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## Sub threshold problem drinkers in DSM-5 alcohol use disorder classification

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**Running head:** Sub threshold problem drinkers in DSM-5 AUD

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## **Abstract**

**Background and objectives.** The DSM-5 defined alcohol use disorder (AUD) to better cover undiagnosed subthreshold alcohol users, but few studies have investigated this topic. This study aimed to test whether subthreshold problem drinkers were a distinct subgroup of undiagnosed drinkers according to the DSM-5 AUD classification by investigating drinking patterns and longitudinal trajectories.

**Methods.** Data were collected in the Cohort Study on Substance Use Risk Factors from young Swiss men in their early twenties ( $n = 4,630$ ) at two time points. Participants responded to the 11 criteria of the DSM-5 AUD and to variables related to drinking patterns.

**Results.** Among drinkers, 23.2% and 23.5% of the participants were subthreshold problem drinkers at baseline and follow-up, respectively. The trends showed that 29.4% of them remained subthreshold problem drinkers over time. Those who remained subthreshold problem drinkers or progressed to AUD status were likely to meet the same criterion/add a new one. Subthreshold problem drinkers showed concurrent and later drinking patterns that were in between those of symptom-free drinkers and AUD drinkers.

**Discussion and conclusion.** Subthreshold problem drinkers were an important subgroup of drinkers with risky drinking patterns, but they do not necessarily progress to later AUD status and do not appear to be a consistent subgroup over time.

**Scientific significance.** Subthreshold problem drinkers did not seem to be a subgroup of undiagnosed problem drinkers in the current DSM-5 classification. The results showed that AUD appeared to be a dimensional construct, in which one additional criterion was associated with worse alcohol-related outcomes.

## Subthreshold problem drinkers in the DSM-5 alcohol use disorder classification

### 1. Introduction

Individuals who endorse some criteria of alcohol use disorder (AUD) without meeting a formal diagnosis have been presented problems in previous classifications of the DSM. These people, who meet one or two criteria of alcohol dependence, were named “diagnostic orphans” in the DSM-IV AUD classification, and studies have suggested that a non-negligible proportion of people were classified in this subgroup<sup>1-4</sup>. Diagnostic orphans constitute a distinct group of undiagnosed alcohol users, in between drinkers with no symptoms and drinkers with a formal diagnosis of AUD. They were found to be more likely to develop further AUD<sup>5</sup>.

The DSM-5 has redefined AUD to overcome this problem, among other reasons, and to provide better coverage of diagnostic orphans by incorporating less severe forms of AUD<sup>5-7</sup>. Recent studies have reported inconsistent conclusions. One study concluded that the DSM-5 definition of AUD better captured subthreshold problem drinkers (i.e., people endorsing a single criterion of AUD), with a lower number of people in this subgroup in comparison with the DSM-IV classification<sup>6</sup>. A second study reported that the overall prevalence rate of DSM-5 subthreshold problem drinkers remained high compared with DSM-IV AUD diagnostic orphans<sup>4</sup>. Additionally, few studies have investigated whether subthreshold problem drinkers were a distinct subgroup of alcohol users in the new DSM-5 AUD classification by investigating their drinking patterns. To date, the only study focusing on this question reported that DSM-5 subthreshold problem drinkers consist of a subgroup midway between symptom-free drinkers and AUD drinkers, as was the case with DSM-IV diagnostic orphans<sup>4</sup>. However, this study was cross-sectional and therefore failed to test the course of

subthreshold problem drinkers and whether they were likely to develop a DSM-5 diagnosis of AUD, for example.

This study aimed to address these gaps, and it investigated the longitudinal trajectories and drinking patterns of subthreshold problem drinkers according to the DSM-5 definition of AUD. More specifically, this study aimed to explore different questions related to the course of subthreshold problem drinkers: 1) Is subthreshold problem drinking a consistent status or a time-limited behavior? 2) Are subthreshold problem drinkers consistent, that is, do subthreshold problem drinkers who remain in this category continue to endorse the same criterion, and do subthreshold problem drinkers who become AUD drinkers endorse the same criterion and add a new one? 3) Are some criteria more severe in the course of problem drinking? 4) Do baseline AUD drinkers with two criteria regress to subthreshold problem drinkers or to symptom-free drinkers? 5) Are there differences in the drinking patterns of those who remain subthreshold problem drinkers, regress to symptom-free drinking, or progress to AUD status?

## **2. Methods**

### *2.1. Sample and procedures*

Data were collected in a longitudinal Cohort Study on Substance Use Risk Factors (C-SURF) among young Swiss men. The participants were enrolled during mandatory conscription in three Swiss national military recruitment centers (French- and German-speaking). There is no preselection for this conscription, and thus all young men around 20 years of age were eligible for inclusion in the study. Army recruitment centers were used to inform and enroll participants, but the study was independent of the army and of individuals' eligibility for military service (i.e., military service, civil service, or no service). All conscripts were given a written information sheet and consent form, and the research staff informed them of the

study's procedures and invited them to participate. Within two weeks of enrollment, the participants who had provided written consent were invited by mail or e-mail to complete the questionnaire (1 h questionnaire, completed with paper and pen or online). Participants who failed to return the questionnaire within two weeks received a reminder, and if they had not answered two weeks later, research staff called them. Thus, the assessment was carried out outside of the army environment. An average of 15 months later, they received a letter or e-mail inviting them to participate in the follow-up, using the same procedure to increase response rates. A total of 5,990 participants completed the baseline questionnaire (September 2010–March 2012), and 5,479 (91.5%) completed the follow-up questionnaire (January 2012–April 2013). This study focused on alcohol users who reported using alcohol at both baseline and follow-up ( $n = 4,820$ ). Missing values were listwise deleted, leading to a final sample of 4,630 participants (96.1% of the alcohol users). Lausanne University Medical School's Clinical Research Ethics Committee approved the study protocol (No. 15/07). More information about the sample and the main results of the cohort study are available elsewhere<sup>8,9</sup>.

## *2.2. Measures*

*DSM-5 AUD.* AUD was assessed according to the 11 criteria reported in the DSM-5 American Psychiatric Association,<sup>10</sup>. The participants were asked to think about the previous 12 months and to choose one answer for each criterion (see criteria in Table 1). “Yes/no” answers were collected, and a sum score of criteria was computed ( $\alpha = .72$  at baseline and  $\alpha = .69$  at follow-up). Following the DSM-5 guidelines, participants with a total of two or more criteria were recorded as having AUD. Participants meeting only one criterion were recorded as subthreshold problem drinkers, and those without any AUD criterion were recorded as symptom-free drinkers. To assess the reliability of the DSM-5 AUD, we used the AUDIT-C.

This three-item alcohol screen was also assessed to identify hazardous drinkers and people with active AUD<sup>11</sup>. A sum score was computed (0-12), and Spearman correlations between the DSM-5 AUD and AUDIT-C were calculated to assess the construct validity of the DSM-5 AUD:  $r = .5$  at both baseline and follow-up. We also conducted Spearman correlations between the DSM-5 AUD and alcohol-related consequences (see description below) to assess its reliability:  $r = .6$  at both baseline and follow-up.

*Drinking volume.* The volume of alcohol intake was measured with an extended quantity-frequency measurement questionnaire (we computed the total number of drinks per week, differentiating between weekdays and weekends<sup>12</sup>).

*RSOD.* We assessed risky single-occasion drinking (RSOD) frequency by asking participants how often they drank a quantity of six or more drinks on a single occasion (10-12 g of ethanol per drink). RSOD that occurred monthly or more frequently was coded “1,” otherwise, “0.”

*Alcohol-related consequences.* Alcohol-related consequences were assessed as in Knight et al.<sup>13</sup> with nine questions (i.e., whether participants drank/took medicines to recover from negative secondary effects, experienced mental blackouts, did something that he or she later regretted, participated in unplanned sex, participated in sex without a condom, experienced an accident/injury, engaged in conflict with the police/authorities more than once, got in an argument/fight, and damaged property). The answers were coded “0” if the consequence had not taken place and “1” if it had occurred at least once. A sum score was then computed.

*Covariates.* The demographic covariates included age, language (French or German), level of education attained (lower secondary, upper secondary, or tertiary) and perceived family income as a proxy for level of income (below-average income, average income, and above-average income).

Alcohol-related variables were assessed over the previous 12 months and were included in both baseline and follow-up assessments. The covariates were assessed at baseline.

### *2.3. Statistical analyses*

First, descriptive statistics were computed, including the prevalence rate of subthreshold problem drinkers and the endorsement of each DSM-5 AUD criterion among subthreshold problem drinkers at baseline and follow-up.

Second, to test whether the course of subthreshold problem drinkers was consistent or whether it was a time-limited behavior (question 1), we used cross-tables of baseline and follow-up status with Fisher exact tests. We differentiated between participants with an AUD status with two criteria and those with an AUD status with three or more criteria to better capture the progression of subthreshold problem drinkers (i.e., the addition of one criterion, question 4).

Third, we investigated whether consistent subthreshold problem drinkers (those who remained subthreshold problem drinkers at baseline and follow-up) and those who progressed to AUD had a stable pattern of criteria endorsement over time, using percentages and chi-square tests (question 2).

Fourth, we investigated the differences in drinking patterns among subgroups of drinkers (question 5). The associations of AUD status with alcohol-related variables (drinking volume, alcohol-related consequences, RSOD, and AUD status) were investigated using generalized linear models (GLMs). Cross-sectional associations of AUD status at baseline (symptom-free drinkers, subthreshold problem drinkers, and AUD drinkers) with drinking volume, alcohol-related consequences, and RSOD at baseline were tested (negative binomials for drinking volume and alcohol-related consequences and logistic regressions for RSOD). The longitudinal associations of AUD status at baseline with drinking volume, alcohol-related consequences, RSOD, and AUD status at follow-up (symptom-free and subthreshold problem drinkers versus AUD drinkers) were then tested (using negative binomials and logistic



regressions). Then, we focused specifically on participants with a subthreshold problem drinking status at baseline and tested whether their AUD status at follow-up (symptom-free, subthreshold problem, and AUD) was associated with different drinking patterns. Finally, we considered different subgroups of subthreshold problem drinkers according to the most endorsed criteria at baseline to determine whether some of them were likely to have worse alcohol outcomes at baseline and follow-up (question 3). For all GLMs, we controlled for demographics (age, language, education, and perceived family income) and the level of the outcome at baseline for longitudinal associations. The analyses were performed using SPSS 22.

#### **4. Results**

The participants were 20.00 years old  $\pm$  1.21 years on average, and 55.4% were French-speaking. A total of 48.8% had a lower-secondary level of education, 24.3% an upper-secondary level of education, and 26.9% a tertiary level of education. Regarding their perceived family income, 13.5% answered that their family had a below-average income, 45.6% reported an above-average income, and 41.0% had an average income.

Of the participants (drinkers at both baseline and follow-up), 23.2% at baseline and 23.5% at follow-up were subthreshold problem drinkers. The prevalence rates of DSM-5 AUD drinkers were 35.1% and 35.3% at baseline and follow-up, respectively (prevalence rate of the whole sample in the cohort study including nondrinkers: 15.2% at baseline and 15.4% at follow-up). Subthreshold problem drinkers mainly endorsed three criteria (see Table 1): “recurrent alcohol use in situations in which it is physically hazardous,” “drink more/longer than intended,” and “tolerance.” The other criteria were less endorsed (sum of the remaining criteria: 12.9% and 12.1%).

The transitions between AUD status are reported in Table 2. We distinguished between AUD drinkers with two criteria and AUD drinkers with three or more criteria to obtain a better overview of less severe forms of AUD. Baseline symptom-free drinkers and AUD drinkers with three or more criteria were most likely to remain in the same category at follow-up ( $p < .05$  for pairwise comparisons between the different groups at follow-up), whereas baseline subthreshold problem drinkers and AUD drinkers with two criteria were likely to show transitions to another status ( $p < .05$  for pairwise comparisons between the different groups at follow-up). Subthreshold problem drinkers were more likely to become symptom-free drinkers than to become AUD drinkers ( $p < .05$  for pairwise comparisons between the different groups at follow-up). AUD drinkers with two criteria were likely to become subthreshold problem drinkers or AUD drinkers with three criteria ( $p < .05$  for pairwise comparisons between the different groups at follow-up).

Table 3 presents the percentages of endorsed criteria for the subthreshold problem drinkers who remained subthreshold problem drinkers at follow-up (first panel) and subthreshold problem drinkers who became AUD drinkers at follow-up (second panel). For subthreshold problem drinkers at both baseline and follow-up, the criteria “drink more/longer than intended” and “recurrent alcohol use in situations in which it is physically hazardous” appeared quite consistent over time (if they were not endorsed at baseline, they were not endorsed at follow-up: 72.4% and 79.7% for “drink more/longer than intended” and “recurrent alcohol use in situations in which it is physically hazardous,” respectively, and if they were endorsed at baseline, they were also endorsed at follow-up: 68.3% and 63.9%, respectively,  $p < .001$  for chi-square tests). In contrast, “tolerance” and “other criteria” were less endorsed at follow-up, with only 32.6% and 28.6% of subthreshold problem drinkers who endorsed these criteria at baseline also endorsing them at follow-up ( $p < .003$  for chi-square tests). Subthreshold problem drinkers at baseline who became AUD drinkers at follow-up

showed higher percentages of endorsement of different criteria at follow-up: for example, participants who endorsed “drink more/longer than intended” at baseline also endorsed it at follow-up (75.2%), and those who did not endorse this criterion at baseline were more likely to endorse it at follow-up (88.5%) ( $p = .006$ ). This result was not observed for tolerance, which was more likely to not be endorsed at follow-up if it was not endorsed at baseline (68.0%) ( $p < .001$ ).

The associations of AUD status at baseline with alcohol-related variables at baseline (cross-sectional) and follow-up (longitudinal) are reported in Table 4. The first panel of Table 4 focused on the sample of all participants (drinkers at baseline and follow-up) and showed that subthreshold problem drinkers at baseline were in between symptom-free drinkers and AUD drinkers regarding all alcohol-related variables (drinking volume, alcohol-related consequences, RSOD, and AUD diagnosis) at both baseline and follow-up. For example, subthreshold problem drinkers at baseline reported 7.84 drinks per week at baseline, whereas AUD drinkers reported 14.56 drinks and symptom-free drinkers reported 5.19 drinks ( $p < .05$  for pairwise comparisons between the different groups). There was a decrease in the drinking patterns of AUD drinkers at baseline (e.g., drinking volume = 14.56 at baseline and 8.79 at follow-up). This was partly because we controlled for the level of the outcome at baseline (without control: drinking volume = 14.6 at baseline and 13.0 at follow-up, not shown in Table 4). For AUD drinkers at baseline and follow-up, their drinking patterns were stable over time (drinking volume: 16.3 at baseline and 15.7 at follow-up,  $p = .558$ , for related-samples Wilcoxon signed rank test; RSOD: 0.83 at baseline, 0.81 at follow-up,  $p = .190$ ; alcohol-related consequences: 3.17 at baseline, 3.08 at follow-up,  $p = .291$ ; results not shown in Table 4). The second panel of Table 4 focused on subthreshold problem drinkers at baseline and showed that baseline subthreshold problem drinkers who became AUD drinkers at follow-up reported higher levels of alcohol-related outcomes (e.g., drinking volume = 9.33) than those

who remained subthreshold problem drinkers (drinking volume = 7.40), and those who remained subthreshold problem drinkers reported higher levels than those who became symptom-free drinkers (drinking volume = 5.17) ( $p < .05$  for pairwise comparisons between the different groups). Finally, there were no significant differences in alcohol-related outcomes according to the criterion that subthreshold problem drinkers endorsed in both the cross-sectional and longitudinal associations (see the third panel of Table 4).

## **5. Discussion**

This study aimed to test whether subthreshold problem drinking status was a specific subgroup according to the DSM-5 AUD classification. For this purpose, we investigated the drinking patterns and longitudinal trajectories of subthreshold problem drinkers.

First, the prevalence rate of subthreshold problem drinkers was quite high using the DSM-5 classification. A total of 23.2% and 23.5% of the participants who were alcohol drinkers during the two time points in the study were classified as subthreshold problem drinkers at baseline and follow-up, respectively. This result was in line with the findings of Hagman et al.,<sup>4</sup> who reported an elevated rate of subthreshold problem drinkers in a sample of US college students (19.6%). The prevalence rate of AUD was high in this sample of drinkers over a period of 15 months: 35.1% were classified as AUD drinkers at baseline and 35.3% at follow-up. When considering the overall sample of the cohort study (including nondrinkers and participants who did not drink at both baseline and follow-up), the prevalence rates were 15.2% and 14.4% at baseline and follow-up, respectively. This prevalence rate is in line with previous studies conducted elsewhere (e.g., 17.6% for US men, 18 years and older<sup>14</sup>).

We first tested whether being a subthreshold problem drinker was a consistent status or a time-limited behavior (question 1). The transitions in AUD status showed a certain stability for symptom-free drinkers and drinkers with an AUD who fulfilled three or more criteria.

They were more likely to remain in the same group 15 months later. In contrast, only 29.4% of the subthreshold problem drinkers at baseline were still classified as subthreshold problem drinkers at follow-up. The symptomatology of subthreshold problem drinking could improve (36.5% became symptom-free drinkers) or deteriorate (34.1% became AUD drinkers). Thus, being a subthreshold problem drinker did not necessarily appear to be a step toward self-reported AUD status. Interestingly, subthreshold problem drinkers were not the only group who appeared to have an unstable status, as AUD drinkers endorsing two criteria were also likely to regress (become a symptom-free drinker or a subthreshold problem drinker) or progress (fulfill three or more criteria) (question 4). The less severe forms of AUD seemed quite unstable in comparison with the more severe forms of AUD and with being a symptom-free drinker. Overall, subthreshold problem drinking seemed to be a time-limited behavior, and thus it seems appropriate that these participants are not given a formal AUD diagnosis. The instability of the participants meeting two AUD criteria may suggest that a cutoff of three AUD criteria would be more appropriate for defining AUD, at least in a sample of young men using self-reported measures. Further investigations should focus on the stability of the less severe forms of AUD.

Second, we focused on the endorsed criteria to test whether subthreshold problem drinkers reported consistent criteria over time (question 2). The most endorsed criteria were the same as those reported in Hagman et al.<sup>4</sup> among US college students: tolerance, drinking in hazardous situations, and drinking more/longer than intended. These criteria are also reported as representing less severe forms of AUD in the DSM-IV classification<sup>5 15</sup>. Two criteria were more likely to be endorsed over time: drinking more/longer than intended and drinking in hazardous situations. Subthreshold problem drinkers who endorsed these criteria at baseline and either remained subthreshold problem drinkers or became AUD drinkers at follow-up were likely to continue endorsing them. When subthreshold problem drinkers became AUD

drinkers, they were also more likely to endorse these criteria if they did not endorse them at baseline. Tolerance showed a different pattern. When subthreshold problem drinkers at both baseline and follow-up endorsed this criterion at baseline, they were not likely to report this criterion at follow-up. Subthreshold problem drinkers at baseline who progressed to AUD drinker status at follow-up were not likely to add this criterion as a second criterion. Tolerance is an important criterion for AUD diagnosis. However, it should be a developmental phenomenon rather than a pathological process for young drinkers<sup>15</sup>. Indeed, as young people learn how to drink, tolerance may indicate something different than the diagnostic criterion. Therefore, the results regarding tolerance and its instability over time should be interpreted cautiously.

We also tested whether some criteria were more severe during the course of problem drinking (question 3). Again, regarding the type of criterion endorsed, the multivariate analyses did not show differences in the drinking patterns of subthreshold problem drinkers according to their endorsed criterion. No criteria appeared more severe in the course of subthreshold problem drinkers.

Finally, we tested whether the drinking patterns differed between the different subgroups of drinkers (question 5). Subthreshold problem drinkers had higher levels of alcohol-related outcomes (drinking volume, RSOD, and alcohol-related consequences) than symptom-free drinkers but lower levels than AUD drinkers. This result was consistent with studies referring to the DSM-IV and DSM-5<sup>4,5</sup>. Subthreshold problem drinkers were also more likely to be engaged in later hazardous drinking patterns, with worse alcohol-related outcomes at follow-up than symptom-free drinkers.

Participants who were classified as AUD drinkers at baseline showed decreases in their drinking patterns over time. This was partly because AUD status was not stable over time, especially for those with a less severe form of AUD (two criteria). Therefore, participants

who regress to subthreshold problem or symptom-free drinking probably contributed to the decrease in drinking patterns. Indeed, when we considered only participants who were AUD drinkers at baseline and follow-up, drinking patterns were stable over time.

This study had some limitations. The first was that the participants were only men; thus, more studies are needed among women to determine whether the findings apply to both genders. Second, the use of self-reported measures may cause response bias, such as participants underreporting high levels of alcohol use, or misinterpretation of the AUD criteria. Indeed, young drinkers may interpret the AUD criteria differently than experienced drinkers<sup>15</sup>. We used the AUDIT-C and alcohol-related consequences to assess the construct validity and reliability of the DSM-5 AUD, resulting in moderate correlations (.5 and .6, respectively). These correlations provided modest support to the validity of the DSM-5 AUD in capturing active AUD. The fact that the reported drinking volumes were similar at baseline and follow-up in participants who remained AUD drinkers at both time points was an indicator of the reliability of the AUD measure. Further investigations comparing self-reported DSM-5 AUD criteria and clinical interviews are needed to test the validity of self-reported DSM-5 AUD, and thus the results of this study should be interpreted cautiously, especially those related to tolerance, which may be over-reported among young people<sup>16</sup>. However, this problem is not specific to this study; previous studies have also reported that reliable diagnoses of substance use disorders are difficult to assess without an extensive anamnesis<sup>17</sup>. Despite this limitation, general population assessments are needed for public health planning and monitoring (i.e., prevalence rates, treatment planning, early interventions), and thus studies focusing on methodological questions related to self-reported screening tools for AUD are important. A last limitation was that the participants were not heavy drinkers (i.e., an average of 15-16 drinks per week for AUD drinkers, whereas the upper limit of nonhazardous drinking is 14-15

drinks per week). We sought to investigate the question of subthreshold problem drinkers in a population-based sample of young adults and found low levels of hazardous drinking, but further investigations including heavy drinkers are needed.

## 6. Conclusions

In sum, this study highlighted that subthreshold problem drinkers remain an important subgroup of drinkers with risky drinking patterns in the new DSM-5 AUD classification; thus, they should be a focus of alcohol screening and prevention efforts. However, these drinkers do not necessarily progress to a later AUD diagnosis and do not appear to be a consistent subgroup over time. Subthreshold problem drinkers did not seem to be a problem in the current DSM-5 classification. The results again showed that AUD appeared to be a dimensional construct in which one additional criterion was associated with worse alcohol-related outcomes.

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Table 1. DSM-5 alcohol use disorder criteria endorsed by subthreshold problem drinkers

	Baseline n=1,072	Follow-up n=1,090
Drink more/longer than intended	31.7 (340)	39.4 (429)
Desire/unsuccesful efforts to cut down/stop drinking	1.1 (12)	0.6 (7)
Spent a lot of time drinking/getting over after-effects	3.5 (37)	3.9 (42)
Craving/urge to use alcohol	0.6 (6)	0.6 (6)
Failure to fulfill major role obligations	5.3 (57)	4.7 (51)
Continued drinking despite social/interpersonal problems	1.0 (11)	1.2 (13)
Given up/cut back important activities in order to drink	0.1 (1)	0.2 (2)
Recurrent alcohol use when physically hazardous	37.6 (399)	38.4 (419)
Continued drinking despite physical/psychological problems	0.6 (6)	0.1 (1)
Tolerance	18.2 (195)	10.1 (110)
Withdrawal	0.7 (8)	0.9 (10)

Percentages (and n) of subthreshold problem drinkers' endorsement of DSM-5 AUD criteria at baseline and follow-up are reported.

Table 2. Transition in AUD status between baseline and follow-up

		Follow-up			
		Symptom-free (41.1%)	Subthreshold problem drinkers (23.5%)	AUD (2 criteria) (15.6%)	AUD (3 ≥ criteria) (19.7%)
Baseline	Symptom-free (41.7%)	62.8 (1,214) <sup>a</sup>	21.7 (420) <sup>b</sup>	8.7 (168) <sup>c</sup>	6.7 (130) <sup>d</sup>
	Subthreshold problem drinkers (23.2%)	36.5 (391) <sup>a</sup>	29.4 (315) <sup>b</sup>	18.9 (203) <sup>b</sup>	15.2 (163) <sup>a</sup>
	AUD (2 criteria) (14.6%)	23.2 (157) <sup>a</sup>	27.4 (186) <sup>b</sup>	25.1 (170) <sup>c</sup>	24.3 (165) <sup>b</sup>
	AUD (3 ≥ criteria) (20.5%)	15.1 (143) <sup>a</sup>	17.8 (170) <sup>b</sup>	19.0 (165) <sup>c</sup>	48.1 (456) <sup>d</sup>

AUD: alcohol use disorder.

Percentages (and n) are given. Percentages are reported by lines, e.g., among symptom-free drinkers at baseline, 62.8% were also symptom-free at follow-up.

<sup>a, b, c, d</sup> Subscript letters correspond to pairwise comparisons within a row (comparisons of proportions between the different groups of drinkers at follow-up according to the group at baseline). A same subscript letter within a row denotes that the proportions did not differ according to Fisher's exact test; two different subscript letters denote that the proportions differed at the 0.05 level.

Table 3. Percentage of endorsed criteria for subthreshold problem drinkers at baseline

				Follow-up		p-value <sup>1</sup>	
				Not endorsed	Endorse d		
Baseline e	Subthreshold problem drinkers at baseline and follow-up (n=315)	Drink more/longer than intended	Not endorsed	72.4	27.6	<.001	
			Endorsed	31.7	68.3		
		Recurrent alcohol use when physically hazardous	Not endorsed	79.7	20.3	<.001	
			Endorsed	36.1	63.9		
		Tolerance	Not endorsed	94.8	5.2	<.001	
			Endorsed	67.4	32.6		
		Other criteria	Not endorsed	90.7	9.3	.003	
			Endorsed	71.4	28.6		
	AUD drinkers at follow-up (n=366)	Subthreshold problem drinkers at baseline and follow-up (n=366)	Drink more/longer than intended	Not endorsed	24.8	75.2	.006
				Endorsed	11.5	88.5	
		Recurrent alcohol use when physically hazardous	Not endorsed	52.4	47.6	<.001	
			Endorsed	16.9	83.1		
		Tolerance	Not endorsed	68.0	32.0	<.001	
			Endorsed	23.8	76.2		
		Other criteria	Not endorsed	39.9	60.1	.021	
			Endorsed	22.6	77.4		

Percentages in rows are reported, e.g., among subthreshold problem drinkers at baseline and follow-up who endorsed the criterion “drink more/longer than intended” at baseline, 68.3% endorsed this criterion at follow-up.

<sup>1</sup> p-values for  $\chi^2$  are reported.

Table 4. Cross-sectional and longitudinal associations of AUD diagnosis and subgroups of subthreshold problem drinkers with alcohol-related variables

		Drinking volume <sup>1</sup>	Alcohol-related consequences <sup>1</sup>	RSOD <sup>2</sup>	AUD diagnosis <sup>2</sup>
Overall	Cross-sectional associations: AUD status at baseline and drinking patterns at baseline				
	Symptom-free	5.19 (0.14) <sup>a</sup>	0.64 (0.03) <sup>a</sup>	0.29 (0.01) <sup>a</sup>	-
	Subthreshold problem drinkers	7.84 (0.27) <sup>b</sup>	1.23 (0.05) <sup>b</sup>	0.52 (0.02) <sup>b</sup>	-
	AUD	14.56 (0.40) <sup>c</sup>	2.79 (0.09) <sup>c</sup>	0.77 (0.01) <sup>c</sup>	-
	Longitudinal associations: AUD status at baseline and drinking patterns at follow-up				
	Symptom-free	6.25 (0.17) <sup>a</sup>	0.93 (0.04) <sup>a</sup>	0.38 (0.01) <sup>a</sup>	0.15 (0.01) <sup>a</sup>
	Subthreshold problem drinkers	7.98 (0.28) <sup>b</sup>	1.26 (0.06) <sup>b</sup>	0.48 (0.02) <sup>b</sup>	0.34 (0.02) <sup>b</sup>
AUD	8.79 (0.26) <sup>c</sup>	1.51 (0.06) <sup>c</sup>	0.59 (0.02) <sup>c</sup>	0.59 (0.01) <sup>c</sup>	
Longitudinal associations: AUD status at follow-up and drinking patterns at follow-up					
	Symptom-free	5.17 <sup>a</sup>	0.63 <sup>a</sup>	0.27 <sup>a</sup>	-
	Subthreshold problem drinkers	7.40 <sup>b</sup>	1.09 <sup>b</sup>	0.49 <sup>b</sup>	-
	AUD	9.33 <sup>c</sup>	1.73 <sup>c</sup>	0.65 <sup>c</sup>	-
Cross-sectional associations: subgroups according to endorsed criteria at baseline and drinking patterns at baseline					
Subthreshold problem drinkers	Drink more/longer	7.32 (0.47) <sup>a</sup>	1.04 (0.09) <sup>a</sup>	0.48 (0.03) <sup>a</sup>	-
	Tolerance	8.73 (0.71) <sup>a</sup>	1.28 (0.13) <sup>a</sup>	0.57 (0.04) <sup>a</sup>	-
	Physically hazardous	7.84 (0.47) <sup>a</sup>	1.09 (0.08) <sup>a</sup>	0.51 (0.04) <sup>a</sup>	-
	Other	7.61 (0.72) <sup>a</sup>	1.76 (0.20) <sup>a</sup>	0.52 (0.05) <sup>a</sup>	-
Longitudinal associations: subgroups according to endorsed criteria at baseline and drinking patterns at follow-up					
	Drink more/longer	6.78 (0.43) <sup>a</sup>	1.08 (0.09) <sup>a</sup>	0.42 (0.03) <sup>a</sup>	0.27 (0.03) <sup>a</sup>
	Tolerance	6.68 (0.55) <sup>a</sup>	1.15 (0.12) <sup>a</sup>	0.47 (0.04) <sup>a</sup>	0.33 (0.04) <sup>a</sup>
	Physically hazardous	7.71 (0.46) <sup>a</sup>	1.19 (0.09) <sup>a</sup>	0.49 (0.03) <sup>a</sup>	0.38 (0.03) <sup>a</sup>
	Other	7.71 (0.74) <sup>a</sup>	1.11 (0.14) <sup>a</sup>	0.47 (0.05) <sup>a</sup>	0.39 (0.04) <sup>a</sup>

Adjusted means/proportions are reported.

AUD: alcohol use disorder, RSOD: risky single-occasion drinking.

Drinking volume: total number of drinks per week (quantity-frequency questionnaire), ranging from .06 to 91.

Alcohol-related consequences: sum score of nine questions (range 0-9).

RSOD: Drinking six or more drinks on a single occasion at least monthly.

<sup>1</sup> negative binomial regressions, <sup>2</sup> logistic regressions.

<sup>a, b, c</sup> Subscript letters correspond to pairwise comparisons within a column (comparisons of means between the different groups of drinkers). A same subscript letter within a column (symptom-free, subthreshold problem drinkers, and AUD) denotes that the means/proportions did not differ between the three groups; two different subscript letters denote that the proportions differed at the 0.05 level.

All analyses were conducted controlling for age, language, educational level, perceived family income, and level of the outcome variable at baseline for longitudinal associations.