

Examination of a possible J-shaped relationship between alcohol consumption and
internalizing disorders in a longitudinal birth cohort

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ABSTRACT

Background

Many studies have reported a J-shaped relationship between alcohol use and affective or anxiety symptoms, with abstainers experiencing more severe symptoms than moderate drinkers. It is less clear whether this relationship is also present for the risk of syndromal internalizing disorders such as depression or anxiety disorders.

Methods

A New Zealand longitudinal birth cohort study (n=1265). Participants were interviewed at ages 18, 21, 25, 30 and 35 years. Alcohol consumption level and the presence of internalizing disorders (major depression; anxiety disorder) for the previous 12 months were determined at each time point. The association between drinking status and major depression and anxiety disorders at ages 18, 21, 25, 30 and 35 years was investigated via Generalised Estimating Equation modelling.

Results

There was little evidence of a statistically significant ($p < .05$) association between alcohol consumption levels and either: a) major depression; or b) anxiety disorder; across the period 18-35 years. Inspection of the annual data showed considerable fluctuation in rates of disorder across alcohol consumption categories.

Conclusion

In young adults there was little evidence of a J-shaped relationship between alcohol use and both major depression and anxiety disorder.

INTRODUCTION

1.1 *The J-shaped relationship between alcohol use and affective symptoms*

In the past three decades there has been increasing interest in alcohol abstainers as an at risk group for adverse health outcomes. This observation was initially made for cardiovascular disease (Shaper et al., 1988) and mortality in general (Power, 1998). Since then, a J-shaped relationship between alcohol consumption and affective symptoms has also been demonstrated, with higher symptom scores among abstainers and heavy drinkers in comparison to moderate drinkers (Alati et al., 2005; Caldwell et al., 2002; Foulds et al., 2013; Graham et al., 2007; Lucas et al., 2010; O'Donnell et al., 2006; Rodgers et al., 2007; Skogen et al., 2009).

Two main explanations have been put forward to account for the excess of mental health symptoms among abstainers. First, the *sick quitter* hypothesis suggests the finding is due to an excess of former heavy drinkers among abstainers (Shaper et al., 1988). However excluding former heavy drinkers attenuates but does not remove the difference in mental health between abstainers and moderate drinkers (Power, 1998; Skogen et al., 2009). The second hypothesis suggests social characteristics of abstainers including lower socioeconomic status and poorer relationships account for their poorer mental health status (Lucas et al., 2010).

There are some limitations to the generalisability of findings on the J-shaped relationship. In particular the findings appear to apply only to symptom score measures rather than the presence of syndromal internalizing disorders (Graham et al., 2007; Rodgers et al., 2007).

There may also be limitations with regard to age, with one study having failed to find increased rates of symptoms amongst younger abstainers (Skogen et al., 2014).

Furthermore, most previous studies on the J-shaped relationship were cross-sectional, and

no previous longitudinal studies investigated the J-shape in relation to the occurrence of syndromal internalizing disorders.

1.2 Objectives

In this study, we used longitudinal data on alcohol consumption and the presence of internalizing disorders from a large birth cohort. The primary aim of the study was to determine whether there was an excess prevalence of: a) major depression; and b) anxiety disorders; among abstainers in comparison to drinkers at three differing levels of alcohol consumption, across ages 18 to 35.

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, 30 and 35 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. Sample size ranged from 1025 (age 18) to 962 (age 35), representing 79% to 82% of the surviving sample at each observation.

2.2 Alcohol use classification, ages 18-35

At ages 18, 21, 25, 30 and 35 years, study participants were interviewed concerning alcohol use, including questions regarding frequency of use and amounts of alcohol consumed. For the measure of frequency, the question asked "Over the last 12 months how often would

you have drunk alcohol?" with answer options ranging from "never" to "almost every day". For the measure of quantity, participants were asked the number and kinds of drinks they would consume in a "usual" drinking session, which was converted to New Zealand ¹ standard drinks per (usual) drinking session.

For the purposes of the present study, a categorical measure of involvement with alcohol over the 12 month period prior to each assessment was constructed. Cohort members who reported consuming no alcohol during the 12 months prior to the assessment were classified as abstinent. For those cohort members who reported consuming alcohol during the previous 12 months, the quantity and frequency measures were used to derive a measure of the number of standard drinks consumed during the past 12 months. These scores were divided into three tertile categories for each assessment period, representing the relative level of alcohol consumption for each participant at each assessment period.

2.3 Major depression and anxiety disorders, ages 18-35

At ages 18, 21, 25, 30 and 35 years, study participants were interviewed on a structured mental health interview designed to assess aspects of mental health and psychosocial adjustment. As part of these assessments, components of the CIDI were used to assess DSM-IV (American Psychiatric Association, 1994) symptom criteria for a series of disorders including: major depression; and a range of anxiety disorders, including generalized anxiety disorder, panic disorder, social phobia, and specific phobias. Participants who met DSM criteria for major depression, or one or more anxiety disorders, during an assessment period were classified as having either: a) major depression; or b) anxiety disorder; during that assessment period.

¹ In New Zealand, a standard drink contains 10 grams of alcohol per drink.

2.4 Statistical analyses

The data on alcohol classification and internalizing disorders were combined over the five assessment periods from age 18 to 35 to obtain population-averaged estimates of the rate of both major depression and anxiety disorder for each level of alcohol classification. Then, in order to estimate the population-averaged associations between the four-level classification of alcohol use and the categorical measures of major depression and anxiety disorder across the five assessment periods from age 18 to age 35, logistic Generalized Estimating Equation (GEE) models (Liang and Zeger, 1986; Zeger and Liang, 1986) were fitted to the data. These models were fitted over two steps. In the first step, the models were used to estimate the linear association between alcohol consumption level and both: a) major depression; and b) anxiety disorders; over the period 18-35 years. In the second step, dummy variables were used to represent the four alcohol classification levels, and a term representing time period, and time period by alcohol classification interaction were included (there was no evidence of a statistically significant ($p < .05$) time period by alcohol classification interaction).

3. Results

Table 1 shows the cohort classified into four groups: alcohol abstinent; and three tertiles representing relative consumption levels, for the 12 months prior to each assessment at ages 18 to 35. For each assessment, the Table shows the percentage meeting DSM criteria for: a) DSM major depression; and b) DSM anxiety disorder. In addition, the Table also shows the population-averaged rate for each disorder across the period 18 to 35 years, the Wald X^2 test of linear association, and the Wald X^2 pairwise tests of significance between the four groups. The Table shows that:

1. For both major depression and anxiety disorder, there was no evidence of a statistically significant ($p < .05$) linear association with alcohol consumption level. In neither case

did those at the highest level of consumption have higher rates of major depression or anxiety disorder than those at lower levels of consumption.

2. Pairwise comparisons showed that for major depression, there were no statistically significant ($p < .05$) differences in rates of depression across the four alcohol consumption groups over the period 18 to 35 years. For anxiety disorder, pairwise comparisons showed that those in the middle tertile for alcohol consumption had significantly ($p < .05$) lower rates of anxiety disorder than abstainers, but did not differ from the other classifications.
3. The results of the pairwise comparisons also showed that there was also no evidence to suggest that the abstinent group had higher rates of either major depression or anxiety disorder than any of the other three alcohol consumption groups. While the estimates at each assessment varied considerably, the pairwise test of the population-averaged rate of major depression and anxiety disorders showed no evidence of a statistically significant difference between the abstinent and the alcohol user groups (all p values $> .10$).

In general, the results of the analyses provide little support for a J-shaped association between alcohol use and internalizing disorders. Those in the abstinent group did not have higher rates of major depression than those in any of the other consumption groups, and those in the highest consumption groups did not have higher levels of either major depression or anxiety disorders than those in the lower consumption groups. The one exception to this pattern was that the middle tertile group had significantly ($p < .05$) lower levels of anxiety disorder than the abstinent group.

4. Discussion

The present study used data from a 35-year longitudinal study to examine whether the associations between internalizing disorders and alcohol use could be described as J-shaped,

in which those abstinent from alcohol have higher rates of internalizing disorder than those who consume alcohol, and in which increasing levels of alcohol consumption are associated with higher levels of disorder. Key strengths of the present investigation include the use of data from a longitudinal birth cohort, the availability of five repeated observations of alcohol consumption and robust measures of both major depression and anxiety disorders, and the fitting of population-averaged GEE models to the data to summarize the nature of the association between alcohol consumption levels and depression and anxiety over time.

The results of the analyses provide little support for the J-shaped curve hypothesis. There was no evidence to suggest that either the abstinent group, or those reporting relatively higher levels of alcohol consumption had significantly ($p < .05$) higher rates of either major depression or anxiety disorder. Indeed, rates of both major depression and anxiety disorder varied considerably across groups over the five observations. The results of these analyses are not consistent with those studies that have found higher rates of affective or anxiety symptoms amongst abstinent individuals than amongst moderate drinkers (Alati et al., 2005; Lucas et al., 2010; Rodgers et al., 2000; Rodgers et al., 2007; Skogen et al., 2009).

Consistent with the present findings, other studies have failed to find differences in the prevalence of syndromal internalizing disorders between abstainers and moderate drinkers (Graham et al., 2007; Rodgers et al., 2007; Skogen et al., 2014). This pattern of results has a number of implications. First, the results suggest that the way mental health outcomes are measured may be an important consideration in relation to whether differences are found in the mental health status of abstainers and moderate drinkers. Mental health symptom score instruments such as the K10 (Kessler et al., 2002) or the CES-D (Radloff, 1977) are useful measures of current symptom severity, and can be regarded as “state” markers which fluctuate in response to individuals’ immediate circumstances (Graham et al., 2007). These

scales are useful to screen for individuals who are at risk of having a serious mental illness (Kessler et al., 2003) but they typically do not directly measure impairment, and are not intended to be used to diagnose mental disorders. Therefore it is possible the higher levels of mental health symptoms previously demonstrated in abstainers do reflect higher levels of psychological distress, but that this distress does not necessarily represent an increased risk of mental disorder. This hypothesis would be consistent with the suggestion abstainers are a socially vulnerable group (Lucas et al., 2010). Further research simultaneously employing both symptom scores and measures of syndromal internalizing disorders would help to clarify the extent to which measurement issues may contribute to contrasting findings in the linkages between alcohol consumption and affective disorders.

A second implication of this pattern of results is that age may be an important consideration in findings of higher levels of symptoms amongst abstainers. Skogen and colleagues (Skogen et al., 2014), using a large cross sectional sample of adolescents, found no evidence of higher levels of psychological distress amongst those abstaining from alcohol than amongst those consuming alcohol. Furthermore, a number of papers that did observe a j-shape association used samples containing a wide range of ages (Alati et al., 2005; Rodgers et al., 2000; Rodgers et al., 2007), with Lucas et al (Lucas et al., 2010) reporting that the association was confined to those participants over 40 years of age. The present study employed a birth cohort, from which observations were made from 18 to 35 years of age, which is generally younger than samples in which the J-shaped association has been observed.

It should be noted that there was no evidence in the present study of higher rates of either major depression or anxiety disorder at higher levels of alcohol consumption. While these results may seem counterintuitive, it should be noted that the alcohol classification used in the present study classified alcohol consumers in tertiles. Foulds et al (2013), using data

from a large cross-sectional survey, reported higher levels of psychological distress amongst those with a high number of self-reported alcohol problems, a group representing 4% of the population.

It should also be noted that the present study did find a difference amongst the alcohol consumption groups on the measure of anxiety disorders, in which the risk of anxiety disorder for the middle tertile was lower than that of abstainers. It is unclear why this difference was observed, but could be argued that the annual variability in risks of disorder shown in Table 1 have led to an artefactual result. Further research is needed to fully elucidate the nature of the associations between alcohol consumption and anxiety disorders specifically (Fergusson et al., 2011).

One possible limitation of the present study is that it may lack sufficient power to detect small or very small effect sizes. Additional research using very large cohorts is required to examine the linkages between alcohol consumption and syndromal internalizing disorders in greater detail.

In summary the findings presented provide evidence that methodological issues influence whether abstainers are found to have greater psychiatric morbidity than moderate drinkers. While previous studies suggest abstainers and those with high levels of alcohol consumption report elevated levels of affective symptoms, the results of the present study suggest that neither group are not at greater risk of syndromal internalizing disorders.

References

- Alati, R., Lawlor, D.A., Najman, J.M., Williams, G.M., Bor, W., O'Callaghan, M., 2005. Is there really a 'J-shaped' curve in the association between alcohol consumption and symptoms of depression and anxiety? Findings from the Mater-University Study of Pregnancy and its outcomes. *Addiction* 100, 643-651.
- Caldwell, T.M., Rodgers, B., Jorm, A.F., Christensen, H., Jacomb, P.A., Korten, A.E., Lynskey, M.T., 2002. Patterns of association between alcohol consumption and symptoms of depression and anxiety in young adults. *Addiction* 97, 583-594.
- Fergusson, D.M., Boden, J.M., Horwood, L.J., 2011. Structural models of the comorbidity of internalizing disorders and substance use disorders in a longitudinal birth cohort. *Soc. Psychiatry Psychiatr. Epidemiol.* 46, 933-942.
- Foulds, J.A., Wells, J.E., Lacey, C.J., Adamson, S.J., Sellman, J.D., Mulder, R.T., 2013. A comparison of alcohol measures as predictors of psychological distress in the New Zealand population. *Int. J. Alcohol Drug Res.* 2, 59-67.
- Graham, K., Massak, A., Demers, A., Rehm, J., 2007. Does the association between alcohol consumption and depression depend on how they are measured? *Alcohol Clin. Exp. Res.* 31, 78-88.
- Kessler, R., Andrews, G., Colpe, L.J., Hiripi, E., Mroczek, D.K., Normand, S.-L.T., Walters, E.E., Zaslavsky, A.M., 2002. Short screening scales to monitor population prevalences and trends in non-specific psychological distress. *Psychol. Med.* 32, 959-976.
- Kessler, R.C., Barker, P.R., Colpe, L.J., Epstein, J.F., Gfroerer, J.C., Hiripi, E., Howes, M.J., Normand, S.-L.T., Manderscheid, R.W., Walters, E.E., Zaslavsky, A.M., 2003. Screening for Serious Mental Illness in the General Population. *Arch. Gen. Psychiatry* 60, 184-189.

Liang, K.Y., Zeger, S.L., 1986. Longitudinal data analysis using generalized linear models. *Biometrika* 73, 13-22.

Lucas, N., Windsor, T.D., Caldwell, T.M., Rodgers, B., 2010. Psychological distress in non-drinkers: Associations with previous heavy drinking and current social relationships. *Alcohol Alcohol.* 45, 95-102.

O'Donnell, K., Wardle, J., Dantzer, C., Steptoe, A., 2006. Alcohol Consumption and Symptoms of Depression in Young Adults From 20 Countries. *Journal of Studies on Alcohol.*

Power, C., 1998. U-shaped relation for alcohol consumption and health in early adulthood and implications for mortality. *Lancet* 352, 877.

Radloff, L.S., 1977. The CES-D scale a self-report depression scale for research in the general population. *Appl. Psychol. Meas.* 1, 385-401.

Rodgers, B., Korten, A.E., Jorm, A.F., Christensen, H., Henderson, S., Jacomb, P.A., 2000. Risk factors for depression and anxiety in abstainers, moderate drinkers and heavy drinkers. *Addiction* 95, 1833-1845.

Rodgers, B., Parslow, R., Degenhardt, L., 2007. Affective disorders, anxiety disorders and psychological distress in non-drinkers. *J. Affect. Disord.* 99, 165-172.

Shaper, A.G., Wannamethee, G., Walker, M., 1988. Alcohol and mortality in British men: explaining the U-shaped curve. *Lancet* 332, 1267-1273.

Skogen, J.C., Harvey, S.B., Henderson, M., Stordal, E., Mykletun, A., 2009. Anxiety and depression among abstainers and low-level alcohol consumers. The Nord-Trøndelag Health Study. *Addiction* 104, 1519-1529.

Skogen, J.C., Sivertsen, B., Lundervold, A.J., Stormark, K.M., Jakobsen, R., Hysing, M., 2014. Alcohol and drug use among adolescents: and the co-occurrence of mental health problems. *Ung@hordaland*, a population-based study. *BMJ Open* 4.

Zeger, S.L., Liang, K.-Y., 1986. Longitudinal data analysis for discrete and continuous outcomes. *Biometrics* 42, 121-130.

Table 1. Associations between alcohol classification and: a) DSM major depression; and b) DSM anxiety disorders (ages 18-35).

% major depression	Alcohol consumption classification			
	Abstinent	Lowest tertile	Middle tertile	Highest tertile
Age 18	13.9	17.7	19.5	18.5
n	72	316	329	308
Age 21	11.1	17.4	16.5	22.1
n	45	304	354	308
Age 25	4.5	17.9	12.7	12.0
n	44	312	346	301
Age 30	15.3	14.7	13.4	12.1
n	59	347	299	282
Age 35	11.0	13.5	9.0	8.7
n	73	289	312	288
Population-averaged rate	11.6 ^a	16.5 ^a	14.4 ^a	14.9 ^a
Test of linear association: $X^2 (1) = 0.64, p > .40$				
% anxiety disorder				
Age 18	22.2	17.4	13.7	19.2
n	72	316	329	308
Age 21	11.1	15.8	11.6	11.7
n	45	304	354	308
Age 25	20.5	20.2	13.3	11.9
n	44	312	346	301
Age 30	22.0	19.9	15.7	14.5
n	59	347	299	282
Age 35	19.2	16.6	16.0	12.2
n	73	289	312	288
Population-averaged rate	19.5 ^a	18.1 ^{a,b}	12.9 ^b	14.9 ^{a,b}
Test of linear association: $X^2 (1) = 2.11, p > .10$				

Note: differing superscripts indicate statistically significant ($p < .05$) difference.

Highlights for review

- This study used data from a longitudinal birth cohort to examine whether a J-shaped curve best described the association between alcohol use patterns and internalizing disorders, with abstinent individuals having higher rates of major depression and anxiety disorders than consumers of alcohol.
- Data included five repeated measures of: a) alcohol use pattern (abstinent; alcohol user [tertiles]); and b) internalizing disorder (DSM major depression; DSM anxiety disorder) over 12 month periods at ages 18, 21, 25, 30, and 35.
- Analyses showed no evidence of a J-shaped curve over the period 18 to 35 years.

Contributors: JAF and JMB planned the study; LJH and JMB collected the data; JMB conducted data analyses; JMB, JAF, and LJH wrote and edited the manuscript.

AUTHOR DISCLOSURES

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