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Alcohol consumption, early onset drinking and health-related consequences in adolescents presenting at Emergency Departments in England

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Conflicts of Interest

JS a researcher and clinician who has worked with a range of types of treatment and rehabilitation service-providers. JS is supported by the National Institute for Health Research (NIHR) Biomedical Research Centre for Mental Health at South London and Maudsley NHS Foundation Trust and King's College London. He has also worked with a range of governmental and non-governmental organisations, and with pharmaceutical companies to seek to identify new or improved treatments from whom he and his employer (King's College London) have received honoraria, travel costs and/or consultancy payments. This includes work with, during past 3 years, Martindale, Reckitt-Benckiser/Indivior, MundiPharma, Braeburn/MedPace and trial medication supply from iGen. His employer (King's College London) has registered intellectual property on a novel buccal naloxone formulation and he has also been named in a patent registration by a Pharma company as inventor of

a concentrated nasal naloxone spray. For a fuller account, see JS's web-page at http://www.kcl.ac.uk/ioppn/depts/ addictions/people/hod.aspx.

Abbreviations

AUDIT – Alcohol Use Disorders Identification Test

BSQF – Beverage Specific Quantities and Frequencies

CI – Confidence Interval

ED – Emergency Department

ESPAD - European School Survey Project on Alcohol and Other Drugs

MINIKID - Mini International Neuropsychiatric Interview for Children and Adolescents

SD – Standard Deviation

SDQ – Strengths and Difficulties Questionnaire

TLFB – Timeline Followback

Abstract

Purpose

Globally, alcohol use is the leading cause of ill-health and life years lost in adolescents, although its clinical impact is often overlooked, particularly in England where most research is based in schools. This study aims to examine the prevalence of alcohol consumption as well as the association between alcohol consumption and age-of-onset with health and social consequences among adolescents presenting to Emergency Departments (ED)**.**

Methods

Consecutive attenders (n=5576) to ten EDs aged 10-17 were included. Information was collected on general health and functioning, quality of life, alcohol use and alcohol-related health and social consequences.

Results

Nearly 40% of adolescents reported the consumption of alcohol that was more than a sip in their lifetime. Age of first alcohol consumption before the age of 15 was associated with tobacco use ($p<0.001$), lower quality of life ($p=0.003$) and evidence of an alcohol use disorder ($p=0.002$). It was also associated with general social functioning (problems with conduct $p=0.001$ and hyperactivity $p=0.001$) and alcohol-related health and social consequences (accident $p=0.046$, problems with a parent $p=0.017$, school $p=0.0117$ or police $p=0.012$).

Conclusions

Rates of alcohol consumption in adolescents presenting to the ED were similar to those reported in schools in England and globally. Associations of alcohol consumption and earlier onset of drinking with poorer health and social functioning were observed. The ED can offer an opportunity for the identification of hazardous alcohol use in adolescents.

Key Words: Alcohol use, Social Functioning, Adolescents, Emergency Department, Health

Implications and Contribution

There is an association of alcohol consumption and earlier onset of drinking with poorer health and social functioning. The ED can offer an opportunity for the identification of hazardous alcohol use in adolescents.

Introduction

Adolescence is a critical period of development during which, the initiation and continuing use of alcohol may have detrimental consequences for the young person (1). Several adverse health and social consequences of alcohol use in young people are widely reported in research and health policy including; an increase in depressive feelings, increased sexual risk taking, lower educational performance, difficulties in maintaining relationships with peers and friends and an increased vulnerability to becoming a victim of crime (2). The European School Survey Project on Alcohol and Other Drugs (ESPAD) in 40 countries reported at least 70% of students aged 15-16 years having had alcohol in their lifetime (3). A survey conducted in schools in England of adolescents aged 11-15 found that 38% of those aged 11-15 had consumed alcohol in their lifetime (4). Worldwide, alcohol is the largest risk factor for incident Disability-Adjusted Life-Years (DALYS: 7%) in adolescents aged 10-24 (5). Although it is difficult to establish causality of alcohol use in adolescents and social and behavioural problems several studies have shown earlier consumption is associated with alcohol-related problems in later life (6-12). A recent review recommended further research to establish the value of later onset in drinking when establishing drinking guidelines in adolescence (13).

Previous research examining the association between alcohol use and health and social consequences in adolescents has generally taken place in the context of the school in England, but the accuracy of this picture may be incomplete owing to the absence of those most vulnerable, who may be missed by school surveys through truancy or sickness at the time of the survey (14). The current research aims to examine the prevalence of alcohol consumption as well as the association between alcohol consumption and age of onset of alcohol consumption with health and social consequences among adolescents presenting at hospital Emergency Departments (ED) in England**.**

Methods

Participants

This research forms part of the SIPS (Screening and Intervention Programme for Sensible Drinking) Junior research programme (15). Data collection took place between the 8th October 2014 and the 31st May 2015. Participants were aged between their 10th and 18th birthdays attending one of 10 participating EDs across England: North East, Yorkshire and Humber, and London. The participating ED's were geographically spread across England covering both rural and urban populations. To be eligible for inclusion in the research the participant had to be alert and orientated and able to speak sufficient English to complete the research assessments. Participants were not eligible for inclusion if they had a severe injury, were suffering from a serious mental health problem, grossly intoxicated, this was determined by ED staff. Participants were also not eligible to take part if they, their parent or guardian were unable or unwilling to provide informed consent to take part. The current study included the data for those participants reporting that they had consumed any alcohol in their lifetime. The study received ethical approval from National Health Service Research Ethics Committee London – Camden and Islington 12/LO/0799, ISRCTN: 45300218.

Procedure

Following clearance by ED staff a researcher approached consecutive ED attenders meeting the study criteria between 8am and midnight. All potential participants, and their parents or guardians where applicable, were given written information about the study and informed that the information disclosed to researchers about the use of alcohol would be kept confidential and not passed to the parent or guardian or ED staff without prior consent of the participant. For those participants under the age of 16 and unaccompanied by a parent or guardian, Gillick competencies was assessed by a member of ED staff when taking informed consent for participation (16). Those participants aged 16 or 17 provided informed consent for themselves.

Participants completed the study questionnaires independently in a private area of the ED, the researcher was available in case clatification of questions or help with the ipad was required. The

study data was anonymised and collected using an electronic tablet devise, with the exception of the timeline follow-back questionnaires, which were manually completed with the researcher. A £5 gift voucher was given to all participants to thank them for their time. All young people participating in the study were also given age-appropriate material containing information on alcohol and local services or help lines providing further support.

M**easures**

Online supplementary figure 1 illustrates the flow of research questions. Demographics including age, gender and ethnicity were collected for all participants as was information on general health behaviours and lifestyle including tobacco smoking. Health-related quality of life was assessed using the Kidscreen (17), a 10-item generic health-related quality of life measure with established validity and reliability in this population. Behavioural and emotional functioning was measured using the Strengths and Difficulties Questionnaire (18, 19) (SDQ). In addition, several questions related to age appropriate service use including questions on; previous use of health and social services, school attendance, and contact with criminal justice were asked.

Among participants who reported any alcohol consumption, the age of first consumption in years was recorded using a single question (How old were you when you had your first drink of alcohol (beer, cider, alcopops wine etc)?) and further questions on whether they had used alcohol in the past 3 months and past 24 hours were asked (see supplementary figure 2). In addition, all participants who had ever drunk alcohol were asked question 19 (“experienced alcohol intoxication in their lifetime?”) and question 21 (“personal experience of alcohol?”) of the European School Survey Project on Alcohol and Other Drugs (3) (ESPAD). Further questions were included to assess the feasibility of conducting a future alcohol intervention study (15) including whether the participant would like further information or advice about alcohol, and whether they would be willing to participate in an intervention and follow up study if offered.

Those participants who indicated that they had consumed alcohol that was 'more than a sip' in the past 3 months were asked additional alcohol specific questions. Hazardous alcohol use and alcohol abuse and dependence, were assessed using the three item Alcohol Use Disorders Identification Test (20) (AUDIT-C) and the alcohol section of the Mini International Neuropsychiatric Interview for Children and Adolescents (21) (MINIKID). Quantity of alcohol consumed in the past 90 days was derived from the Timeline Follow-Back Form 90 (22) (TLFB) and converted to standard units where one unit was the equivalent of 8g of pure ethanol. The AUDIT has been validated in adolescent populations in the ED in the United States (23, 24). As part of the current programme of research the shorter, 3 question AUDIT-C was validated with a cut-off of 3. The TLFB has been validated for use in this population (25-27). Perceived consequences (physical fight, accident/injury, severe problem with parents, severe problem with friends, performing poorly at school, victimised by robbery or theft, trouble with the police, hospitalised or admitted to the emergency department, engaged in sexual intercourse with no condom, engaged in sexual intercourse that was regretted the next day) of alcohol consumption were assessed by ESPAD question 22 "Because of your own alcohol use, how often during the last 12 months have you experienced the following?" (online supplementary table 1).

Statistical analyses

Logistic regression was used to examine the relationship between demographics (age, gender and ethnicity) and measures of health and social functioning as predicted variables and whether a participant had consumed alcohol in the previous 3 months as a predictor variable. Logistic, linear or multinomial regression analysis was undertaken to explore the relationship between alcohol consumption in the previous 90 days and psychological and social problems. Age, gender and ethnicity were included in the analysis with total alcohol consumed (in standard UK units) in the previous 90 days as the predictor variable. Alcohol consumption was transformed taking the natural logarithms to ameliorate its non-normal distribution. The scores for the SDQ were transformed into a categorical

scale (Normal, Bordeline and Abnormal) using the original 3-band categorisation cut-offs. Alcohol related consequences (measured using ESPAD), tobacco use, MINIKID diagnosis, Strengths and Difficulties Questionnaire domains and quality of life (measured using the Kidscreen) were included as predicted variables. There is a reciprocal relationship between alcohol and behavioural and emotional functioning, whereby alcohol may result in problems with functioning or problems with functioning may lead to alcohol use. This relationship is difficult to disentangle. To demonstrate this linear regression analyses were performed with alcohol consumption as the predicted variable and SDQ, Kidscreen and tobacco use as individual predictors taking into consideration age, gender and ethnicity. The results of these analyses are presented in online supplementary table 2.

Regression analysis was also used to explore the relationship between age of first drink of alcohol and psychological and social problems in participants aged 16 or 17. Current UK drinking guidelines recommend an alcohol-free childhood; and that young people choosing to consume alcohol should not do so until age 15, nor exceeding adult daily unit recommendations, nor drink more than once a week (28). To reflect these guidelines, only those aged 16 or 17 were included in the analysis of time of onset of alcohol consumption. Consumption in the previous 90 days (transformed by taking the logarithms), gender and ethnicity were covariates in the analysis with age of first alcohol consumption (two categories, aged less than 15 and aged 15+) as the predictor variable. Those variables that showed a relationship that was significant at the 20% level were included as predicted variables.

Results

A total of 5376 participants consented to take part in the research. Of these, 2112 (39.5%) reported having had a drink of alcohol that was more than a sip in their lifetime, figure 1 presents a breakdown by age. The mean age of those who took part in the research was 13 years old (SD 2.07), proportions of males and females were roughly even but a greater proportion of participants were white compared with other ethnicities (table 1).

< figure 1 about here >

< Table 1 about here >

A total of 1374 (25.6% of the whole sample) reported drinking more than a sip of alcohol in the previous 3 months. The average age of first alcoholic drink was 12.9 (standard deviation = 2.19), ranging from five to 17 years of age (17 was the upper limit for inclusion in this study). Alcohol consumption in the previous3 months was associated with older age, being female, white and to have smoked tobacco. In addition, those who had consumed alcohol within the previous 3 months were more likely to report a lower quality of life and to have peer and social problems. Online supplementary table 1 presents the descriptive data on demographics, general social functioning and quality of life for those who had consumed alcohol in the previous 3 months.

The results of the regression analysis found that total alcohol consumed in the previous 90 day period was associated with tobacco use, lower quality of life, poorer general social functioning (conduct and hyperactivity) and ESPAD questions on health and social problems (Table 2).

< table 2 about here >

Further regression analysis investigated the association between age of first alcohol consumption and psychological and social problems. Only participants aged 16 or 17 who had consumed alcohol in the past 3 months were included in this analysis (10% of the total study sample, 44% of those who had consumed alcohol in the past 3 months). Variables that did not show an association with alcohol use were excluded from the analysis. Online supplementary table 3 gives an overview of the subsample.

Table 3 presents the results of the regression analysis. Consumption of alcohol before the age of 15 was associated with an increased risk of a number of health and social problems. These included a greater risk of smoking tobacco and a diagnosis of an alcohol use disorder as indicated by the MINIKIDS. Consumption of alcohol before the age of 15 was also associated with a greater risk of experiencing conduct and hyperactivity problems and more alcohol related social problems including,

having an accident, problems with a parent, school problems as well as experiencing problems with the police.

< table 3 about here >

Discussion

Nearly 40% of the adolescents presenting to the ED in England reported that they had had a drink of alcohol that was more than a sip in their lifetime. Rates of consumption increased considerably with age raging from just 4% for those aged 10 to 90% for those aged 17. Comparable rates of lifetime alcohol consumption have been found in school surveys. A recent survey conducted in schools in England reported that 38% of those aged 11-15 had consumed alcohol in their lifetime, the current study found a lifetime consumption rate of 34% among those of the same age (4). In older adolescents (aged 15-16) the ESPAD study reported an average lifetime consumption rate across 40 countries of 70%, in the same age group this study found a lifetime alcohol consumption rate of 71%.

Among adolescents who had consumed alcohol in the last 3 months15.8% of drinkers screened positive for harmful alcohol use (three or more on the AUDIT-C) and 15% screening positive for alcohol abuse or dependence (using MINIKID). The prevalence of a diagnosis of alcohol abuse or dependence was considerably higher among participants who started drinking before the age of 15, with almost 1 in 3 meeting the criteria for alcohol abuse or dependence. Participants were less likely to report parent and school problems compared to young drinkers in the ESPAD 2011 survey of school pupils in Europe (3). However, they were more likely to have reported experiencing an accident or injury, been a victim of robbery or theft, or been hospitalised or admitted to an emergency room as a result of their own alcohol consumption. It is possible that at least in part these risk behaviours reflect the underlying 'behavioural disinhibition' reported to characterise young people who use substances (29). This may lead to young people being at a greater risk of alcohol use as well as a series of other risk behaviours.

Regression analysis (Table 3) showed that higher alcohol consumption in the last 90 days (from the TLFB) was associated with increased odds of all the negative consequences of alcohol consumption studied (from ESPAD). Heavier drinking was also associated with smoking, worse quality of life, and conduct and hyperactivity problems on the SDQ, as well as alcohol use disorders and alcohol abuse. Earlier onset of drinking (under 15) was associated with increased odds of four of the 10 ESPAD alcohol consequences studied, as well as smoking, worse quality of life, and conduct and hyperactivity problems on the SDQ, and also alcohol use disorders and alcohol abuse (Table 3). This study clearly shows an association between earlier alcohol consumption and harm in adolescents but it remains to be established whether these persist into adulthood (9). A large birth cohort study found that around half of adolescents studied who were exposed to drugs or alcohol prior to the age of 15 had no history of conduct disorder, but they were still at an increased risk of behavioural and social problems in adulthood (10). While the results of the current study do not establish causality, effective interventions to reduce alcohol consumption in this population could potentially mitigate the negative consequences related to alcohol that are experienced from a young age in this group.

It is difficult to establish the direction of causality relationship between alcohol consumption and emotional and behavioural functioning, with little consensus being reached in the literature (10-11). We investigated this association with two sets of linear regressions: one with alcohol consumption as the predicted variable, and one with consumption as the predictor. Similar results were found for both analyses (online supplementary table 2). The relatively high rates of self-report 'abnormal' hyperactivity and conduct problems, which are related to behavioural disinhibition and seen as developmental symptoms that generally appear early in life, and their continuing predictive power in regression analyses would tend to support the view that these young people had differed from their peers prior to drinking alcohol. The adolescent manifestation of behavioural disinhibition depends on environmental factors such as high or low availability of alcohol and other substances. However, the ORs associated with hyperactivity and conduct problems were relatively weak compared to the

predictive power of most of the ESPAD social and behavioural 'consequences' of alcohol. This suggests that even among a group at generally high risk for social and behavioural problems, early alcohol use and greater alcohol consumption add considerably to risk.

This is the first study to investigate the prevalence of alcohol consumption and the relationship with emotional and behavioural problems and alcohol related harms in adolescents presenting to the ED in England. The strengths of this study include the large sample size, the wide age range of non-alcohol treatment-seeking adolescents studied, and the broad spread of study across 10 EDs across England. Fieldwork took place over several months every day of the week and from 8 am to midnight, so our findings are a good indication of the prevalence of alcohol use disorders in this population. Most of the evidence on alcohol screening and brief intervention in young people comes from a school setting and older adolescents. However, as this study identified a high prevalence of alcohol use disorders in adolescents attending emergency departments, we suggest this setting is a relevant one for research on alcohol screening in young people. The questionnaire asked participants about a comprehensive range of alcohol measures (TLFB, BSQF, AUDIT, MINIKIDS, as well as the ESPAD questions on intoxication), which will be explored fully in a separate paper. Use of technology to collect data was successful in this study, and it is known that technology shows promise as a tool to deliver interventions (30).

This study does have some limitations. Those with a severe injury or mental health problem were excluded from participating due to ethical reasons. The association between alcohol and severe injury and mental health problems has been well established therefore excluding these participants may have introduced bias. Many of the measures used (such as TLFB), were initially developed for adults, although some have also been validated for use in this population (for example the TLFB) (21, 25-27). Some of the questions about alcohol consequences (e.g. ESPAD) are usually asked about the last 12 months, however in the present study these questions were only asked of participants who drank

alcohol in the last three months. Some of the outcomes measured may have been experienced among less recent drinkers (or non-drinkers), and these may not have been captured, especially as at a young age drinking patterns are often infrequent or irregular (31). This suggests that questions routinely used to measure drinking in young people may not be sufficiently detailed. Data on those eligible participants who declined to take part was not collected, this is a potential source of bias that was not investigated. Finally, for some of the less common outcomes studied, there was a small sample size in some subgroups and resulting odds ratios should be interpreted with caution (for example the OR of 13.5 for early onset and involvement with the police seen in Table 5).

It is possible that the self-completion nature of the survey and the study setting may have biased our estimates. There is evidence to suggest that self-reported measures of alcohol consumption are reliable with importance placed on factors such as privacy, confidentiality and completion of questionnaires electronically (32-34)). Focus groups were held with members of a national youth organisation to explore young people's views of answering questions about alcohol in the ED. Anonymous self-completion of the questionnaires on an electronic tablet device was perceived as highly confidential and secure by the members of the national youth organisation.. In order to minimise bias in the current research, study questionnaires were self-completed using an electronic tablet device in a private area of the ED and confidentiality was assured. A further limitation of the current research may be the potential recall bias for the age of first alcohol use, this variable only asked for adolescents to recall the first time that they had a drink of alcohol. Forward telescoping may occur where participants recall the age of first consumption closer to their current age and this is more common in infrequent drinkers (35). There is some debate in the literature regarding the importance of 'sips' of alcohol (35), however, a recent study called for greater importance to

be placed on ‘sips’ when considering the association between alcohol consumption and health and social consequences (36).

Current UK drinking guidelines recommend an alcohol-free childhood and that young people choosing to consume alcohol should not do so until age 15 or older, and if they drink, should not exceed adult recommendations and should not drink more than one occasion per week (28). Our study supports this but also shows a similar prevalence of hazardous drinking among participants who started drinking at age 15 or older (Online supplementary table 3), therefore the risks of drinking are not restricted to those with an early onset. Future studies should explore how the risks associated with drinking alcohol vary by age of onset in more detail.

A high prevalence of alcohol use disorders among adolescents presenting at EDs in England was identified in this study. Associations between alcohol consumption and earlier onset of drinking and negative consequences of drinking (as measured by the ESPAD questions) and poorer health and functioning were also observed. This study found ED waiting rooms a source of willing research participants, and this context may also represent a teachable moment to change young people’s behaviour using either face-to-face or electronic interventions (31, 37, 38). The ED also has a high level of staff expertise who are well placed to initiate safeguarding procedures where required and who provide a good point of onward referral to specialist services. The possibility of conducting alcohol screening among adolescents presenting at the ED in England should be investigated, and the potential for providing interventions to help reduce alcohol consumption in this population and setting established (15, 39).

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Figure 1: Percentage of participants who have had a drink of alcohol that was more than a sip in their life by current age

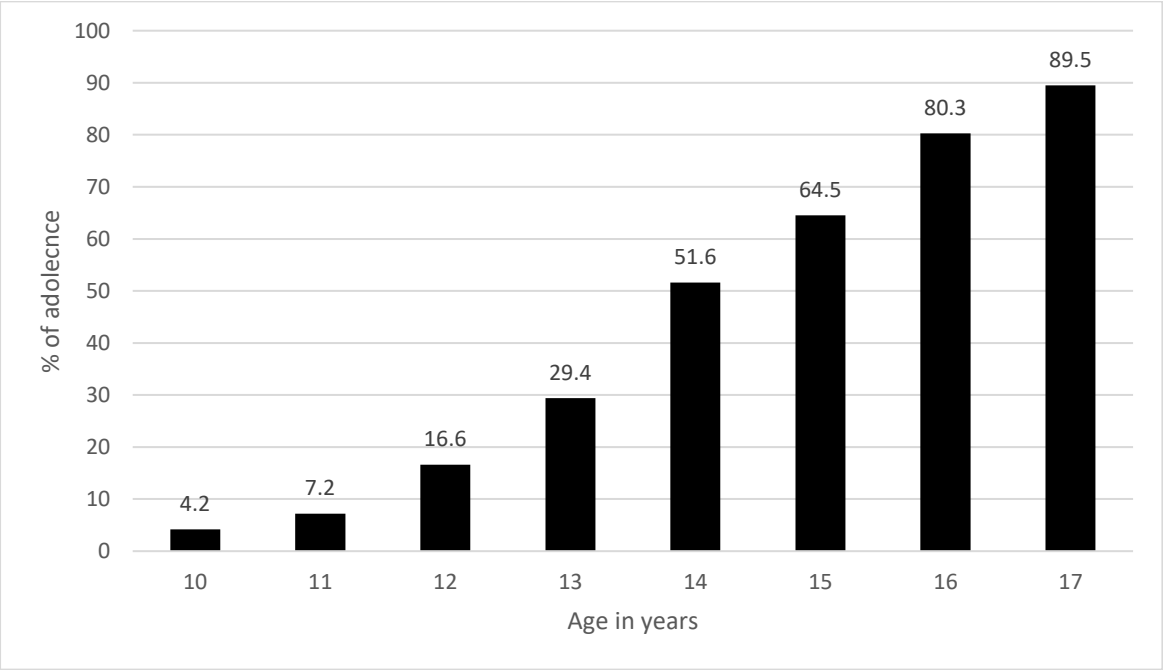

Table 1: overview of study sample and regression analysis to explore the relationship between demographics and measures of general health and social functioning and the consumption of alcohol in the previous 3 months

	Whole sample (N=5376)	No alcohol in the past 3 months (N=3960)	Consumed alcohol in the past 3 months (1374)	Odds of having consumed alcohol in the past 3 months
Age, mean (SD)	13.28 (2.074)	12.65 (1.850)	15.12 (1.511)	OR = 2.147, p<0.001, 95% CI=2.050-2.248
Gender, N (%)[1]				
Male	2869 (53.8)	2183 (55.1)	686 (49.9)	****
Female	2465 (46.2)	1777 (44.9)	688 (50.1)	OR = 1.232, p=0.001, 95% CI=1.090-1.393
Ethnicity, N (%)[2]				
Other	1396 (27.4)	1215 (32.1)	181 (13.8)	****
White	3699 (72.6)	2565 (67.9)	1134 (86.2)	OR = 2.968, p<0.001, 95% CI = 2.501-3.521
Tobacco, N (%)[3]				
No	4846 (91.1)	3843 (97.36)	1003 (73.2)	****
Yes	476 (8.9)	108 (2.7)	368 (26.8)	OR = 13.056, p<0.001, 95% CI = 10.420-16.357
Emotion scale, N (%)[4*]				
Normal	4556 (86.9)	3442 (87.4)	1114 (85.6)	****
Borderline	284 (5.4)	211 (5.4)	73 (5.6)	OR=1.069, p=0.634, 95% CI=0.812-1.407
Abnormal	400 (7.6)	285 (7.2)	115 (8.8)	OR=1.247, p=0.057, 95% CI=0.994-1.56
Conduct scale, N (%)[5*]				
Normal	1404 (78.6)	3082 (78.7)	1022 (78.3)	****
Borderline	519 (9.9)	382 (9.8)	137 (10.5)	OR=1.082, p=0.459, 95% CI=0.879-1.331
Abnormal	600 (11.5)	453 (11.6)	147 (11.3)	OR=0.979, p=0.831, 95% CI=0.802-1.194
Hyperactivity scale, N (%)[6*]				
Normal	3919 (74.9)	2941 (74.9)	978 (75.2)	****

Borderline	495 (9.5)	380 (9.7)	115 (8.8)	OR=0.910, p=0.403, 95% CI = 0.730-1.135
Abnormal	815 (15.6)	608 (15.5)	207 (15.9)	OR=1.024, p=0.790, 95% CI= 0.861-1.218
Peer scale, N (%)[7*]				
Normal	4471 (85.5)	3393 (86.4)	1078 (82.7)	****
Borderline	584 (11.2)	413 (10.5)	171 (13.1)	OR=0.303, p=0.007, 95% CI=1.077-1.577
Abnormal	175 (3.3)	121 (3.1)	54 (4.1)	OR=1.405, p=0.042, 95% CI=1.012-1.950
Prosocial scale, N (%)[8*]				
Normal	4704 (89.6)	3639 (92.3)	1065 (81.5)	****
Borderline	328 (6.2)	204 (5.2)	124 (9.5)	OR=2.077, p<0.001, 95% CI=1.6452.623
Abnormal	218 (4.2)	101 (2.6)	117 (9.0)	OR=3.958, p<0.001, 95% CI=3.007-5.210
Quality of life, mean (SD)[9]	42.92 (5.32)	43.58 (5.03)	40.92 (5.66)	OR=0.906, p<0.001, 95% CI=0.894-0.918

NB: OR = Odds Ratio, CI = Confidence Interval, Number of participants with missing data; [1]1, [2]245, [3]25, [4]112, [5]129, [6]124, [7]122, [8]102, [9]25, *Derived from the SDQ, **** Reference group

Table 2: Regression analysis for the association between alcohol consumption (TLFB) and psychological and social problems

Variable	β	OR	p	95% confidence interval
Tobacco[1]				
No	0	1.0		
Yes	0.640	1.897	**<0.001**	1.670 – 2.155
Emotion[2*]				
Normal	0	1.0		
Borderline	-0.015	0.893	0.985	0.787 – 1.231
Abnormal	0.057	1.059	0.523	0.889 – 1.261
Conduct[2*]				
Normal	0	1.0		
Borderline	0.235	1.265	**0.005**	1.074 – 1.490
Abnormal	0.270	1.309	**0.001**	1.115 – 1.538
Hyperactivity[2*]				
Normal	0	1.0		
Borderline	0.167	1.182	0.065	0.990 – 1.412
Abnormal	0.193	1.212	0.006	1.057 – 1.391
Peer[2*]				
Normal	0	1.0		
Borderline	0.003	1.003	0.971	0.866 – 1.162
Abnormal	0.158	1.171	0.213	0.913 – 1.501
Prosocial[2*]				
Normal	0	1.0		
Borderline	0.087	1.091	0.332	0.915 – 1.300
Abnormal	0.076	1.079	0.404	0.902 – 1.291
Quality of life[3**]	-0.537		**<0.001**	-0.802 - -0.271
Alcohol measures				
AUDIT C[1]				
Score less than 3	0 -0.047	1.0		
Score equal or greater than 3		0.954	0.505	0.830-1.096
Minikid[1]				
No diagnosis	0	1.0		
Diagnosis	1.049	2.855	**<0.001**	2.388 – 3.414
Physical fight[1***]				
No	0	1.0		
Yes	0.880	2.410	**<0.001**	1.998 – 2.907
Accident[1***]				
No	0	1.0		
Yes	0.709	2.032	**<0.001**	1.737 – 2.378
Serious problem with parents[1***]				
No	0	1.0		
Yes	0.924	2.519	**<0.001**	2.039 – 3.112

Serious problem with friends[1*]**				
No	0	1.0		
Yes	0.633	1.883	**<0.001**	1.601 – 2.214
Performed poorly at school[1*]**				
No	0			
Yes	0.625	1.869	**<0.001**	1.520 – 2.298
Victimised by Robbery or theft[1*]**	0	1.0		
No	0.576	1.778	**<0.001**	1.493 – 2.118
Yes				
Trouble with the police[1*]**				
No	0	1.0		
Yes	0.850	2.340	**<0.001**	1.877 – 2.918
Emergency Admission[1*]**				
No	0	1.0		
Yes	0.765	2.150	**<0.001**	1.765 – 2.618
Engaged in sexual intercourse with no condom[1*]**	0	1.0		
No	0.787	2.197	**<0.001**	1.833 – 2.634
Yes				
Engaged in sexual intercourse and regretted it the next day[1*]**	0	1.0		
No	0.781	2.183	**<0.001**	1.803 – 2.644
Yes				

NB: After adjusting for age, gender and ethnicity as covariates. [1] Logistic regression, [2]Multinomial regression, [3]Linear regression, OR = Odds Ratio, *Derived from the SDQ, **Kidscreen, ***ESPAD

Table 3: Regression analysis of whether age of alcohol onset was less than 15 on psychological and social problems – in respondents aged 16 and 17

Variable	β	OR	P	95% confidence interval
Tobacco[1]				
No	0	1.0		
Yes	1.039	2.827	**<0.001**	1.861 – 4.295
Conduct[2*]				
Normal	0	1.0		
Borderline	0.944	2.569	**0.014**	1.209 – 5.461
Abnormal	1.523	4.588	**0.001**	1.841 – 11.433
Hyperactivity[2*]				
Normal	0	1.0		
Borderline	0.359	1.431	0.322	0.704 – 2.910
Abnormal	0.977	2.657	**0.001**	1.462 – 4.830
Quality of Life[3**]	1.591		**0.003**	0.562 – 2.620
Minikid[1]				
No diagnosis	0	1.0		
Diagnosis	0.903	2.467	**0.002**	1.379 – 4.414
Physical fight[1***]				
No	0	1.0		
Yes	0.683	1.979	0.073	0.938 - 4.174
Accident[1***]				
No	0	1.0		
Yes	0.591	1.807	**0.046**	1.010 – 3.232
Seious problem with parents[1***]	0	1.0		
No	1.500	4.483	**0.017**	1.303 – 15.426
Yes				
Serious problem with friends[1***]	0	1.0		
No	0.089	1.093	0.768	0.606 – 1.972
Yes				
Performed poorly at school[1***]	0	1.0		
No	1.332	3.789	**0.017**	1.266 – 11.344
Yes				
Victimised by robbery or theft[1***]				
No	0	1.0		
Yes	0.280	1.324	0.434	0.655 – 2.673
Trouble with the police[1***]	0	1.0		

No Yes	2.605	13.526	**0.012**	1.785 – 102.481
Hospitalised or admitted to an emergency room[1*]** No Yes	0 0.389	1.0 1.475	0.350	0.653 – 3.335
Engaged in sexual intercourse with no condom[1*]** No Yes	0 0.550	1.0 1.733	0.074	0.949 – 3.166
Engaged in sexual intercourse and regretted it the next day[1*]** No Yes	0 0.434	1.0 1.543	0.210	0.783 – 3.043

NB: After adjusting for gender, ethnicity and alcohol consumption (TLFB) as covariates. [1]Logistic regression, [2]Multinomial regression, [3]Linear regression, OR = Odds Ratio. *Derived from the SDQ, **Kidscreen, ***ESPAD