian Social Science Data Services.

Our analyses were confined to respondents who participated in all four waves, and who were 13-17 years at T1. From this subsample, we excluded 3% due to high rates of missing data. The final study sample comprised 2171 respondents, of whom 57% were females.

Key measures

Heavy episodic drinking (HED) was captured by asking about the frequency of consuming alcohol to the point of feeling clearly intoxicated in the past 12 months. There were six response options: never (coded 0), once (1), 2 to 5 times (3.5), 6 to 10 times (8), 11 to 50 times (30), and more than 50 times (55).

Emotional distress were assessed by asking to what extent the respondents had been bothered by various symptoms in the past week, using this four-point scale: not at all (1), a little bit bothered (2), quite bothered (3), and extremely bothered (4). The following three items from the Hopkins Symptoms Check List [45] were added up and averaged to construct an index for symptoms of anxiety: (1) Suddenly scared for no reason; (2) Constantly scared or worried; and (3) Nervousness or shakiness inside. The internal consistency showed little variation across the four waves (Cronbach's alpha 0.75 - 0.78), while the stability coefficients (Pearsons' r) ranged from 0.37 (T2 to T3) to 0.44 (T1 to T2).

Depressed mood was also measured as an additive index, using six items from The Depressive Mood Inventory [46]: (1) Felt too tired to do things; (2) Had trouble sleeping; (3) Felt unhappy, sad, or depressed; (4) Felt hopeless about the future; (5) Felt tense or keyed up; and (6) Worried too much about things (Cronbach's alpha: 0.82-0.85). The lowest stability coefficient was 0.42 (T2 to T3) while the highest was 0.55 (T1 to T2).

The cross-sectional correlations between the indices for anxiety and depressed mood ranged from 0.55 (T2) to 0.65 (T4), and we also constructed a compound index for emotional distress based on all the nine items mentioned above (Cronbach's alpha 0.82-0.87). The stability coefficients for this measure varied between 0.42 (T2 to T3) and 0.55 (T3 to T4).

Time-varying covariate

We used four items from UCLA Loneliness Scale [47] to construct an index for self-perceived loneliness. The respondents considered statements such as "No one really knows me very well" and "People are around me but not with me", and reported on a scale ranging from 1 (never) to 4 (often) how often they felt this way (Cronbach's Alpha: 0.72-0.78).

Statistical analyses

First, we performed descriptive statistics of the key variables at all four assessments. Changes in proportions between waves were tested using z-tests, while changes in means were examined using t-tests for dependent samples. Subsequently, we estimated a set of fixed-effects models [19, 20]. More precisely, we calculated change scores for both HED and each of the three measures on emotional distress by subtracting T1 from T2, T2 from T3, and T3 from T4. Next, the latter change scores were included in multiple OLS regressions to estimate associations with changes in the frequency of HED. As illustrated below, this implies that the time-invariant confounders are cancelled out:

$$\begin{aligned} (1) \quad HED_{i1} &= \beta_1 ED_{i1} + \beta_2 C_i + e_{i1} \\ (2) \quad HED_{i2} &= \beta_1 ED_{i2} + \beta_2 C_i + e_{i2} \end{aligned}$$

In model (1) HED_{i1} and ED_{i1} refer to heavy episodic drinking and emotional distress, respectively, for individual i at T1. C_i denotes other causes of HED that are stable across time. If ED and C_i correlate, the estimate of β_1 will be biased. Model (2) is equivalent, but refers to T2. If we subtract (1) from (2), C_i is eliminated, and thereby that particular source of bias.

All estimates based on fixed-effects modelling were adjusted for changes in self-perceived loneliness. To assess whether the link between changes in anxiety and changes in the frequency of HED was modified when controlling for changes in depressiveness, we estimated one model excluding (model 1), and another model including (model 2) the latter covariate. We used the same approach when assessing the corresponding association between depressed mood and HED, i.e. symptoms of anxiety were added to the equation in model 2. Finally, we examined how the change scores for the compound measure on emotional distress were associated with changes in HED.

The above-mentioned analyses were conducted for all the respondents, and for males and females separately. When statistically significant gender differences were detected, this is reported. Moreover, because a four-year age range is substantial in adolescence, we performed age specific analyses for this developmental period. That is, in addition to analyses of the whole sample, we conducted separate analyses of the youngest (13-15 years at T1) and the oldest respondents (16-17 years at T1), and compared the estimates using T-test.

Due to the large sample size, we chose the 1% level for statistical significance. As the sampling was clustered by school, we used robust clustered standard errors with school as cluster variable [48]. The statistical analyses were conducted using Stata (version 12) and SPSS (version 21).

Results

The proportion reporting HED as well as the mean frequency of HED increased from T1 to T2 and reached a peak at T3 (Table 1). The level of anxiety did not vary across the three first

waves, but was clearly lower at the final assessment. Symptoms of depressed mood also declined from T3 to T4, yet the highest level was observed at T2. The mean scores for the compound measure of emotional distress decreased slightly from T2 to T3, while the decrease from T3 to T4 was quite substantial.

Table 1. *Descriptive statistics on key variables at the four waves of data collection.*

	T1	T2	T3	T4
Mean age (SD=1.5)	14.9	16.4	21.8	28.3
% Reporting heavy episodic drinking \geq 1 time	33.1	53.1**	87.1**	83.3**
Frequency of heavy episodic drinking, M (SD)	3.90 (9.78)	6.88** (12.24)	16.97** (16.66)	13.93** (15.62)
Symptoms of anxiety ¹ , M (SD)	1.34 (0.47)	1.34 (0.47)	1.33 (0.49)	1.28** (0.45)
Symptoms of depressed mood ¹ , M (SD)	1.71 (0.55)	1.75** (0.57)	1.72* (0.59)	1.69** (0.59)
Symptoms of either kind of emotional distress ¹ , M (SD)	1.53 (0.45)	1.55 (0.47)	1.52* (0.48)	1.42** (0.45)

* $p < 0.01$; ** $p < 0.001$ = significantly different from the proportion or the mean at the previous wave of data collection. ¹ Scale: 1 – 4

Table 2 shows the outcomes of the fixed-effects models. As can be seen, there were no associations between any measure of emotional distress and HED in adolescence (T1 to T2). We also conducted age specific analyses, and found that the estimates for youngest respondents (13-15 years at T1) were all far from statistically significant, as were the estimates for the oldest (16-17 years at T1) (estimates not shown).

In the transition from adolescence to early adulthood (T2 to T3), there was initially a weak positive impact of changes in anxiety on changes in HED (model 1). However, it weakened and was far from statistically significant when concurrent changes in depressed mood were taken into account (model 2). In contrast, there was a highly significant impact of changes in depressed mood, which barely attenuated when we accounted for changes in anxiety. The impact of the composite measure on emotional distress was also statistically significant in this period.

The general pattern of findings in early adulthood (T3 to T4) echoed that of the preceding period. However, for the first time, a statistically significant impact of anxiety was

observed (model 1), yet it attenuated and was above the 1% level of statistical significance when we added the measure for depressed mood to the equation (model 2).

Table 2. *Changes in the frequency of heavy episodic drinking regressed on changes in anxiety (Δ Anx), depressed mood (Δ Dep) and in the overall level of emotional distress (Δ Emo) in adolescence (T1 to T2), in the transition from adolescence to early adulthood (T2 to T3), and in early adulthood (T3 to T4). Fixed-effects models with robust clustered standard errors.*

	Model ¹	Adolescence			Adolescence / early adulthood			Early adulthood		
		Est	SE	p	Est	SE	p	Est	SE	p
Δ Anx	1	-0.82	0.68	0.229	2.06	0.86	0.020	3.65	0.74	<0.001
	2	-0.75	0.67	0.265	0.03	0.94	0.977	2.29	0.87	0.011
Δ Dep	1	-0.44	0.55	0.420	3.65	0.67	<0.001	3.12	0.63	<0.001
	2	-0.19	0.52	0.714	3.64	0.72	<0.001	2.20	0.75	0.005
Δ Emo	1	-0.65	0.54	0.233	2.37	0.62	<0.001	3.01	0.53	<0.001

¹ Model 1: Controlling for changes in loneliness. Model 2: Controlling for changes in loneliness and depressed mood (in analyses of anxiety) and for changes in anxiety (in analyses of depressed mood).

The results in table 2 imply that an increase by one unit on the compound index for emotional distress in early adulthood, e.g. from “a little bit bothered” to “quite bothered” (representing 2.1 SDs) would give an average increase in the number of heavy drinking episodes of 2.4 times a year. The corresponding number for the transition from adolescence to early adulthood is about three times a year.

Finally, we conducted fixed-effects modelling for males and females separately, and compared the estimates. We detected no differences below the 1% level for statistical significance, but the impact of depressed mood on HED in early adulthood was significant for females (Est=2.54, SE=0.86, p=0.005) but not for males (Est=1.87, SE=1.30, p=0.157) (t=2.46, p<0.05).

Discussion

In this study, we assessed intra-individual associations between different forms of emotional distress and HED using fixed-effects modelling. Such associations seem more relevant in relation to the topic at issue than are inter-individual associations. Thus, some individuals may increase their drinking in periods of elevated distress, yet this does not necessarily imply that they drink more and have more symptoms of internalizing problems than other people when such periods occur. Because fixed-effects modelling eliminates bias due to time-invariant confounders, our study also sheds light on the issue of causality.

Neither anxiety nor depressed mood were related to HED in adolescence, while the results for the subsequent periods that we assessed were mixed. Changes in anxiety had a positive and highly significant impact on changes in HED, but only in early adulthood, and only when we did not control for concurrent changes in depressiveness. In contrast, increased levels of depressed mood was independently related to more frequent HED – both in the transition from adolescence to early adulthood, and in the early adult period. The composite index on emotional distress also had a statistically significant impact on HED in these two periods of life. The results thus lend conditional support to the notion that emotional distress and heavy drinking may be causally related, but the magnitude of the effects was moderate.

The present study also indicates that the association between internalizing symptoms and heavy drinking among young people may be specific to depressed mood. However, the internal consistency of our measure on anxiety was somewhat lower than that of depressed mood, and the results may have been affected accordingly. On the other hand, the findings seem to agree with the extant body of research on the issue. Thus, while a link between depression and heavier drinking has been found repeatedly [1-4], the association between anxiety and alcohol use seems less clear. It is true that both forms of emotional distress rarely have been assessed in one and the same study, but Skogen et al. [49] recently reported that depressive symptoms were related to frequent intoxication among late teen youth, while symptoms of anxiety were not. Similar results emerged in another recent study of young people [10].

Our findings are also congruent with the assumption that mental health risk factors are likely to become increasingly important in influencing drinking behaviour as individuals move from adolescence into adulthood [17]. Furthermore, the age gradient in the associations that we observed corroborates the results reported by Briere et al. [18] in their study of comorbidity between depression and excessive drinking from adolescence to adulthood.

As regards the absence of associations between emotional distress and HED in adolescence (T1 to T2), one should keep in mind that a solid majority (66%) of the respondents reported no HED at the first wave of data collection. The same was true for 47% at the second survey 1.5 years later. Hence, to a substantial extent, the aggregate level changes in drinking from T1 to T2 reflected age-typical transitions from abstinence to drinking, or from early, experimental drinking to more regular HED.

Irrespective of their level of emotional distress, most young people start to drink sometime during adolescence [50]. To initiate drinking, and to gradually increase one's alcohol consumption, may be considered normative behaviour in this developmental period. Moreover, adolescents most often drink for social and enjoyment reasons [28, 51], and one may assume that drinking to relieve emotional distress is relatively more prevalent among older and more experienced drinkers. Indeed, Cooper et al.'s [52] longitudinal study showed that self-medication motives for drinking were reported gradually more often during the transition from adolescence into early adulthood.

The research findings cited above all seem relevant in the context of the present study, but one should keep in mind that the directionality of the associations at issue is still open to question. Based on recent studies of subclinical conditions, including two studies of young people, we assumed that emotional distress increases the risk of heavier drinking rather than the other way around. However, this assumption may not necessarily be correct.

In their review of the literature, Boden and Fergusson [1] concluded that alcohol use disorders increase the risk of major depression rather than vice versa. However, this conclusion relied mainly on one single study (i.e. [21]), and has therefore been called into question [53]. Based on more recent evidence, Bell *et al.* [35] hypothesized that internalizing problems may increase the risk of heavier drinking until symptoms of alcohol dependence begin to emerge, whereby the causal direction of the association is likely to reverse.

Indeed, there is little doubt that excessive drinking may deteriorate individuals' mental health, among other things because it can bring about social, financial and relationship problems [1]. Our finding that emotional distress and HED were unrelated in adolescence may reflect that teenagers rarely consume so much alcohol that their mental health or well-being is affected. As they grow older and increase their drinking, the risk of such adverse outcomes is also likely to increase.

Methodological considerations

There are limitations of our study that warrant attention. We assessed symptoms of emotional distress during the past week, while there was a one-year time frame for the frequency of HED. However, the stability in the level of both anxiety and depressiveness was far from negligible across the developmental periods that we assessed, indicating that the differences in the temporal point of reference may not pose major problems.

Another weakness is that the frequency scale for HED was fairly crude, and the ensuing measurement errors imply that the estimated associations are likely to be deflated. Moreover, self-perceived loneliness was the only potential confounder that we accounted for, yet there are probably many other time-dynamic factors that impact on both emotional distress and HED. For instance, there is solid evidence that negative life events increase the risk of depression [54], and an association with heavier drinking has also been found [55, 56]. Social support is another time-variant factor that is likely to confound the association between depression and alcohol use [57].

Conclusions

This longitudinal study of young people lends conditional support to the notion that emotional distress and HED are likely to be causally related. There were no associations between the two in adolescence, but increased levels of depressiveness correlated significantly with more frequent HED in the transition from adolescence to early adulthood, and in the early adult period. The corresponding associations between symptoms of anxiety and HED were either non-existent or less clear.

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References

- [1] Boden JM, Fergusson DM. Alcohol and depression. *Addiction* 2011;106:906-14.
- [2] Sullivan LE, Fiellin DA, O'Connor PG. The prevalence and impact of alcohol problems in major depression: a systematic review. *Am J Med* 2005;118:330-41.
- [3] Galaif ER, Sussman S, Newcomb MD, Locke TF. Suicidality, depression, and alcohol use among adolescents: a review of empirical findings. *Int J Adolesc Med Health* 2007;19:27-36.
- [4] Hartka E, Johnstone B, Leino EV, *et al.* A meta-analysis of depressive symptomatology and alcohol consumption over time. *Brit J Addict* 1991;86:1283-98.
- [5] Kushner MG, Abrams K, Borchardt C. The relationship between anxiety disorders and alcohol use disorders: a review of major perspectives and findings. *Clin Psychol Rev* 2000;20:149-71.
- [6] Kaplow JB, Curran PJ, Angold A, *et al.* The prospective relation between dimensions of anxiety and the initiation of adolescent alcohol use. *J Clin Child Psychol* 2001;30:316-26.
- [8] Burns L, Teesson M. Alcohol use disorders comorbid with anxiety, depression and drug use disorders: Findings from the Australian National Survey of Mental Health and Well Being. *Drug Alcohol Depen* 2002;68:299-307.
- [9] Grant BF, Stinson FS, Dawson DA, *et al.* Prevalence and co-occurrence of substance use disorders and independent mood and anxiety disorders: Results from the national epidemiologic survey on alcohol and related conditions. *Arch Gen Psychiat* 2004;61:807-816.
- [10] Edwards AC, Heron J, Dick DM, *et al.* Adolescent alcohol use is positively associated with later depression in a population-based UK cohort. *J Stud Alcohol Drugs* 2014;75:758-765.
- [11] Fröjd S, Ranta K, Kaltiala-Heino R, *et al.* Associations of social phobia and general anxiety with alcohol and drug use in a community sample of adolescents. *Alcohol Alcoholism* 2011;46:192-199.
- [12] Goodwin RD, Fergusson DM, Horwood LJ. Association between anxiety disorders and substance use disorders among young persons: results of a 21-year longitudinal study. *J Psychiat Res* 2004;38:295-304.

- [13] Graham K, Massak A, Demers A, Rehm J. Does the association between alcohol consumption and depression depend on how they are measured? *Alcohol Clin Exp Res* 2007;31:78-88.
- [14] Brown SA, McGue M, Maggs J, *et al.* developmental perspective on alcohol and youths 16 to 20 years of age. *Pediatrics* 2008;121:S290-S310.
- [15] Schulenberg JE, Maggs JL. A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood. *J Stud Alcohol Drugs* 2002:54.
- [16] Graber JA. Internalizing problems during adolescence. In: Lerner RM, Steinberg L, eds. *Handbook of adolescent psychology*, second edition. New Jersey: John Wiley & Sons, 2004:587-626.
- [17] Poikolainen K, Tuulio-Henriksson A, Aalto-Setälä T, *et al.* Predictors of alcohol intake and heavy drinking in early adulthood: a 5-year follow-up of 15–19-year-old Finnish adolescents. *Alcohol Alcoholism* 2001;36:85-8.
- [18] Brière FN, Rohde P, Seeley JR, *et al.* Comorbidity between major depression and alcohol use disorder from adolescence to adulthood. *Compr Psychiatry* 2014;55:526-33.
- [19] Allison PD. Change scores as dependent variables in regression analysis. *Social Methodol* 1990;20:93-114.
- [20] Halaby CN. Panel models in sociological research: theory into practice. *Ann Rev Sociol* 2004;30:507-44.
- [21] Fergusson DM, Boden JM, Horwood LJ. Tests of causal links between alcohol abuse or dependence and major depression. *Arch Gen Psychiat* 2009;66:260-6.
- [22] Swendsen JD, Tennen H, Carney MA, *et al.* Mood and alcohol consumption: an experience sampling test of the self-medication hypothesis. *J Abnorm Psychol* 2000;109:198.
- [23] Khantzian EJ. The self-medication hypothesis of substance use disorders: a reconsideration and recent applications. *Harvard Rev Psychiat* 1997;4:231-44.
- [24] Kushner MG, Sher KJ, Beitman BD. The relation between alcohol problems and the anxiety disorders. *Am J Psych* 1990;147:685-695
- [25] Stewart SH, Devine H. Relations between personality and drinking motives in young adults. *Pers Individ Differ* 2000;29:495-511.
- [26] Cooper ML, Frone MR, Russell M, Mudar P. Drinking to regulate positive and negative emotions: a motivational model of alcohol use. *J Pers Soc Psychol* 1995;69:990.
- [27] Flynn HA. Comparison of Cross-Sectional and Daily Reports in Studying the Relationship Between Depression and Use of Alcohol in Response to Stress in College Students. *Alcohol Clin Exp Res* 2000;24:48-52.
- [28] Kuntsche E, Knibbe R, Gmel G, *et al.* Why do young people drink? A review of drinking motives. *Clinical Psychol Review* 2005;25:841-61.
- [29] Crum RM, Mojtabai R, Lazareck S, *et al.* A prospective assessment of reports of drinking to self-medicate mood symptoms with the incidence and persistence of alcohol dependence. *JAMA* 2013;70:718-26.
- [30] Holahan CJ, Moos RH, Holahan CK, *et al.* Drinking to cope, emotional distress and alcohol use and abuse: A ten-year model. *J Stud Alcohol Drugs* 2001;62:190.
- [31] Menary KR, Kushner MG, Maurer E, *et al.* The prevalence and clinical implications of self-medication among individuals with anxiety disorders. *J Anxiety Disord* 2011;25:335-9.

- [32] Mushquash AR, Stewart SH, Sherry SB, *et al.* Depressive symptoms are a vulnerability factor for heavy episodic drinking: A short-term, four-wave longitudinal study of undergraduate women. *Addict Behav* 2013;38:2180-6.
- [33] Kuntsche E, Müller S. Why do young people start drinking? Motives for first-time alcohol consumption and links to risky drinking in early adolescence. *Eur Addict Res* 2011;18:34-9.
- [34] Bell S, Britton A. An exploration of the dynamic longitudinal relationship between mental health and alcohol consumption: a prospective cohort study. *BMC Medicine*, 2014;12:91.
- [35] Bell S, Orford J, Britton A. Heavy drinking days and mental health: An exploration of the dynamic 10-year longitudinal relationship in a prospective cohort of untreated heavy drinkers. *Alcohol Clin Exp Res*, 2015 (DOI: 10.1111/acer.12681)
- [36] Heinrich LM, Gullone E. The clinical significance of loneliness: A literature review. *Clinical psychology review* 2006;26:695-718.
- [37] Ernst JM, Cacioppo JT. Lonely hearts: Psychological perspectives on loneliness. *Appl Prev Psychol* 1999;8:1-22.
- [38] Hawkey LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann Behav Med* 2010;40:218-27.
- [39] Kuntsche E, Rehm J, Gmel G. Characteristics of binge drinkers in Europe. *Soc Sci Med* 2004;59:113-27.
- [40] McBroom EM, Fife EM, Nelson CL. "Risky Business": The College Transition, Loneliness, and Alcohol Consumption. *J of the First-year Experience and Students in Transition* 2008;20:45-64.
- [41] Bonin MF, McCreary DR, Sadava SW. Problem drinking behavior in two community-based samples of adults: Influence of gender, coping, loneliness, and depression. *Psychol Addict Behav* 2000;14:151.
- [42] Cacioppo JT, Hawkey LC, Crawford LE, *et al.* Loneliness and health: Potential mechanisms. *Psychosom Med* 2002;64:407-17.
- [43] Strand NP, von Soest T. *Young in Norway - Longitudinal. Documentation of design, variables and scales.* Oslo: Norwegian Social Research; 2007.
- [44] Wichstrøm L, von Soest T, Kvaalem IL. Predictors of growth and decline in leisure time physical activity from adolescence to adulthood. *Health Psychol* 2013;32:775.
- [45] Derogatis LR, Lipman RS, Rickels K, *et al.* The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behav Sci* 1974;19:1-15.
- [46] Kandel DB, Davies M. Epidemiology of depressed mood in adolescents: An empirical study. *Arch Gen Psychiat* 1982;39:1205-12.
- [47] Russell D, Peplau LA, Cutrona CE. The revised UCLA Loneliness Scale: concurrent and discriminant validity evidence. *J Pers Soc Psychol* 1980;39:472-80.
- [48] Williams RL. A note on robust variance estimation for cluster-correlated data. *Biometrics* 2000;56:645-6.
- [49] Skogen JC, Sivertsen B, Lundervold AJ, *et al.* Alcohol and drug use among adolescents: and the co-occurrence of mental health problems. *Ung@ hordaland, a population-based study.* *BMJ open* 2014;4:e005357.
- [50] Pape H, Hammer T. Sober adolescence—Predictor of psychosocial maladjustment in young adulthood? *Scand J Psychol* 1996;37:362-77.
- [51] Kuntsche E, Gabhainn SN, Roberts C, *et al.* Drinking motives and links to alcohol use in 13 European countries. *J Stud Alcohol Drugs* 2014;75:428.

- [52] Cooper ML, Krull JL, Agocha VB, Flanagan ME, *et al.* Motivational pathways to alcohol use and abuse among Black and White adolescents. *J Abnorm Psychol* 2008;117:485.
- [53] Flensburg-Madsen T. Alcohol use disorders and depression—the chicken or the egg? *Addiction* 2011;106:916-8.
- [54] Dawson DA, Grant BF, Ruan WJ. The association between stress and drinking modifying effects of gender and vulnerability. *Alcohol Alcoholism* 2005;40:453-460.
- [55] Fetzner MG, McMillan KA, Sareen J, *et al.* What is the association between traumatic life events and alcohol abuse/dependence in people with and without PTSD? Findings from a nationally representative sample. *Depress Anxiety* 2011;28:632-638.
- [56] Peirce RS, Frone MR, Russell M, *et al.* A longitudinal model of social contact, social support, depression, and alcohol use. *Health Psychol* 2000;19:28-38.
- [57] Tennant C. Life events, stress and depression: a review of recent findings. *Aus N Z J Psychiatry* 2002;36:173-182.

