

## Adolescents Admitted to In-Patient Treatment with Alcohol Intoxication: Risk and Resilience Factors Associated with Problematic Alcohol Use

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### Abstract

**Background and Objectives:** Although the number of adolescents admitted to in-patient treatment with alcohol intoxication (AIA) has strongly risen in many countries, knowledge about this patient population with respect to risk and resilience factors is lacking. The objectives of this study were (1) to explore whether the prevalence of substance use and use-related problems in a sample of AIA is elevated compared to adolescents from the general population and (2) to investigate which biopsychosocial factors are associated with prior problematic alcohol use in AIA.

**Methods:** In a cross-sectional naturalistic study 65 AIA (M and SD age 15.2 ± 1.6 yr) completed questionnaires and were interviewed the morning after admission in two pediatric hospitals in the City of Dresden, Germany. Assessment included substance use, alcohol use disorders, and risk and resilience factors for problematic alcohol use.

**Results:** Elevated prevalence rates were found for alcohol abuse, alcohol dependence, binge drinking, smoking, and illicit substance use. Exploratory analyses revealed that deviant peer affiliations, a positive family history of alcoholism, an elevated alcohol tolerance, and a parenting style characterized by less supervision and strictness were associated with problematic alcohol use.

**Conclusions:** The investigated risk and resilience factors for problematic alcohol use should be included in the clinical decision regarding psychosocial interventions following hospitalization.

**Keywords:** Adolescents; Alcohol use disorders; Alcohol intoxication; AUDIT; Risk factors

### Introduction

In many European countries the number of adolescents admitted to in-patient treatment with alcohol intoxication (AIA) has dramatically risen over the last 10 years [1-3]. In Germany, this figure increased for individuals between the ages of 10 and 20, from 14,105 cases in 2003 to 26,673 in 2012 [4]. This is a disturbing development since excessive alcohol consumption is associated with acute problems, including aggressive behavior [5], suicide [6], accidents [7], and sexual violence [8]. Moreover, risky consumption patterns can impair psychosocial development [9] and elevate the risk for future alcohol dependence [10,11]. However, current knowledge is insufficient regarding the patient population of AIA. Hence, until now, it is unclear whether AIA are already at an elevated risk for problematic alcohol use or the development of alcohol use disorders (AUD). On the one hand, an alcohol-related hospital admission might possibly reflect an “accident,” not necessarily implying problematic habitual drinking. On the other hand, it already can be an indicator for a problematic psychosocial development. To shed light on this question, our first research aim was to explore whether the prevalences of substance use and use-related

problems in AIA are elevated compared to adolescents from the general population.

Within this context, problematic alcohol use in adolescents is an important health hazard since it is associated with a higher risk for the development of AUD [12,13]. Yet, knowledge about which biopsychosocial factors are associated with problematic alcohol use in AIA is lacking. However, it would help pediatricians to improve their decisions about which factors to be focus on in a psychosocial intervention. Therefore, the second aim of the present study was to explore which biopsychosocial risk and resilience factors are associated with problematic alcohol use in AIA. For this purpose, we considered the following five potential risk and resilience factors which might predict problematic alcohol use and assessed these variables by interviewing AIA at the bedside.

First, parenting behavior has been identified as a factor associated with the health and drinking behaviour of adolescents [14,15]. Evidence from longitudinal studies suggests that particularly parental supervision, parental involvement, and a good parent-child relationship contribute to a delay of early alcohol initiation and moderate later alcohol use by adolescents [16]. We hypothesized that higher rates of parental involvement and parental supervision are associated with a lower risk for problematic alcohol use in AIA. On the

other hand, pronounced authoritarian parenting behavior can corrupt the quality of the parent-child relationship [17]. We therefore hypothesized that authoritarian behavior, reflected by lower rates of autonomy granting, are associated with a higher risk for problematic alcohol use. Second, the influence of peers on adolescent behavior including drinking increases over time, while that of parents decreases [18]. Particularly deviant peer affiliations were found to be associated with adolescent substance abuse [19]. We hypothesized that higher rates of deviant peer affiliations predict the risk for problematic alcohol use in AIA. Third, children of parents with alcohol problems have an increased risk to drink more during adolescence and are more likely to develop alcohol dependence themselves [20]. We therefore hypothesized that in AIA, parental alcoholism would also be associated with problematic alcohol use. Fourth, it is assumed that an elevated alcohol tolerance is associated with a higher risk for problematic alcohol use and the development of AUD [21]. That is why we hypothesized that AIA with problematic alcohol use have a higher alcohol tolerance than AIA with no problematic alcohol use. Fifth, an early onset of alcohol use is an often-discussed risk factor for heavy drinking and the development of AUD. We therefore hypothesized that AIA with problematic alcohol use report an earlier age of onset than AIA without problematic alcohol use.

## Materials and Method

### Participants and recruitment

This study was conducted between May 2009 and September 2010 in the two hospitals for children and adolescents in the city of Dresden, Germany (University Hospital Carl Gustav Carus and Municipal

Hospital Dresden-Neustadt). On the morning after admission, nurses asked all patients who were hospitalized due to acute alcohol intoxication or toxic effect of alcohol (ICD-10: F10.0, T51.0, or T51.9) whether they would volunteer to participate and provided written information on the study [22-25]. If patients agreed, nurses called study staff, who visited the patients within 12 to 18 hours after admission. Inclusion criteria were (i) age  $\leq$  17 years; (ii) in-patient treatment due to alcohol intoxication which was verified by reviewing the laboratory test results, and (iii) written informed consent from at least one parent or legal guardian and from the patient if he or she was at least 16 years old. Exclusion criteria were (i) lack of competence in German language and (ii) inability to give informed consent.

A total of 65 children and adolescents and their parents gave written informed consent. They were interviewed at the bedside by study staff and completed the questionnaires described below. Altogether, these procedures lasted approximately 45 minutes. Data from hospital medical records were also collected. According to the hospitals' electronic chart systems, another 52 patients were treated during the study period with a diagnosis of acute alcohol intoxication or toxic effect of alcohol in the two hospitals, but did not participate in our study. Reasons for not participating in the study were that parents refused to give informed consent, patients were discharged early or left the hospital against medical advice, or study staff could not be informed by nursing staff given the high workload at the paediatric hospitals. A comparison between demographic characteristics of participants and patients who did not participate revealed that the groups did not statistically significant differ in terms of age and sex (Table 1).

	Participants	Non-participants	Group difference (p-value)
Sex (n)			0.12
Female	22	25	
Male	43	27	
Age			
Mean (SD)	15.2 (1.6)	15.5 (1.3)	0.24
Age range, n (% female)			
10-11	2 (100%)	0	
12-13	8 (38%)	4 (25%)	
14-15	22 (36%)	19 (42%)	
16-17	33 (27%)	29 (55%)	

**Table 1:** Demographic characteristics comparing study participants with non-participating patients admitted during the recruitment period.

### Assessment of substance use and use-related problems

The 10-item AUDIT questionnaire [26] was used to determine harmful alcohol use (lifetime). We employed a cut-off score of 7 or more to define problematic alcohol use since this was found to be more appropriate for adolescent populations [27,28] than the cut-off of 8 that is usually applied in adults. Alcohol consumption was assessed using the three AUDIT items measuring consumption frequency,

consumption quantity, and frequency of binge drinking, respectively (AUDIT-C) [29]. We used the proposed AUDIT-C cut-off score of 5 or more to identify problematic drinking [27]. Alcohol dependence and abuse (lifetime) according to DSM-IV were assessed using the Munich Composite International Diagnostic Interview (M-CIDI) [30]. Smoking status was determined by asking participants if they currently smoke. Response categories included "no," " $\leq$  1x/ month," " $\leq$  1x/ week," "weekly, but not daily," and "daily." The categories " $\leq$  1x/ month"

and “≤ 1x/ week” and the categories “weekly, but not daily” and “daily” were collapsed into “Irregular smoking” and “Regular smoking,” respectively. For regular smokers, the degree of nicotine dependence was measured using the Fagerström Test for Nicotine Dependence (FTND) [31]. Lifetime use of illicit substances was assessed by asking whether the participants had ever consumed cannabinoids, hallucinogens, amphetamines, ecstasy, cocaine, heroin, or benzodiazepines. Blood alcohol concentration (BAC) was measured from blood samples obtained on admission and expressed as mg ethanol per 100 mg of full venous blood, i.e., 80 mg% is equivalent to 0.08% or 0.8 ‰.

### Assessment of risk and resilience factors for problematic alcohol use

Parenting styles were assessed by the patients using a self-rating questionnaire with three subscales according to Steinberg et al. [28]. The supervision/strictness subscale measures parental monitoring, i.e. the perceived level of parental knowledge about the activities of their children and the setting of limits (8 items). The acceptance/ involvement scale measures the extent to which the adolescent perceives his or her parents as loving, responsive, and involved (9 items). The autonomy granting subscale measures the perceived level of decision-making by the parent without child participation and the extent to which parents employ democratic discipline (9 items). In our sample, Cronbach’s α for the 3 subscales was 0.67, 0.68, and 0.68. Family history of alcoholism was assessed by asking the following question: “Do you think that one of your biological relatives had a serious alcohol problem that has been treated or that should have been treated?” A list with relatives was presented to the participants where they should decide whether or not one or more of their parents or grandparents had a problem with alcohol. A family history density of alcoholism (FHDA) score was calculated, adding 0.5 for each alcohol-affected parent and 0.25 for each alcohol-affected grandparent. Thus, FHDA scores could range from 0 to 2 [33]. Deviant peer behaviour was assessed using a German version of the Deviant Peer Affiliations Scale [34]. Participants indicated whether their friends were involved in at least one of the following behaviours: use of tobacco, alcohol or illicit drugs, stealing or beating somebody up, cutting school, being expelled from school, or having trouble with the police. Affirmed items

were summed up to obtain a total score ranging from 0 to 7. The age of first alcohol drink was assessed by asking participants at which age they had their first full drink of alcohol. Alcohol tolerance was measured with the Self-Rating of the Effects of Alcohol (SRE) questionnaire according to Schuckit et al. [31].

### Statistical analyses

We tested sex differences in prevalences of substance use and use-related problems for statistical significance by applying t-tests for the continuous variables “BAC at admission” and “FTND score” and chi-square tests or Fisher’s exact test (for cell sizes ≤ 5) for categorical variables. To explore which factors were associated with problematic alcohol use in AIA, we classified participants into groups with AUDIT scores below the critical cut-off for problematic alcohol use in adolescents of 7 (low AUDIT) vs. 7 or above (high AUDIT). Differences between the two groups with respect to putative risk and resilience factors for problematic alcohol use were tested for statistical significance using binary logistic regression models for every risk and resilience factor by applying the dichotomous group variable “low AUDIT” vs. “high AUDIT” as dependent variable. Age and sex were included in all regression models as independent variables to control for their influence. AUDIT group differences with respect to age and sex were tested for significance using t-test and chi-square test, respectively. Statistical analyses were performed using IBM SPSS Statistics Version 22 (IBM Corp., Armonk, NY).

### Ethics

The study and its protocol were approved by the ethics committee of the Technical University (Technische Universität) Dresden.

### Results

#### Prevalence of substance use and use-related problems

Our exploration of substance use patterns and use-related problems revealed the prevalences described in Table 2. Analyses of sex differences revealed no statistically significant differences between male and female participants (Table 2).

	Total		Male		Female		Sex difference (p-value)
	n	% / M	n	% / M	n	% / M	
Alcohol							
Alcohol consumption <sup>1</sup>							
Frequency							0.79
Never	6	10.5	4	10.5	2	10.5	
Monthly or less	23	40.4	14	36.8	9	47.4	
2-4 times a month	20	35.1	15	39.5	5	26.3	
>Once a week	8	14.0	5	13.2	3	15.8	
Quantity (number of drinks on a typical drinking day) <sup>2</sup>							0.39
1 or 2	42	82.4	27	79.4	15	88.2	

3 or 4	2	3.9	2	5.9	-		
5 or 6	3	5.9	3	8.8	-		
≥ 7	4	7.8	2	5.9	2	11.8	
Binge drinking (≥ 6 drinks on one occasion) <sup>2</sup>							0.67
Never	23	45.1	14	41.2	9	52.9	
Less than monthly	17	33.3	11	32.4	6	35.3	
Monthly	4	7.8	3	8.8	1	5.9	
Weekly or more often	7	13.7	6	17.6	1	5.9	
Problematic alcohol use							
AUDIT cut-off ≥ 7	25	43.9	18	47.4	7	36.8	0.45
AUDIT-C cut-off ≥ 5	10	17.5	8	21.1	2	10.5	0.47
Alcohol Use Disorders <sup>3</sup>							
Alcohol abuse	8	13.3	5	12.8	3	14.3	1.00
Alcohol dependence	9	14.8	8	20.0	1	4.8	0.15
BAC at admission in mg%, mean (SD)	65	147.8 (38.4)	43	149.7 (30.0)	22	144.2 (51.3)	0.65
Nicotine							
Smoking							0.12
No current smoking	29	50.9	23	60.5	6	31.6	
Irregular smoking	7	12.3	4	10.5	3	15.8	
Regular smoking	21	36.8	11	28.9	10	52.6	
FTND score <sup>4</sup> , mean (SD)	21	3.2 (2.4)	11	2.8 (1.7)	10	3.6 (3.1)	0.49
Illicit substances							0.73
Never used illicit substances	44	75.9	29	74.4	15	78.9	
Use of cannabinoids	12	20.7	9	23.1	3	15.8	
Use of other illicit substances	2	3.4	1	2.6	1	5.3	

Note: Except for BAC and Nicotine all measures refer to lifetime prevalence. Varying number of cases per variable was due to missing data. M = Mean (standard deviation).

<sup>1</sup>Due to small case numbers the last two response categories in all three AUDIT items were collapsed.

<sup>2</sup>Refers to participants who reported regular alcohol use.

<sup>3</sup>According to DSM-IV.

<sup>4</sup>Refers to regular smokers.

### Relation between risk and resilience factors and problematic alcohol use

In the analysis of AUDIT group differences with respect to risk and resilience factors for problematic alcohol use, we could observe statistically significant differences in the variables family history density of alcoholism, deviant peer affiliations, and drink count in SRE questionnaire, with higher scores being indicated in the “high AUDIT”

group and odds ratios ranging from 1.31 to 2.06. The age of first drink was only marginally significantly lower in the “high AUDIT” group (odds ratio .68). Regarding parenting styles, a statistically significant difference could only be observed in the strictness/supervision subscale, with higher scores resulting in the “low AUDIT” group” (odds ratio .80) (Table 3).

	AUDIT < 7 (“low”)	AUDIT ≥ 7 (“high”)	Group difference (p-value)
n	32	25	
Age	15.0 (1.9)	15.3 (1.4)	0.50
Sex (female)	37.5%	28.0%	0.45
Putative risk and resilience factors			
Parenting styles			
Acceptance/involvement (possible range 9-36)	27.5 (4.4)	27.5 (4.0)	0.88
Autonomy granting (possible range 9-36)	23.9 (4.4)	24.6 (4.9)	0.74
Strictness/supervision (possible range 8-32)	23.8 (4.0)	20.5 (4.6)	0.01
Family history density of alcoholism (possible range 0-2)	.09 (.20)	.26 (.28)	0.02
Alcohol-affected parent and/or grandparent	20.0%	50%	
Deviant peer affiliations (possible range 0-7)	1.1 (1.3)	2.0 (1.4)	0.02
Drink count in SRE questionnaire	6.5 (3.0)	13.1 (8.2)	< 0.01
Age of first drink	13.9 (1.7)	13.2 (1.7)	0.06
Note: Except for sex and alcohol-affected parent and/or grandparent, means and standard deviations are reported in parentheses.			

**Table 3:** Age, sex, and risk and resilience factors across groups according to AUDIT sum score.

## Discussion

The aims of the present study were, on the one hand, to investigate the prevalence of substance use patterns and use-related problems in AIA. On the other hand, we aimed to explore which known risk and protective factors for problematic alcohol use are important in AIA.

We found that 15% (n = 9) of the sample qualified for lifetime alcohol dependence, and 13% (n = 8) for alcohol abuse. 44% (n = 25) and 18% (n = 10) scored above the critical AUDIT and AUDIT-C cut-offs, respectively, which indicate problematic alcohol use. Furthermore, 22% (n = 11) reported at least monthly binge drinking, 11% (n = 6) reported having never used alcohol before the current hospital admission, 37% (n = 21) reported current regular smoking, and 24% (n = 14) the lifetime use of illicit substances. These data are comparable to findings from epidemiological studies in the general population. It becomes apparent that AIA are at an elevated risk for AUD, binge drinking, smoking, and illicit substance use: In a representative community sample in Germany, lifetime prevalences for alcohol dependence of 1.8% and for alcohol abuse of 4.4% were found for the age group 14-17 years [36]. A representative survey among children and adolescents in Germany found that 16% of participants scored above the critical AUDIT-C cut-off [37]. This prevalence is only slightly lower than the prevalence for problematic alcohol use found in our study. The prevalence for binge drinking in AIA seems elevated since 12% of adolescents in the general population reported this consumption pattern at least once per month [37]. However, in terms

of frequency of alcohol consumption, AIA and adolescents in the general population do not seem to differ, as 14% of adolescents in the general population also reported alcohol use at least weekly [38]. When considering prevalence of smoking and illicit substance use, the percentage of AIA using these substances was substantially higher in our study compared to adolescents in the general population: The prevalence of current regular and irregular smoking was 12% and the lifetime prevalence for illicit substance use was 7% in adolescents within the general population in Germany [38].

Our explorative analysis of factors associated with problematic drinking in AIA suggested that deviant peer affiliations, a positive family history of alcoholism, and an elevated alcohol tolerance might serve as risk factors, while a parenting style with pronounced supervision and strictness might be protective in this patient population. These results are in line with findings from studies with non-AIA samples. For example, higher parental monitoring has also been found to be associated with less heavy drinking [16,39] and less problematic alcohol use in adolescence [40]. Also, our finding that deviant peer behavior is associated with problematic alcohol consumption in AIA is in accordance with other studies in adolescent populations [41,42].

Another risk factor was a positive family history of alcoholism since the number of relatives with assumed alcohol dependence, weighted by the percentage of genes shared with the patient, was significantly higher in the high AUDIT group compared to the low AUDIT group.

We were surprised that we could substantiate this hypothesis already in a small sample of only 57 under-aged patients, particularly since the effect of genes on the development of alcohol dependence is relatively low during adolescence and increases over the lifespan [20,43]. However, the influence of a positive family history of alcoholism can also be considered from a behavioral perspective. Relatives and particularly parents also act as social models and the problematic alcohol use patterns of affected parents could increase the likelihood that also their children develop risky drinking patterns for example through observational learning. It might also be possible that harmful coping strategies abusing alcohol will be adapted by the children.

Regarding the onset of alcohol use, we could only descriptively observe an earlier age of first alcoholic drink in the high AUDIT group compared to the low AUDIT group. However, this difference only reached marginal significance, which may be explained by the relatively small sample size.

In interpreting our results, it is important to recognize the limitations of this naturalistic study. First, the patients were interviewed at bedside on the morning after admission; thus, some of them were considerably impaired by hangover, which is probably the reason why some of them complained about not being able to focus on the interview questions, possibly affecting the quality of data. Second, some parents insisted to be present in the room during the interview, which could have influenced their children's answers. Third, the percentage of patients who participated compared to all patients treated during the study period was 56%. We cannot rule out that this possible selection bias affected the distribution of the examined risk and resilience factors. Although participants and non-participating patients did not differ significantly in term of age and sex, we also cannot exclude that the rate of problematic alcohol use and other risk behaviors was higher in non-participants than participants. Assuming this scenario, our results would underestimate the prevalence of problematic alcohol use. Fourth, our results are derived from exploratory analyses without correcting for multiple testing. This may have increased the likelihood for detecting significant results. Fifth, we were only able to examine a relatively small sample. Future studies should aim to investigate AIA with larger sample sizes to increase generalizability.

## Conclusion and Implications for Future Research

We could show that AIA in our sample are not inexperienced drinkers. They are even at an elevated risk for AUD, which implies an increased need for psychosocial interventions for this patient population. Against this background, we suggest including the investigated risk and resilience factors for problematic alcohol use in the clinical decision regarding psychosocial intervention following hospitalization.

Future research should consider comparing results from AIA with inpatients of same age and sex who were treated due to conditions other than alcohol intoxication to allow estimations about the relative risk of AIA. Furthermore, for future studies, it is also important to examine AIA in longitudinal studies to evaluate the long-term psychosocial development of these patients.

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