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The predictive capacity of AUDIT and AUDIT-C among adolescents in a one-year follow-up study

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ABSTRACT

Aim: The Alcohol Use Disorders Identification Test (AUDIT) has been validated for use with adolescents to screen their harmful alcohol consumption. How well AUDIT or its derivative consumption version AUDIT-C predicts the development of problematic alcohol use among adolescents remains unknown. The aim of our study was to examine the predictive capacity of AUDIT and AUDIT-C among adolescents in a one-year follow-up.

Methods: Finnish adolescents (N = 337) were examined at baseline with AUDIT and one year later with the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version (K-SADS-PL) interview to assess alcohol problem use. Test characteristics and regression models were analyzed in predicting alcohol problem use.

Results: The sensitivity of AUDIT (cut-off ≥5) was 0.809 and specificity 0.621 in predicting alcohol problem use among adolescents one year later. The positive test posterior probability was 0.51. For those who screened negative at baseline, the positive test posterior probability was 0.13. With AUDIT-C (cut-off ≥3), the posterior probabilities were 0.47 and 0.12, respectively (sensitivity 0.855, specificity 0.529). The odds ratio was 6.95 for those screening positive with AUDIT and 6.59 with AUDIT-C at baseline to have alcohol problem use one year later.

Conclusions: AUDIT has utility in screening youth at risk for developing alcohol problem use. It has significant predictive capacity in detecting risk especially among adolescents with depression.

1. Introduction

Alcohol remains the most common substance used by adolescents, and young age at onset of drinking has been considered to be a risk factor for different adverse alcohol-related outcomes (Miech et al., 2018; Morean et al., 2019). Both short- and long-term consequences of adolescent alcohol use have been extensively investigated. Short-term consequences include early sexual activity, violence, attempted suicide, and binge drinking (Miller et al., 2007), and more recent studies have shown associations between early alcohol use and alcohol intoxications, heavy drinking, and school problems (Morean et al., 2014, 2019). The long-term effects of early alcohol consumption comprise a higher risk of developing later alcohol abuse, dependence, or illicit drug use (RW.ERROR - Unable to find reference:295; American academy of pediatrics. policy statement. committee of substance abuse. alcohol use by youth and adolescents: A pediatric concern, 2010; Hingson and Zha, 2009). Patterns of alcohol exposure in early adolescence are strongly associated with later alcohol use, and altering drinking patterns in early adolescence has the potential to reduce harmful use in later adolescence (Heron et al., 2012). Delaying the initiation of drinking from early adolescence to late adolescence is an important goal for prevention efforts (Pitkanen et al., 2005). Alcohol use in adolescents should be actively screened to facilitate early intervention in order to prevent the development of alcohol use disorders (AUDs) and to minimize the

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consequences and risky behaviors related to substance use disorders (SUDs) (Baer et al., 2001; Huurre et al., 2010).

The Alcohol Use Disorders Identification Test (AUDIT) was developed in a WHO collaborative project for screening hazardous and harmful alcohol consumption, drinking behavior, and alcohol-related problems in adults (Saunders et al., 1993). The full 10-item AUDIT has been argued to be too long for clinical settings, and consequently, abbreviated versions have been developed. AUDIT-consumption (AUDIT-C) contains the first three questions from the original AUDIT, which estimate hazardous alcohol consumption (Bush et al., 1998; Doyle et al., 2007). Although originally developed as a screening test for adults, AUDIT can also be used for adolescents. Among adults, a cut-off score of 8 points or more is commonly applied to detect hazardous or harmful use of alcohol (Saunders et al., 1993), and some authors suggest using a lower cut-off for women (Reinert and Allen, 2002). Appropriate cut-offs for adolescents have been validated (Knight et al., 2003; Kokotailo et al., 2004). Von Der Pahlen et al. (2008) suggested that the AUDIT cut-off scores be tailored according to age, gender, and drinking culture (von der Pahlen et al., 2008). We have previously validated appropriate cut-off points for 13- to 18-year-olds to detect alcohol problem use, defined as those having a diagnosis of alcohol use disorder (AUD), either alcohol abuse or dependence, as well as those having had one or more reported alcohol-related problems that did not reach the diagnostic threshold for AUD. Our recommendation was to use a cut-off $\geq$5 when using the full version of AUDIT, and a cut-off $\geq$3 with AUDIT-C (Liskola et al., 2018). Toner et al. (2019) conducted a systematic review and a meta-analysis of alcohol screening and assessment measures for young people. They recommended using AUDIT-C or the full 10-item AUDIT with young people when there is an opportunity to ask more than a single question (Toner et al., 2019).

Some studies have been conducted on AUDIT and AUDIT-C and their predictive capacity or validity, but these have mostly focused on adults. To our knowledge, no studies have evaluated AUDIT and its predictive capacity in adolescents. Conigrave et al. (1997) examined the predictive capacity of AUDIT among adults in a 2- to 3-year follow-up study. They found that of those who scored positive (cut-off $\geq$8) in AUDIT, 61 % experienced alcohol-related social problems compared with 10 % of those with lower scores. AUDIT was considered to be a better predictor of social problems and hypertension than laboratory markers, and found to be a valuable tool in screening for hazardous and harmful alcohol consumption (Conigrave et al., 1995). Bradley et al. (2016) observed that AUDIT-C scores and score increases from baseline have predictive validity for HDL cholesterol, alcohol-related gastrointestinal hospitalizations, and physical trauma. Among prisoners, pre-release AUDIT scores have been shown to predict hazardous drinking six months after release (Thomas et al., 2014).

The aim of this study was to evaluate the predictive capacity of AUDIT and AUDIT-C among adolescents in a one-year follow-up and to determine whether AUDIT and AUDIT-C are useful tools in detecting adolescents at risk of developing alcohol-related problems. To our knowledge, no similar studies exist concerning the predictive capacity of AUDIT/AUDIT-C among adolescents.

2. Methods

2.1. Subjects

The study population was gathered from the Adolescent Depression Study (ADS) (Karlsson et al., 2006). The ADS patients with clinical depression (age 13–19 years, n = 218) were drawn from two adolescent outpatient clinics between 1998 and 2001. Age- and sex-matched controls (n = 200) were drawn in 2002 from the enrollment lists of four schools in the corresponding geographical area. The participants were examined at baseline and one year later. A more detailed description of the ADS can be found elsewhere (Karlsson et al., 2008). Only subjects who participated in both stages were included in the analyses of this study (N = 367). Those who dropped out during the one-year follow-up did not differ from participants in age (p = 0.095), gender (p = 0.843), being "AUDIT positive" or "AUDIT negative" at baseline (p = 0.788), or being in the patient or control group (p = 0.472). Of those who were non-problem users at baseline, 91.3 % and of those who were problem users 84.7 % continued in the study and responded to the questionnaire one year later ($\chi^2 = 4.225$, df = 1, p = 0.040).

The study protocol was approved by the Ethics Committee of the Hospital District of Helsinki and Uusimaa (Helsinki University Hospital).

2.2. AUDIT assessment

All subjects filled in the Finnish translation of the 10-item AUDIT questionnaire (Babor et al., 2001) at baseline when entering the study. Questions are scored from 0 to 4, yielding a maximum possible score of 40. When assessing the AUDIT questionnaire, if a participant scored "0" on the first question and left other questions unanswered, indicating no use of alcohol, he/she was given a sum score of zero. In cases where some other item besides the first question was not filled in by the participant, the missing item was imputed with the calculated mean of the filled items. If more than one answer was missing, the questionnaire was excluded. An AUDIT score was available for 352 study subjects. In our study sample, Cronbach's alpha for AUDIT was 0.882 and for AUDIT-C 0.894.

According to scores from AUDIT, the participants were dichotomized into two groups using previously determined cut-offs for adolescents reported in a previous publication (Liskola et al., 2018) by our research group. Adolescents who scored <5 were classified as "AUDIT negative", and adolescents who scored $\geq$5 were classified as "AUDIT positive". With AUDIT-C, the cut-off was <3 for "AUDIT-C negative" and $\geq$3 for "AUDIT-C positive".

2.3. Diagnostic interview

Psychiatric diagnoses according to DSM-IV (Diagnostic and statistical manual of mental disorders, 1994), including substance use disorders, were assigned using the Schedule for Affective Disorders and Schizophrenia for School-Age Children – Present and Lifetime version (K-SADS-PL) interview at baseline and one year after baseline (Kaufman et al., 1997). Alcohol use was classified with K-SADS-PL into five mutually exclusive groups: (1) no use, (2) non-problem use, (3) problem use, (4) alcohol abuse, and (5) alcohol dependence. "No use" was defined as no reported alcohol use during the past year. The full information was available from 337 subjects. "Non-problem use" was defined as any reported alcohol use during the past year, but no reported alcohol-related problems. "Problem use" was defined as one or more reported alcohol-related problems, i.e. at least one AUD symptom criterion without reaching the diagnostic threshold for an AUD. Problem use included also heavy binge drinking and blackouts due to alcohol use (diagnostic orphans or AUD NOS). "Alcohol Abuse" and "Alcohol Dependence" were defined by the corresponding DSM-IV criteria. Alcohol use ratings were further used in the analyses as a dichotomy; the "any problem use" rating included problem use, abuse, and dependence.

Depressive symptoms were assessed at baseline with the Beck Depression Inventory (BDI, Beck et al., 1961). A more detailed description of the BDI and its psychometric properties can be found elsewhere (Beck et al., 1961).

2.4. Statistical analysis

Results are presented as means and proportions (%). Differences between groups were analyzed with Chi-squared tests.

The two dichotomized groups ("AUDIT positive" and "AUDIT negative"; "AUDIT-C positive and "AUDIT-C negative) at baseline were compared for their level of alcohol use according to the K-SADS-PL one year later. Test characteristics calculated were sensitivities, specificities,

negative and positive predictive values (NPV and PPV, respectively), prevalences, and accuracies. The predictive capacity was measured by posterior probabilities, which were calculated to measure the likelihood of prevalence of any alcohol problem use after one year for those who were either test positive or test negative at baseline.

The predictive capacity of AUDIT and AUDIT-C to screen any alcohol problem use one year from the baseline was also analyzed using multivariate logistic regression models (odds ratios, ORs) with age and sex as covariates, and depressive symptoms and baseline "any problem use" of alcohol as confounding factors. The regression models were performed with the whole sample but also with the control sample and depression patients separately that included bootstrap statistics.

P-values <0.05 were considered statistically significant, and for ORs, 95 % confidence intervals (95 % CIs) were calculated. SPSS 22 software was used for all analyses.

3. Results

3.1. Characteristics of the study group

Of the study subjects, 18.8 % (n = 69) were boys (Table 1). Their mean age at baseline was 16.3 years (SD 1.6). Of the patient group, 105 (60.0 %) and of the control group 78 (44.1 %) were AUDIT positive (χ^2 = 8.949, df = 1, p = 0.003). Of the boys and girls, 33 (50.8 %) and 150 (52.3 %), respectively, were AUDIT positive, with no significant difference between the sexes (χ^2 = 0.047 df = 1, p = 0.827). With AUDIT-C, 116 (55.0 %) of the patient group were positive and 95 (45.0 %) of the control group (χ^2 = 5.831, df = 1, p = 0.016). In the whole sample, the prevalence of problematic alcohol use was 32.6 % (n = 116) at one year after baseline according to K-SADS-PL.

3.2. Test characteristics

The sensitivity of AUDIT in identifying any alcohol problem use one year later was 0.809, specificity 0.621, NPV 0.870, and PPV 0.509. The accuracy was 0.682. These yielded a positive test posterior probability of 51 %. To have any alcohol problem use one year later for a person who was "AUDIT negative" at baseline, the posterior probability was 13 % (Table 2). With AUDIT-C, to have any alcohol problem use at one-year follow-up, the sensitivity was 0.855, specificity 0.529, NPV 0.882, and PPV 0.468. The accuracy was 0.635. These yielded a positive test posterior probability of 47 % and a negative test posterior probability of 12 %.

As those who have AUD might be easily recognized even without AUDIT, we calculated the posterior probability also for those subjects with no AUDs at baseline (20 adolescents with an AUD excluded). The prevalence of any alcohol problem use at one year without baseline AUDs was 28.7 % in this group. The sensitivity of AUDIT was 0.780, specificity 0.623, NPV 0.876, and PPV 0.455. The accuracy was 0.669. These yielded a positive test posterior probability of 45 % and a negative test posterior probability of 12 %. With AUDIT-C, the sensitivity was 0.824, specificity 0.531, NPV 0.882, and PPV 0.414. The accuracy was 0.615. These yielded a positive test posterior probability of 41 % and a negative test posterior probability of 12 %.

Table 1
Clinical characteristics of patients and controls.

	Whole sample *n* = 367		ADS patients *n* = 189		ADS controls *n* = 178	
Sex, % (*n*)						
Boys	18.8	(69)	18.5	(35)	19.1	(34)
Girls	81.2	(298)	81.5	(154)	80.9	(144)
Age, *M* (*SD*)	16.3	(1.6)	16.4	(1.6)	16.3	(1.6)
AUDIT baseline, % (*n*)						
Positive	54.0	(183)	60.0	(105)	44.1	(78)
Negative	48.0	(169)	40.0	(70)	55.9	(99)
Alcohol use one year from baseline, % (*n*)						
No use	13.6	(48)	15.2	(27)	12.1	(21)
Non-problem use	53.4	(188)	48.9	(87)	58.0	(101)
Problem use	28.1	(99)	28.7	(51)	27.6	(48)
Abuse	3.4	(12)	5.1	(9)	1.7	(3)
Dependence	1.4	(5)	2.2	(4)	0.6	(1)
AUDIT, *M* (*SD*)	6.32	(6.60)	7.95	(7.48)	4.71	(5.15)
AUDIT-C, M (SD)	3.57	(2.91)	4.10	(2.99)	3.05	(2.73)
BDI, *M* (*SD*)	13.89	(11.55)	22.35	(8.86)	4.86	(5.83)

The AUDIT cut-off was ≥5 and the AUDIT-C cut-off ≥3 for a person to be positive (groups "problem use, "abuse", and dependence").

Table 2
AUDIT and AUDIT-C baseline level and outcome after one year.

	K-SADS one year from baseline (*n*)		Total
	non-problem use	any alcohol problem use	
AUDIT baseline, n (%)			
Negative	141 (41.8)	21 (6.2)	162 (48.1)
Positive	86 (25.5)	89 (26.4)	175 (51.9)
Total	227 (67.4)	110 (32.6)	337 (100)
AUDIT-C baseline, n (%)			
Negative	120 (35.6)	16 (4.7)	136 (40.4)
Positive	107 (31.8)	94 (27.9)	201 (59.6)
Total	227 (67.4)	110 (32.6)	337 (100)

The AUDIT cut-off was ≥5 and the AUDIT-C cut-off ≥3 for a person to be positive.

3.3. Predictive capacity of AUDIT

Multivariate logistic regression models were used to test AUDIT positivity as a predictor of any alcohol problem use at one year.

AUDIT-positive condition had an OR of 6.95 (95 % CI 4.03–11.99, p < 0.001) to predict any alcohol problem use. When age, sex, and depressive symptoms were included in the model, the OR was 7.82 (4.36–14.04) (Model 1, Table 3). In a more stringent model, the predictive capacity of AUDIT positivity remained even after the baseline alcohol problem use was included in the model, yielding an OR of 2.57 (1.26–5.23) (Model 2, Table 3) at one year, and if baseline AUDs were included in the model the OR was 6.79 (3.72–12.39, p < 0.001).

Similarly with AUDIT-C, the OR was 6.59 (3.65–11.89, p < 0.001) in predicting any alcohol problem use at one year. When age, sex, and depressive symptoms were included in the model, the OR was 7.54 (4.02–14.14) (Model 1, Table 4). In the more stringent model, the predictive capacity of AUDIT-C positivity remained even after the baseline alcohol problem use was included, yielding an OR of 2.65 (1.27−5.52)

Table 3
Odds ratios for any alcohol problem use in two multinomial regression models with AUDIT.

	Any alcohol problem use at one year		
	OR	95 % CI	p
Model 1			
AUDIT positive	7.82	4.36–14.04	<0.001***
Male sex	2.87	1.47–5.60	0.002**
Age	0.92	0.78–1.08	0.300 ns
BDI	1.01	0.99–1.04	0.243 ns
Model 2			
AUDIT positive	2.57	1.26–5.23	0.009
Alcohol problem use at baseline	8.92	4.62–17.24	<0.001***
Male sex	2.44	1.18–5.04	0.016*
Age	0.90	0.74–1.07	0.204 ns
BDI	0.97	0.97–1.03	0.966 ns

ns = not significant.
BDI = Beck Depression Inventory.
* p < 0.05.
** p < 0.01.
*** p < 0.001.

Table 4
Odds ratios for any alcohol problem use in two multinomial regression models with AUDIT-C.

	Any alcohol problem use at one year		
	OR	95 % CI	p
Model 1			
AUDIT positive	7.54	4.02–14.14	<0.001***
Male sex	3.04	1.57–5.90	0.001**
Age	0.93	0.79–1.10	0.401 ns
BDI	1.02	0.99–1.04	0.138 ns
Model 2			
AUDIT positive	2.65	1.27–5.52	0.009**
Alcohol problem use at baseline	9.55	5.06–18.03	<0.001***
Male sex	2.51	1.20–5.27	0.015*
Age	0.88	0.73–1.06	0.191 ns
BDI	1.00	0.98–1.03	0.898 ns

BDI = Beck Depression Inventory.
ns = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

(Model 2, Table 4). If baseline AUDs were included, the OR was 6.26 (3.31–11.85, $p < 0.001$).

In a multivariable logistic regression model with the control group only (community drawn sample), those who were "AUDIT positive" had an OR of 7.69 (95 % CI 3.28–18.01, $p < 0.001$) for any alcohol problem use one year later (Table 5). In a stringent model where any problem use at baseline was included the OR was 2.23, but it was not statistically significant (Table 5). In the depression patient sample the OR was 8.29 (4.51–19.61, $p < 0.001$), and even after any problem use at baseline was included in the model the AUDIT positive status remained as a significant predictor (OR 2.96, 1.06–8.25, $p < 0.05$).

Similarly in multivariable logistic regression models with AUDIT-C, the OR for any alcohol problem use one year later was 8.74 (3.41–22.39, $p < 0.001$) among the control group and in the stringent model, which included the baseline any problem use, the OR was 2.54 (0.80–8.08, p not siqnificant), but not statistically significant (Table 6). With patient sample the ORs were 6.65 (2.73–16.24) and 2.49 (0.89–6.93, p not significant), respectively, but not reaching statistical significance in the latter.

4. Discussion

This study examined the predictive capacity of AUDIT and AUDIT-C in a one-year follow-up among 13- to 19-year-old adolescents. To our knowledge, this is the first study to examine AUDIT/AUDIT-C and their capacity to predict alcohol problem use solely among adolescents. In our sample, the prevalence of alcohol problem use was 32.6 %. Among those who scored negative with AUDIT, the probability of having alcohol problem use one year later decreased to 13 % (with AUDIT-C to 12 %). Among those who scored positive, the probability of having alcohol problem use one year later increased to 51 % (with AUDIT-C to 47 %). These changes can be considered relatively large, especially as no other factors (besides AUDIT) need to be taken into account.

In the multivariate logistic regression analyses, where age, sex, and depression symptoms were included in the models, AUDIT and AUDIT-C positive screening results yielded significant ORs for any alcohol problem use at one year. If the information about the baseline alcohol problem use was included, the significance of AUDIT and AUDIT-C as predicting later alcohol problem use was expectedly diminished. The OR with AUDIT in the adolescents with depression remained significant even in this stringent model. These results are in line with previous study among Finnish adolescents which showed that early-onset depression predicted later frequent alcohol use (Sihvola et al., 2008).

The short- and long-term effects caused by early onset of drinking among adolescents have been widely studied, and a causal relationship has been assumed between early onset of alcohol use and later adverse alcohol-related outcomes (DeWit et al., 2000; Hingson and Zha, 2009; Liang and Chikritzhs, 2015). However, in a systematic review by Maimaris and Cambridge (2014) no strong evidence emerged that starting to drink early leads to alcohol-related problems in adulthood. Their recommendation was to focus more on acute and short-term effects associated with drinking among children and adolescents than on uncertain long-term effects (Maimaris and McCambridge, 2014). Furthermore, Enstad et al. (2019) carried out a longitudinal study among Norwegian and Australian adolescents and found that adolescent drinking behavior was an indicator of alcohol-related problems in late adolescence/young adulthood, but not later. They concluded that preventing drinking in early adolescence may have an impact on drinking patterns later in adolescence and early adulthood (Enstad et al., 2019). These findings suggest that in clinical practice more attention should be given to interventions for those adolescents whose alcohol use is problematic and might last. Our findings with the use of AUDIT solely emphasize that adolescents who score positive with the given cut-offs are at higher risk of having alcohol use problems one year later, which will increase the odds of developing adverse acute and short-term effects caused by alcohol use.

When using screening tests, a positive result should lead to clinical

Table 5
Odds ratios for any alcohol problem use in multivariate logistic regression models with AUDIT and statistics for r = 2,500 bootstrapped logistic regression by study group.

	Any alcohol problem use at one year			Bootstrap statistics			
	OR	95 % CI	p	B	SE of B	95 % CI (BCa)	p
Control sample model 1							
AUDIT positive	7.69	3.28–18.01	<0.001***	2.04	0.49	1.09–3.50	<0.001***
Control sample model 2							
AUDIT positive	2.23	0.76–6.51	0.143ns	0.81	0.90	−0.66–2.24	0.140ns
Alcohol problem use at baseline	19.91	6.83–58.00	<0.001***	2.99	0.93	1.70–5.40	<0.001***
Depression patient sample model 1							
AUDIT positive	8.29	3.51–19.61	<0.001***	2.12	0.48	1.22–3.54	<0.001***
Depression patient sample model 2							
AUDIT positive	2.96	1.06–8.25	0.038*	1.08	0.59	−0.14–2.49	0.031*
Alcohol problem use at baseline	5.92	2.37–14.79	<0.001***	1.78	0.55	0.76–3.19	<0.001***

Models are controlled for sex, age and BDI scores.
ns = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

Table 6
Odds ratios for any alcohol problem use in multivariate logistic regression models with AUDIT-C and statistics for r = 2,500 bootstrapped logistic regression by study group.

	Any alcohol problem use at one year			Bootstrap statistics			
	OR	95 % CI	p	B	SE of B	95 % CI (BCa)	p
Control sample model 1							
AUDIT-C positive	8.74	3.41–22.39	<0.001***	2.17	0.86	1.16–4.06	0.001**
Control sample model 2							
AUDIT-C positive	2.54	0.80–8.08	0.114ns	0.93	0.69	−0.66–2.93	0.108ns
Alcohol problem use at baseline	19.53	6.76–56.42	<0.001***	2.97	0.64	1.76–5.37	<0.001***
Depression patient sample model 1							
AUDIT-C positive	6.65	2.73–16.24	<0.001***	1.90	0.63	0.94–3.41	<0.001***
Depression patient sample model 2							
AUDIT-C positive	2.49	0.89–6.93	0.081ns	0.91	1.02	−0.46–2.79	0.061ns
Alcohol problem use at baseline	7.16	3.01–17.05	<0.001***	1.97	0.49	1.05–3.29	<0.001***

Models are controlled for sex, age and BDI scores.
ns = not significant.
* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

examination and interview of the patient (Altman, 1991). Other risk factors and need for intervention must be assessed in a clinical examination. Numerous studies have been conducted on the predictors of adolescent alcohol consumption and binge drinking and different related trajectories. For example, Kelly et al. (2004) investigated the predictors of problem drinking among older adolescent emergency department patients, finding that those who presented for treatment of an assault-related injury or acute alcohol intoxication, who were alcohol positive at admission, and who reported becoming intoxicated at least once a month were likely to have a severe drinking problem (Kelly et al., 2004). Morean et al. (2019) evaluated predictors leading from the initiation of alcohol use to binge drinking. They noted that male sex, older age at onset, drinking liquor on one's first occasion, and experiencing high arousal negative alcohol effects on one's first drinking occasion were associated with a shorter delay to first binge drinking episode. Also interpersonal violence has been reported as a predictor for adolescent binge drinking (Cisler et al., 2012). Combining these findings, clinicians' accuracy in detecting adolescents in need of a more intense treatment and intervention improves even more after screening these individuals with AUDIT. It has been suggested also that there is a need to develop new instruments to assess young people's alcohol-related problems (Toner et al., 2019).

A strength of our study was that the study sample included both clinical and control samples. The assessment of AUDs and alcohol problem use was based on a semi-structured diagnostic interview (K-SADS-PL), enabling reliable assessment of AUDIT's predictive capacity. The follow-up of only one year may be seen as too short for assessment of development of actual AUDs, even though a pattern of alcohol use can develop in one year. A further limitation is that girls represented almost 80 % of both clinical and control samples, precluding appropriate analyses according to gender.

5. Conclusions

AUDIT has utility in screening youth at risk for developing alcohol problem use. It has significant predictive capacity in detecting risk especially among adolescents with depression.

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Contributors

MM, HH, NL and JL were responsible of the study concept and design. MM, NL, LK, and SN contributed to the data acquisition. MM, HH, OK, and JL performed the statistical analyses. JL provided the first version of the manuscript. MM, HH, NL, OK, LK and SN provided critical revision of the manuscript. All authors critically reviewed the content and approved the final version of this manuscript.

Declaration of Competing Interest

The authors report no declarations of interest.

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