Running Head: Alcohol and outcomes

Alcohol misuse and psychosocial outcomes in young adulthood: Results from a longitudinal birth

cohort studied to age 30

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Abstract

Purpose: This study examined the associations between measures of alcohol abuse/dependence symptoms and a range of psychosocial outcomes from ages 21-30 in a New Zealand birth cohort.

Methods: Outcome measures included measures of: criminal offending; family violence and relationship instability; sexual risk-taking and consequences; mental health; and other adverse health and adjustment outcomes. Bivariate associations between a three-level classification of alcohol misuse (no symptoms; subclinical level of symptoms; met criteria for alcohol dependence) and each outcome during the period 21-30 years were computed using Generalised Estimating Equation models. These associations were then adjusted for non-observed sources of confounding using conditional fixed effects regression modelling, augmented by time-dynamic covariate factors. For both sets of models estimates of the attributable risk (AR) were computed.

Results: There were statistically significant ($p < .05$) bivariate associations between alcohol misuse and each of the fifteen outcome measures, with estimates of the AR ranging from 7.4% to 46.5%. Adjustment for non-observed fixed effects generally reduced the magnitude of these associations; however, after adjustment, 12 of the 15 associations remained statistically significant ($p < .05$). Estimates of the AR after adjustment for fixed effects ranged from 3.6% to 44.3%.

Conclusions: The results suggest that there are pervasive and persistent linkages between alcohol misuse and a range of adverse psychosocial outcomes. A reduction in levels of alcohol misuse amongst individuals of this age group could reduce substantially the overall level of personal and societal cost of hazardous levels of alcohol consumption.

Keywords: alcohol abuse/dependence, psychosocial outcomes, longitudinal study, non-observed confounding

1. Introduction

There has been a large and ever-growing literature on the adverse consequences of alcohol misuse, spanning a number of domains of personal and psychosocial functioning. These domains include: crime; family violence; sexual risk-taking; mental health; as well as a range of other outcomes (Boden and Fergusson, 2011b; Cook and Clark, 2005; Gmel and Rehm, 2003; Jane-Llopis and Matytsina, 2006; Marshal, 2003; Parker and Auerhahn, 1998; Rehm et al., 2003). In all cases it can be suggested that alcohol misuse has both physiological and behavioural consequences that lead to increased risks in a large number of areas of personal functioning. In addition it is likely that these adverse consequences will vary with age, with young adults being at greatest risk of most of the adverse outcomes listed above (Grossberg et al., 2004; Hope, 2004; Naimi et al., 2003; Rehm et al., 2006).

While the risks of alcohol misuse are now well-documented, less attention has been given to the accumulative effects of alcohol misuse on overall levels of psychosocial functioning and wellbeing in the population. Specifically, it can be argued that since alcohol misuse has adverse consequences for a large number of areas of personal functioning, the consequences of this misuse on population health and wellbeing are extensive and far-reaching. In this paper we address the issue of the burden of alcohol misuse by reporting on the associations between alcohol misuse (assessed using DSM criteria) (American Psychiatric Association, 1994) and a wide range of outcomes in a birth cohort studied over the period of young adulthood (21-30 years). The outcomes considered span measures of: crime; family violence and interpersonal relationships; sexual risk-taking; mental health; and related outcomes. The first aim of the paper is to develop a profile of the associations between patterns of alcohol misuse in young adulthood and a wide range of outcome measures.

An issue which has recurred in the literature has concerned the extent to which associations between alcohol misuse and adverse outcomes reflect the presence of third or confounding factors that are associated with alcohol misuse and also influence other aspects of development. In most

previous research, issues of confounding have been addressed by the use of regression or similar models in which the associations between alcohol misuse and outcomes are adjusted for observed sources of confounding. A limitation of this approach is that it may be suggested that any associations that remain following control for observed sources of confounding can be attributed to the effects of non-observed sources of confounding. Subject to the availability of repeated measures (longitudinal) data, it is possible to fit regression models which take into account non-observed sources of confounding, providing these sources of confounding have a fixed and enduring effect on the outcome being studied. This control may be achieved by fitting fixed effects regression models (Cameron and Trivedi, 1998; Greene, 1990). However, the model does not address the issue of confounders that may vary over time and to control for such confounding, the fixed effects model needs to be augmented by observed time-dynamic confounding factors. The second aim of this paper is therefore to fit fixed effects models to adjust the associations between alcohol misuse and a wide range of outcomes, to estimate the associations between alcohol misuse and outcomes net of fixed and time-dynamic sources of confounding.

A further issue that has arisen in the literature on alcohol misuse concerns the way in which associations between alcohol misuse and outcomes are quantified. In many studies this quantification has relied on the reporting of regression coefficients, odds ratios, confidence intervals, and tests of significance. While all of these statistics are important as descriptions of statistical models, they fail to convey the impact that alcohol misuse has on rates of problems in the population. Arguably, the best measure for describing the overall impact of alcohol misuse is provided by the attributable risk (AR) fraction that assesses the extent to which risk within this population would be reduced if all alcohol misuse were to be eliminated. The AR thus provides a useful benchmark against which to assess the potential impact of alcohol misuse on population risk.

2. Methods

2.1 Participants

The data were gathered during the course of the Christchurch Health and Development Study (CHDS). In this study a birth cohort of 1265 children (635 males, 630 females) born in the Christchurch (New Zealand) urban region in mid-1977 has been studied at birth, 4 months, 1 year and annually to age 16 years, and again at ages 18, 21, 25 and 30 years (Fergusson and Horwood, 2001; Fergusson et al., 1989). All study information was collected on the basis of signed consent from study participants and all information is fully confidential. All aspects of the study have been approved by the Canterbury (NZ) Ethics Committee.

2.2 Alcohol misuse (alcohol abuse/dependence (AAD) symptoms and alcohol dependence; ages 18-21, 21-25, and 25-30 years).

In this investigation alcohol misuse has been operationalized as symptoms of alcohol abuse/dependence (AAD), or meeting DSM-IV (American Psychiatric Association, 1994) criteria for alcohol dependence. At ages 21, 25 and 30 years, study participants were interviewed concerning alcohol use using components of the Composite International Diagnostic Interview (CIDI)(World Health Organization, 1993) to assess DSM-IV (American Psychiatric Association, 1994) symptom criteria for AAD. These symptom measures were used to create a three-level classification of cohort members as to their relative level of alcohol misuse during the periods 18-21 years, 21-25 years, and 25-30 years. Participants who reported no symptoms of AAD during an assessment period were classified as having no symptoms for that period. Cohort members who reported at least one symptom during an assessment period, but who did not meet criteria for DSM-IV alcohol dependence during that assessment period, were classified as having a subclinical level of symptoms during that period. Finally, those met criteria for DSM-IV alcohol dependence on the basis of

symptom reports during any assessment period were classified as alcohol dependent during that period.

Details concerning alternative formulations of the alcohol misuse measure are given in the Online Supplement.

2.3 Outcome measures

The following self-reported outcome measures were used in the present study. All measures were dichotomous. Complete descriptions of each measure are provided in the Online Supplement.

2.3.1 Criminal offending outcomes (ages 20-21, 24-25, and 29-30). These measures included violent offending, property offending, and arrest/convictions.

2.3.2 Family violence and relationship instability outcomes. These outcome measures included physical intimate partner violence (IPV) perpetration and victimization (ages 20-21; 24-25; and 29-30 years), and relationship dissolution (ages 18-21; 21-25; and 25-30 years).

2.3.3 Outcomes related to sexual risk-taking and consequences (ages 18-21; 21-25; and 25-30 years). These measures included sexually transmitted infection (STI) and having ten or more sexual partners during an assessment period.

2.3.4 Mental health outcomes (ages 20-21; 24-25; and 29-30 years). Mental health outcomes included major depression, anxiety disorder, and suicidal ideation.

2.3.5 Other adverse outcomes (ages 18-21; 21-25; and 25-30 years). A further series of outcome measures included: three or more months of unemployment; motor vehicle accident; serious illness/accident; and violence victimization.

2.4 Time-dynamic covariate factors

Several time-dynamic covariate factors were employed in the present study. A number of these covariate factors were derived from outcome variables described above, including: major depression; anxiety disorder; violent offending; and arrest/conviction (see above for details). Several additional time-dynamic covariate factors were also included, and are described briefly below. A more detailed description of these factors is available in the Online Supplement.

2.4.1 Frequency of cannabis use (ages 20-21; 24-25; and 29-30 years). A six point measure of frequency of cannabis use, ranging from "never" to "daily", during the 12 months prior to each assessment.

2.4.2 Other illicit substance use (ages 20-21; 24-25; and 29-30 years). A dichotomous variable indicating illicit (non-cannabis) substance use during the 12 months prior to each assessment.

2.4.3 Caring for a dependent child (ages 20-21; 24-25; and 29-30 years). A dichotomous variable indicating whether the cohort member was caring for a dependent child during the 12 months prior to each assessment.

2.4.4 Partner substance use and criminal offending (ages 20-21; 24-25; and 29-30 years). A pair of dichotomous variables indicating whether the cohort member's domestic partner: a) used cannabis or other illicit drugs; or b) engaged in criminal offending; during the 12 months prior to each assessment.

2.5 Statistical analyses

2.5.1 Associations between alcohol misuse and outcomes. In the first stage of the analyses, the pooled associations between the categorical measure of symptoms of alcohol misuse (no symptoms; some symptoms; met criteria for DSM-IV alcohol dependence) and each outcome were

estimated via Generalized Estimating Equation methods (Liang and Zeger, 1986; Zeger and Liang, 1986). Estimates of the attributable risk (AR) for each outcome were calculated using methods described by Bruzzi et al (Bruzzi et al., 1985). Details of these analyses are given in the Online Supplement.

2.5.2 Fixed effects model for covariate adjustment. To adjust the associations between alcohol misuse and outcomes for non-observed fixed effects, conditional fixed effects regression models were fitted to the joint data for each of the outcomes over the measurement periods. These models were augmented by the inclusion of a series of time-dynamic covariate factors. Details of these analyses are also provided in the Online Supplement.

2.6 Sample sizes

The present analyses were based on samples ranging from 987 to 1011, representing 78% to 80% of the original cohort of 1265 participants, for whom data were available concerning alcohol misuse and outcomes at ages 21, 25, and 30. Details of tests of sample bias are given in the Online Supplement.

3. Results

3.1 Associations between alcohol misuse and outcomes (ages 21-30)

Supplementary Table 1 in the Online Supplement shows the data describing the associations between levels of alcohol misuse (coded as: none; sub-clinical; and met criteria for alcohol dependence) and a series of outcome measures assessed at ages 21, 25, and 30. As explained in Methods, these data were analysed using logistic regression Generalised Estimating Equation (GEE) models. The results of these analyses are summarised in Table 1, which shows estimated odds ratios

(OR) and 95% confidence intervals (CI) between alcohol misuse and each outcome (pooled over ages 21, 25 and 30). The Table shows:

3.1.1   Crime: There were strong and highly significant linear tendencies for increased rates of alcohol misuse to be associated with increasing rates of violent offending (p < .0001), property offending (p < .0001), and arrest/conviction (p < .0001). Those meeting criteria for alcohol dependence at any time during the period from 21-30 years had odds of these outcomes that ranged from 4.19 (arrest/conviction) to 9.21 (violent offending) times greater than those with no alcohol misuse. Estimates of the attributable risk (AR) show that the elimination of all alcohol misuse could reduce the rate of crime for this population by 30.0% to 46.5%.

3.1.2   Family violence and relationship instability: There were moderate and significant linear tendencies for increased rates of alcohol misuse to be associated with increasing rates of physical intimate partner violence (IPV) perpetration (p < .0001), IPV victimisation (p < .0001), and relationship breakdown (p < .0001). Those meeting criteria for alcohol dependence at any time during the period from 21-30 years had odds of these outcomes that ranged from 2.42 (IPV victimisation) to 2.90 (relationship breakdown) times greater than those with no alcohol misuse. Estimates of the AR show that the elimination of all alcohol misuse could reduce the rate of family violence and relationship instability by 13.6% to 15.8%.

3.1.3   Sexual risk-taking and consequences: There were moderate to strong linear tendencies for increased rates of alcohol misuse to be associated with increasing rates of sexually transmitted infection (STI) (p < .0001) and having ten or more sex partners (p < .0001). Those meeting criteria for alcohol dependence at any time during the period from 21-30 years had odds of these outcomes that ranged from 4.84 (STI) to 9.51 (ten or more sex partners) times greater than for those individuals with no alcohol misuse. Estimates of the AR show that the elimination of all alcohol misuse could reduce the rate of sexual risk-taking and consequences by 31.5% to 36.4%.

3.1.4   Mental health: There were weak to moderate linear tendencies for increased rates of

alcohol misuse to be associated with increased rates of major depression ($p < .0001$), anxiety

disorder ($p < .001$), and suicidal ideation ($p < .0001$). Those meeting criteria for alcohol

dependence had odds of these outcomes that ranged from 1.66 (anxiety disorder) to 4.13

(suicidal ideation) times higher than those with no alcohol problems. Estimates of the AR

show that the elimination of all alcohol misuse could reduce the rate of mental health

disorders by 8.1% to 15.4%.

3.1.5   Other adverse outcomes: There were weak to moderate linear tendencies for increased

rates of alcohol misuse to be associated with increased rates of three or months of

unemployment ($p < .0001$), motor vehicle accidents ($p < .0001$), serious illness/accident ($p <$

.05), and violence victimisation ($p < .0001$). Those meeting criteria for alcohol dependence

had odds of these outcomes that were 1.59 (serious illness/accident) to 6.85 (violence

victimisation) times greater than those with no alcohol misuse. Estimates of the AR show

that the elimination of all alcohol misuse could reduce the rate of these adverse outcomes

by 7.4% to 36.8%.

INSERT TABLE 1 HERE

3.2 Adjustment for non-observed fixed effects

To adjust the associations between alcohol misuse and outcomes presented in Table 1, fixed effects

regression models were fitted to the data. These models estimated the associations between

alcohol misuse and outcomes after controlling for both non-observed sources of confounding, and

time-dynamic covariate factors (see Methods). The adjusted results are shown in Table 2. This

Table shows that, after control for fixed effects and time-dynamic covariate factors, the majority (12

out of 15) comparisons remained statistically significant ($p < .05$) or marginally significant ($p < .10$).

The Table shows:

3.2.1 <u>Crime:</u> All offending outcomes remained statistically significant, with estimates of the adjusted AR ranging from 21.7% to 44.3%.

3.2.2 <u>Family violence and relationship instability:</u> All family violence and relationship instability outcomes remained statistically significant or marginally significant (p < .10), with estimates of the adjusted AR ranging from 8.7% to 11.6%.

3.2.3 <u>Sexual risk-taking and consequences:</u> After adjustment, the association between alcohol misuse and ten or more sex partners remained statistically significant (p < .0001), but the association between alcohol misuse and STI did not (p > .30). Estimates of the adjusted AR ranged from 16.1% to 37.2%.

3.2.4 <u>Mental health:</u> Two of the three mental health outcomes (major depression; suicidal ideation) remained statistically significant after controlling for fixed effects. Estimates of the adjusted AR ranged from 3.6% to 30.2%.

3.2.5 <u>Other adverse outcomes:</u> Three of the four other adverse outcomes remained statistically significant after controlling for fixed effects, with the exception being serious illness/accident (p >.10). Estimates of the adjusted AR ranged from 6.8% to 25.0%.

INSERT TABLE 2 HERE

3.3 Supplementary analyses

3.3.1 <u>Effects of gender:</u> To examine the extent to which findings varied with gender, the analyses in Table 1 were extended to include a gender x alcohol misuse interaction term. These analyses showed that in only one case (for the outcome ten or more sex partners) was there a statistically significant (p < .05) interaction between gender and alcohol misuse. For this outcome, the analysis indicated that the association between alcohol misuse and having ten or more sex partners was stronger for females than for males.

3.3.2 <u>Alternative measures of alcohol misuse:</u> To examine the sensitivity of the results to the method for measuring alcohol misuse, the data were re-analysed using two alternative

measures of alcohol misuse. These analyses included: Comparison of those meeting criteria for alcohol dependence with other sample members; and the use of a three-level classification measure based on a count of the number of DSM-IV symptoms for alcohol abuse/dependence. These analyses produced the same pattern of findings as the results described previously.

4. Discussion

In this paper we have used data gathered over the course of a 30-year longitudinal study to examine the linkages between alcohol misuse in young adulthood and a wide range of psychosocial outcomes known or believed to be related to alcohol misuse. Compared to previous studies in this general area, this study has a number of advantages.

First, the study examined a wide range of adverse outcomes assessed over a developmental period (young adulthood) when risks of alcohol related harm is likely to be high (Grossberg et al., 2004; Hope, 2004; Naimi et al., 2003; Rehm et al., 2006). Second, the longitudinal design makes it possible to use fixed effects regression methods to control for non-observed fixed sources of confounding, as well as time-dynamic covariate factors. Finally the study provides a broad perspective of the extent of harm caused by alcohol misuse in young adulthood. To our knowledge no previous study has addressed the risks of alcohol-related harm in young adulthood using such a wide range of outcome measures with rigorous control of confounding. The key findings of the study are reviewed below.

Crime was the outcome with the strongest associations with alcohol misuse. After adjustment for confounding those meeting criteria for alcohol dependence had odds of criminal behaviour (violent offending; property offending; arrest/conviction) that were between 2 to 9 times higher than those without symptoms of alcohol misuse. These findings are consistent with previous

research and theorising linking alcohol misuse to increased risks of antisocial behaviour (Boden et al., 2012, 2013; Bureau of Justice Statistics, 2009; Farke and Anderson, 2007).

There were also significant or marginally significant (p <.10) associations between alcohol misuse and measures of domestic violence perpetration/ victimisation and relationship breakdown. Those meeting criteria for alcohol abuse had odds of these problems which were approximately twice the odds for those without alcohol problems. These findings are consistent with previous research linking alcohol misuse to increased risks of domestic violence and relationship problems (Foran and O'Leary, 2008; Leonard and Rothbard, 1999; Marshal, 2003).

The adjusted results also show a clear trend for alcohol misuse to be associated with sexual risk-taking with those meeting criteria for alcohol dependence having odds of having ten or more sexual partners that were over ten times greater than those without symptoms of alcohol misuse. These findings are consistent with previous research linking alcohol misuse to sexual risk-taking (Chesson et al., 2003; Fortenberry, 1998; Parks et al., 2009).

There were significant tendencies for alcohol misuse to be associated with increased rates of both major depression and suicidal behaviour. Those meeting criteria for alcohol dependence had odds of depression that were over twice the odds of those without alcohol problems and odds of suicidal ideation that were over six times higher . These findings are consistent with previous research and theorising linking alcohol misuse to increased risks of depression (Boden and Fergusson, 2011a; Davis et al., 2008; Fergusson et al., 2009; Jane-Llopis and Matytsina, 2006) and suicidality (Davis et al., 2008; Fu et al., 2002; Vilhjalmsson et al., 1998).

In addition to the findings above, alcohol misuse was associated with significant increases in odds of: unemployment; motor vehicle accidents; and violence victimisation. Again these findings are consistent with previous research and theorising on the role of the alcohol misuse in these outcomes (Heather, 1994; Ramstedt, 2008; Rehm and Gmel, 1999; Scott et al., 1999; Young et al., 2008).

Further analysis showed that the findings above held equally for males and female and there was only once instance of a significant gender interaction in which the harms of alcohol misuse varied with gender (for the outcome related to the number of sexual partners). This is a particularly important finding given that: a) males have higher levels of alcohol misuse than females (Kraus et al., 2000; Kuntsche et al., 2004; Schulte et al., 2009); and b) there has been some evidence to suggest that the pattern of harm associated with alcohol misuse varies with gender (Keyes et al., 2011; Perreira and Sloan, 2001; Ramisetty-Mikler and Caetano, 2005). What the findings suggest is that one of the consequences of the changing patterns of alcohol consumption amongst females in recent years (Grucza et al., 2008; Keyes et al., 2008) has been to result in a situation in which both males and females are at similar risks to the adverse effects of alcohol misuse.

In this paper we have measured alcohol misuse using symptom data for DSM-IV (American Psychiatric Association, 1994) defined alcohol abuse/dependence using this information to classify the sample into those meeting criteria for dependence and those with subclinical symptoms. It could be suggested that the findings we have reported are dependent on the use of a particular method of classification. This does not appear to be the case as experimentation with different ways of representing symptom level data (scale scores; diagnostic classification) produced very similar conclusions (see Results)

In recent years there have been growing public and professional concerns about the impacts of alcohol misuse on population health and wellbeing. These concerns have been strongly expressed in a New Zealand context as a result of the high overall rates of alcohol consumption in New Zealand and alcohol-related problems amongst the New Zealand population (Connor et al., 2005; Ministry of Health, 2009; New Zealand Law Commission, 2010; Slack et al., 2009; Wells et al., 2007). The present study shows that such concerns are well-justified by the history of this cohort. This history shows that the misuse of alcohol is related to a wide range of social ills and public health concerns and that theoretically the elimination of alcohol misuse would substantially reduce the risks of a wide range of adverse outcomes with crime reduction being the most marked area.

There has been a growing literature on approaches to addressing alcohol-related harms which has concluded that the most effective methods for addressing these harms are population-level interventions which reduce alcohol consumption by reducing the accessibility of alcohol and increasing the price. These interventions include: raising the drinking age; limiting drinking hours; regulating the supply of alcohol; and increasing the cost of alcohol (Adams and Effertz, 2010; New Zealand Law Commission, 2009; Ponicki et al., 2007; Voas et al., 2003; Wagenaar et al., 2010). The findings of this study strongly support the introduction of these methods. An interesting point to emerge from the study is that although there have been numerous arguments advanced for raising the legal age of drinking both in New Zealand and abroad (New Zealand Law Commission, 2009, 2010) the findings from this study suggest that by itself raising the drinking age will have limited impacts on the consequence of alcohol misuse. This is clearly illustrated by the findings of this study examining the outcomes of alcohol misuse for a population of young adults who were over the current legal age for alcohol purchase (18 years) in New Zealand, and who in fact were subject to an earlier version of the law in New Zealand whereby the legal age of purchase was 20 years. While raising the legal drinking age may reduce risks for adolescents (Ponicki et al., 2007; Voas et al., 2003), this approach will likely have a smaller effect on the adverse consequences of alcohol misuse by the high-risk young adult population aged 21-30 years. It is likely that the risks faced by this population have increased in recent years as a result of the increasing trend to defer parenthood until after 30 (Bray et al., 2006; McMahon et al., 2011; Statistics New Zealand, 2010). As we have shown in a previous paper (Fergusson et al., 2012), the transition to parenthood is one factor which reduces rates of alcohol misuse with the consequence that social trends to delay parenthood are likely to place the young adult population at increased risks of alcohol misuse and the related adverse consequences.

While this paper has a number of strengths relating to the longitudinal design and breadth of the data collection, it also has some limitations that should be borne in mind. First, the findings are based on a specific birth cohort assessed over a particular historical period. The extent to which the study findings generalise to other cohorts and settings remains to be established. Second the

study is likely to have underestimated the overall adverse impacts of alcohol consumption by young adults since it is possible that a number of those classified as not having symptoms of alcohol misuse may have experienced adverse consequences from the use of alcohol. Finally, all measures were obtained via self-report, which may be subject to biases related to socially-desirable responding.

Notwithstanding these reservations, the findings of this study show that the misuse of alcohol by members of this birth cohort during young adulthood had substantial and far-reaching consequences for a wide range of developmental outcomes spanning: crime; domestic violence; relationship stability; sexual risk-taking; mental health; and related outcomes. Given the far-reaching consequences of alcohol misuse there are substantial grounds for putting into place policies, strategies and services targeted at both the reduction of alcohol misuse and minimisation of the harmful consequences of this behavior.

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Table 1. Population averaged odds ratios (OR) and 95% confidence intervals (CI); and attributable risks (AR) for the associations between alcohol misuse and outcome measures assessed from ages 21 to 30.

Outcome (ages 21-30)	Alcohol misuse level (ages 21-30)			p^1	AR estimate (%)
	None	Subclinical	Met criteria for alcohol dependence		
Crime (OR; 95% CI)					
Violent offending	1 --	3.02 (2.03-3.760)	9.21 (5.93-14.30)	<.0001	44.5
Property offending	1 --	2.90 (2.26-3.71)	8.33 (5.13-13.74)	<.0001	46.5
Arrest/conviction	1 --	2.05 (1.70-2.47)	4.19 (2.98-6.09)	<.0001	30.0
Family violence and relationship instability (OR; 95% CI)					
Physical intimate partner violence (IPV) perpetration	1 --	1.60 (1.29-2.001)	2.59 (1.66-4.01)	<.0001	15.8
Physical IPV victimisation	1 --	1.56 (1.29-1.87)	2.42 (1.68-3.50)	<.0001	13.6
Relationship breakdown	1 --	1.70 (1.47-1.97)	2.90 (2.15-3.90)	<.0001	15.2
Sexual risk-taking and consequences (OR; 95% CI)					
Sexually transmitted infection (STI)	1 --	2.20 (1.57-3.08)	4.84 (2.45-9.50)	<.0001	31.5
Ten or more sex partners OR (95% CI)	1 --	3.08 (2.36-4.03)	9.51 (5.55-16.12)	<.0001	36.4
Mental Health (OR; 95% CI)					
Major depression OR (95% CI)	1 --	1.58 (1.34-1.87)	2.50 (1.78-3.50)	<.0001	15.4

Anxiety disorder	1 --	1.29 (1.08-1.53)	1.66 (1.17-2.35)	<.001	8.1
Suicidal ideation	1 --	2.03 (1.61-2.57)	4.13 (2.29-6.61)	<.0001	14.4
Other adverse outcomes (OR; 95% CI)					
Three or more months unemployed	1 --	1.55 (1.31-1.84)	2.41 (1.72-3.37)	<.0001	14.4
Motor vehicle accidents	1 --	1.30 (1.13-1.50)	1.69 (1.27-2.25)	<.0001	7.9
Serious illness/accident	1 --	1.26 (1.05-1.51)	1.59 (1.11-2.29)	<.05	7.4
Violence victimisation	1 --	2.62 (2.11-3.24)	6.85 (4.46-10.59)	<.0001	36.8

[1] Wald χ^2 from Generalised Estimating Equation models.

Table 2. Adjusted ORs, 95% CI and adjusted AR for associations between alcohol misuse and outcomes (ages 21-30), after adjustment for non-observed fixed effects and time-dynamic covariate factors.

Outcome (ages 21-30)	Alcohol misuse level (ages 21-30)			p^2	Adjusted AR estimate (%)	Significant (p < .05) time-dynamic covariate factors[2]
	None	Subclinical	Met criteria for alcohol dependence			
Crime (OR; 95% CI)						
Violent offending	1 --	2.99 (1.96-4.62)	8.94 (3.84-21.34)	<.0001	44.3	1
Property offending	1 --	1.77 (1.16-2.69)	3.13 (1.34-7.24)	<.01	33.1	1,2
Arrest/conviction	1 --	1.55 (1.10-2.17)	2.40 (1.22-4.70)	<.05	21.7	--
Family violence and relationship instability (OR; 95% CI)						
Physical IPV perpetration	1 --	1.37 (0.95-1.99)	1.87 (0.90-3.96)	<.10	11.6	3
Physical IPV victimisation	1 --	1.39 (1.00-1.93)	1.93 (1.00-3.72)	<.05	10.8	3, 5, 6, 7
Relationship breakdown	1 --	1.29 (1.01-1.63)	1.66 (1.02-2.66)	<.01	8.7	2, 4
Sexual risk-taking and consequences (OR; 95% CI)						
STI	1 --	1.35 (0.77-2.36)	1.81 (0.59-5.56)	>.30	16.1	--
Ten or more sex partners	1 --	3.28 (1.87-5.77)	10.76 (3.50-33.29)	<.0001	37.2	1, 2

Mental Health (OR; 95% CI)

Major depression	1 --	1.54 (1.14-2.09)	2.37 (1.30-4.37)	<.01	14.7	2
Anxiety disorder	1 --	1.11 (0.84-1.46)	1.22 (0.70-2.14)	>.40	3.6	--
Suicidal ideation	1 --	2.54 (1.55-4.16)	6.45 (2.40-17.31)	<.0001	30.2	1

Other adverse outcomes (OR; 95% CI)

Three or more months unemployed	1 --	1.37 (1.01-1.85)	1.88 (1.02-3.42)	<.05	11.1	5
Motor vehicle accidents	1 --	1.30 (1.04-1.62)	1.69 (1.08-2.62)	<.05	7.9	8, 9
Serious illness/accident	1 --	1.23 (0.94-1.62)	1.52 (0.88-2.60)	>.10	6.8	--
Violence victimisation	1 --	1.66 (1.18-2.33)	2.76 (1.39-5.43)	<.01	25.0	1

[1] Wald χ^2 from Generalised Estimating Equation models.

[2] Covariate factors: 1 = Frequency of cannabis use; 2 = other illicit drug use; 3 = anxiety disorder; 4 = major depression; 5 = caring for a dependent child; 6 = partner substance use; 7 = partner criminal offending; 8 = violent offending; 9 = arrest/conviction