University Library



A gateway to Melbourne's research publications

Minerva Access is the Institutional Repository of The University of Melbourne

Author/s:
Bentley, R;Baker, E;Martino, E;Li, Y;Mason, K

Title:
Alcohol and tobacco consumption: What is the role of economic security?

Date:
2021-07-01

Citation:
Bentley, R., Baker, E., Martino, E., Li, Y. & Mason, K. (2021). Alcohol and tobacco consumption: What is the role of economic security?. Addiction, 116 (7), pp.1882-1891. https://doi.org/10.1111/add.15400.

Persistent Link:
https://hdl.handle.net/11343/298169

Li Yuxi (Orcid ID: 0000-0002-8564-2381)

Title

Alcohol and Tobacco Consumption: What is the role of Economic Security?

List of Authors

Rebecca Bentley [a]
Emma Baker [b]
Erika Martino [a]
Yuxi Li [a]
Kate Mason [c]

Affiliations and addresses

[a] Melbourne School of Population and Global Health, The University of Melbourne, 207 Bouverie St, Carlton VIC 3053, Australia
[b] School of Architecture and Built Environment, The University of Adelaide, SA 5005, Australia.
[c] Institute of Population Health Sciences, University of Liverpool, Brownlow Street, Liverpool, L69 3GL, United Kingdom

Corresponding author

Yuxi Li
Email: yuxil12@student.unimelb.edu.au
Address: Melbourne School of Population and Global Health, University of Melbourne, 207 Bouverie St, Carlton VIC 3053, Australia

Running heading

Economic security, alcohol and tobacco

Word count

3497

Declarations of Interest

None

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/add.15400

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

ABSTRACT

Aims

To understand better the longstanding inequalities concerning alcohol and tobacco use, we aimed to quantify the effect of household economic security on alcohol and tobacco consumption and expenditure.

Design

Longitudinal analysis using data from the Household, Income and Labour Dynamics in Australia survey (2001-2018)..

Setting

Australia

Participants

A nationally representative cohort of 24,134 adults aged 25-64 years (187,378 observations).

Measurements

Tobacco and alcohol use (Yes/No), frequency of use of each per week, household expenditure on each per week, household weekly income (CPI-adjusted), employment security (based on conditions of employment), and housing affordability (housing costs relative to household income).

Findings

This article is protected by copyright. All rights reserved.

At baseline, one-quarter of the sample used tobacco and 87% used alcohol. Annual increases in household income were associated with the increased use of both tobacco and alcohol for people in households in the lowest 40% of the national income distribution (OR 1.13, 95%CI 1.03-1.23 and OR 1.12, 95% CI 1.04-1.20 respectively) with no similar income effect observed for higher-income households. In relation to smoking, the odds of a resident's tobacco use increased when their household was unemployed (OR 1.32, 95% CI 1.07-1.62). In relation to alcohol, the odds of use decreased when households were insecurely employed or unemployed, or housing costs were unaffordable (OR 0.87, 95% CI 0.77-0.98, OR 0.66, 95%CI 0.55-0.80 and OR 0.84, 95% CI 0.75-0.93 respectively). This was also reflected in the reduced odds of risky drinking (defined in accordance with Australian guidelines) when housing became unaffordable or households became unemployed (OR 0.90, 95% CI 0.81-0.99; OR 0.82, 95% CI 0.69-0.98 respectively).

Conclusions

In Australia, smoking and drinking appear to exhibit different socio-behavioural characteristics and household unemployment appears to be a strong determinant of smoking.

Keywords: Alcohol; Tobacco; Employment; Housing; Security; Longitudinal.

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

INTRODUCTION

Drinking alcohol and smoking cigarettes are both considered 'risky' (1) health behaviours that can result in harmful outcomes. These two health behaviours have different patterns of population uptake. Smoking is a major cause of premature death and is linked to a range of poor health outcomes including cancers, cardiovascular disease and stroke, poor lung function, diabetes, eye disease, and immune and auto-immune disease (2). Alcohol consumption and binge drinking are also related to a heightened risk of cancer and heart disease(3-5), injury and accident (6) and a range of mental health issues (7-9).

In previous research, smoking has been clearly linked to a social gradient (10) whereby lower socio-economic status is commonly associated with a higher likelihood of smoking (11, 12). Although alcohol is a similar risky health behaviour, its use has been shown to have a paradoxical socially-graded relationship where those with lower socio-economic status tend to drink the same or less than those on higher incomes, yet experience a greater burden of alcohol-related harms (13). A number of studies have pointed to the potential role of employment and housing-based economic insecurity in the population distribution of smoking and drinking. For example, housing tenure (14) and unemployment duration(15) have been shown to be associated with drinking outcomes; while insecure employment conditions (16) and unemployment(17) have been associated with patterns of smoking. We use a large longitudinal dataset to investigate the role of employment and housing-based economic insecurity in shaping alcohol and tobacco consumption and expenditure. We argue that these forms of economic insecurity could help explain these differences in research findings for smoking and drinking behaviours. Using causally focused methods we use eighteen waves of a large annually collected, longitudinal dataset to consider the following research questions:

This article is protected by copyright. All rights reserved.

1) Is there an income-based gradient in tobacco and alcohol consumption in Australia?

2) Does a change in economic security (household income, housing affordability and household employment security) affect smoking and alcohol consumption and expenditure?

Author Manuscript

METHODS

Study Population

The Household, Income and Labour Dynamics in Australia (HILDA) Survey is a longitudinal study which collects information on demographic, social, economic and health characteristics of individuals by interviews and self-completed questionnaires. Initiated in 2001, the original sample included over 13969 participants from over 7682 households at baseline. All members of the households which provided at least one interview in wave 1 formed the basis of the panel surveyed in subsequent waves. The sample has been gradually extended to include any new household members. A top-up sample of 2153 households was added in 2011 to maintain representativeness, leading to a sample size of 42747 individuals after 18 waves (18) .

Study sample restrictions

Our study sample was restricted to participants aged between 25 and 64 years to ensure that survey respondents were economically active. For some participants, data were missing data on outcomes (tobacco use and expenditure, alcohol use and expenditure), exposures (housing affordability stress, household income, employment insecurity) and covariates as summarised in Figure 1.

This article is protected by copyright. All rights reserved.

In addition, the models used in these analyses relied on the exposure or both the exposure and outcome to be time invariant (depending on the model) and so the final analytical sample ranged from 2945 to 20822 people as described in Appendix Table 2.

-------Insert Figure 1 at about here------

Conceptual model

Underpinning our analytical models is the conceptual model described in Figure 2. This model described our assumptions about confounder and mediator (stress and mental health) pathways in relation to the exposure (household economic insecurity) and outcomes (household expenditure and person level use) of interest. Following from this, we have adjusted our models for individual time-varying covariates (age, education, household structure, separation/divorce and limiting long term illness) and accounted for time invariant covariates (e.g. gender) by using models that make comparisons within people over time. We have not adjusted our models for mental health status as, being a mediator, this would constitute over adjustment of the relationship between household economic insecurity and use of tobacco or alcohol.

-------Insert Figure 2 at about here-------

Household economic insecurity

The unit of analysis in this study is the individual, however, the key exposure variables relate to the income, housing and employment situation of the household in which individuals live. This is because household resources and composition impact how economic insecurity is experienced by household members. Each of these is measured as follows:

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

Housing affordability stress

The definition of being in housing affordability stress was based on the "30:40 ratio measure" (19, 20). An individual was defined as living in unaffordable housing if they were part of a household that was paying more than 30% of the household equivalized disposable income on rent or mortgage payments, and the household gross income was in the bottom 40 per cent of the Australian household income distribution (indicating the low to moderate part of the distribution). The use of an equivalized income is not total household income, but rather income relative to how it is shared across persons within the household structure, based on the 'modified OECD equivalence scale' (21). This scale gives each household member a weighted value that represents their cost within the household. Using this definition, housing affordability stress is a binary variable (0-No, 1-Yes).

Household Income

Household equivalized disposable annual income was assessed as a continuous exposure. Values were adjusted by the Consumer Price Index (CPI) to account for inflation over time. In the analysis, household income was centred around its mean in each wave and rescaled such that one-unit increase equals $10000 AUSD more annually. This value was chosen because it was close to the average annual change in household income in the dataset of $12000 AUSD (noting that for households in the upper 60% of the income distribution the average change was greater at $12710 than for households in the lower 40% of the income distribution where the average change was $9250). In addition to applying models to the whole sample, models examining the relationship between household income and each outcome were stratified into two groups representing 'lower-income' and 'moderate to high income' households. Following previous work

This article is protected by copyright. All rights reserved.

of the Australian Bureau of Statistics (22), the cut-off between these two groups was located at 40% of the national income distribution.

Employment insecurity

Employment status is assessed by a categorical variable with three levels: 0-secure employment, 1-insecure employment, 2-unemployment. A household's employment was classified as 'secure' if any adult in the household had a permanent or fixed-term job. We considered those on a fixed-term contract as "securely employed", because in Australia, fixed-term contracts more closely mirror the terms and conditions of permanent employees than casual employees, and fixed-term contract workers have been shown to be more socio-demographically similar to those employed permanently than casual employees (23, 24).

Households in which no one was securely employed but at least one person was insecurely employed (self-employed, casual or labour hire) were classified as 'insecure'. Households in which no adult of working age was employed, either securely or insecurely but where one or more adults of working age had actively sought employment in the past month, were classified as 'unemployed'.

Outcomes

Tobacco use and expenditure

Any individual who identified as a current smoker of cigarettes or other tobacco products, regardless of smoking frequency, was classified as a smoker (0-No, 1-Yes). From wave 2, the heaviness of smoking was indicated from the self-reported number of cigarettes smoked per week and was used as a continuous variable in the analysis. From wave 5 onwards, participants

This article is protected by copyright. All rights reserved.

Author Manuscript

were asked how much their household spent on cigarettes in a typical week. From this, we derived weekly tobacco expenditure adjusted for inflation using the Consumer Price Index for 2017/8 (25).

Alcohol use and expenditure

Alcohol was similarly considered as a binary variable based on the self-reported status of drinking (0- 'never', 1- 'drinks alcohol'). In addition, for drinkers, we defined risky drinking according to the Australian guideline as drinking more than 10 standard drinks per week or more than 4 standard drinks on any one day (26). The variable was modelled as a binary variable (0-No, 1-Yes) from wave 2 onwards. Like tobacco expenditure, weekly alcohol expenditure was available from wave 5 onwards, adjusted for inflation and modelled as a continuous variable.

Covariates

Models were adjusted for time varying confounders: age (five-year groups between age 25 and age 64), household structure (1-couple without children, 2-couple with children, 3-lone parent with children, 4-lone person, 5-unrelated group households, multifamily, or unclassified), having experienced separation/divorce in the past 12 months (yes/no), the highest education level (1-Degree or higher, 2- Diploma, Certificate or Year 12, 3- Year 11 or below) and having a long term health condition (Yes/No) in the same wave as the exposure and outcome. With the exception of 'separation' which was measured from wave 2 to 18, all other covariates were measured in every wave.

See Appendix Table 1 for a summary description of the type of variable (continuous, categorical or binary) and time of measurement used for each of the exposure and outcome variables included in analyses.

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

Statistical Analysis

We estimated the prevalence in each outcome of interest across survey waves from 2001 to 2018 to examine changes over time. To describe the income based *socio-economic gradient* of alcohol and tobacco use, we estimated the prevalence of each outcome by quintiles of household income (adjusted for age and gender) across pooled survey waves.

To examine the effect of *economic security* on alcohol and tobacco use we used fixed effects regression analyses to examine the association between each exposure measure of economic insecurity and each outcome. Fixed effects models were chosen because they examine changes within people over time making each person their own reference (27). As a consequence, residual confounding from time invariant factors (such as gender) is removed. Models were estimated according to the following formula (shown for the scenario of models with a continuously measured outcome):

1. $y_{it}=X_{it}\beta+\alpha_i+\mu_{it}$

Where y_{it} is the dependent variable observed for individual i at time t and X_{it} is the time variant regressor vector, β is the matrix of parameters and α_i is the unobserved time-invariant individual effect. The error term is μ_{it}.

The models generate estimates describing the difference in the outcome when a person is economically insecure compared to when the same person was economically secure. Models were estimated at the individual level and were adjusted for time varying confounders. To test for bias from attrition from the panel survey, we estimated additional models restricted to

This article is protected by copyright. All rights reserved.

respondents who participated in every wave (a balanced panel) to compare with estimates from our main analyses.

To examine the effect of household economic security on household expenditure on alcohol and tobacco, we also used fixed effects regression models. These models were estimated at the household level and were adjusted for household structure.

All analyses were performed using Stata 15.1 using the 'xtlogit' or 'xtreg' commands. Robust standard errors were estimated for 'xtreg' models where the outcome was treated as a continuous variable. The code used to generate variable and estimate the models is available on request from the corresponding author. These analyses were not pre-registered, and the results should, therefore, be considered exploratory

RESULTS

Descriptive results

Around 25% of the cohort reported using tobacco at baseline in 2001. This prevalence decreased to 19% by wave 18. Average weekly expenditure amongst smokers rose over the 18 years from roughly $68 AUD per week in wave 5 to $77 AUD per week in wave 18. Interestingly, while expenditure rose across the period, the average number of cigarettes smoked per week decreased by almost 20% from a baseline of 91 cigarettes per week.

Considering alcohol consumption, the majority of the respondents (87%) reported using alcohol at baseline. This prevalence was roughly stable over 18 years, decreasing to 83% by the final

This article is protected by copyright. All rights reserved.

Author Manuscript

wave. Similarly, the number of standard drinks per week was stable across the study period, overall decreasing from 8.9 to 8.7 standard drinks on average. Among people who consumed alcohol, the average weekly household expenditure on alcohol remained relatively stable at around $37 AUD per week.

Tobacco use was lower in older age groups, whereas alcohol use remained relatively stable across age groups and at a high prevalence (ranging between 82% and 91% prevalence) (Table 1). Alcohol and tobacco use were higher for males compared to females (29% compared to 23% for tobacco and 90% compared to 85% for alcohol). As has been previously reported, patterns of consumption were socio-economically patterned with higher rates of tobacco use and risky alcohol consumption amongst people with lower levels of formal education and people who were unemployed. Two sub-populations traditionally associated with markers of socio-economic disadvantage, public housing tenants and Indigenous survey respondents, reported the highest prevalence of smoking (47% and 52% respectively) while homeowners and non-Indigenous Australians reported the highest prevalence of alcohol use (89% and 90% respectively).

------Insert Table 1 at about here------

In keeping with the observed distribution of smoking by education and employment, smoking and weekly expenditure on tobacco varied by household income (Table 2). The odds of smoking and number of cigarettes smoked per week was lowest in the highest income quintiles. In contrast, and interestingly, weekly expenditure was highest in the highest income quintiles.

------Insert Table 2 at about here------

This article is protected by copyright. All rights reserved.

Author Manuscript

The opposite pattern is observed for alcohol consumption (Table 3). The odds of alcohol use were highest in the highest income quintile where respondents reported more than 2.3 times the odds of drinking alcohol (OR 2.25, 95% CI 2.01 to 2.52). Similarly, drinking frequency and weekly expenditure on alcohol were highest when income was highest with households spending nearly 50% more on alcohol per week in the top quintile of income compared with the bottom.

------Insert Table 3 at about here------

Analytical results

Tobacco consumption

When households in the lowest 40% of the income distribution experienced a $10,000 AUSD *increase* in their income per annum, they were 13% more likely to use tobacco (Table 4). The odds of smoking were 32% higher when a person's household was unemployed compared to times when the household was securely employed (OR 1.32, 95% CI 1.07 to 1.62) with no discernible difference in weekly cigarette consumption for people who already used tobacco.

Alcohol consumption

When households in the lowest 40% of the income distribution experienced a $10,000 AUSD *increase* in their income per annum, they were 12% more likely to use alcohol. When households shifted from secure employment to insecure employment or unemployment, their odds of alcohol use decreased (OR 0.87, 95% CI 0.77 to 0.98 and OR 0.66, 95% CI 0.55 to 0.80 respectively). A slight increase in the number of standard drinks per week was observed for households in the upper 60% of the income distribution (OR 0.02, 95%CI 0.005 to 0.05) when their income increased, with no change detected in the number of drinks for their lower-income counterparts. Neither shifts in housing nor employment security were related to changes in the

This article is protected by copyright. All rights reserved.

Author Manuscript

number of standard drinks consumed each week. In keeping with the above observations, the odds of risky drinking decreased when a household's housing costs became unaffordable (OR 0.90, 95% CI 0.81 to 0.99) or their household changed from being securely employed to unemployed (OR 0.82, 95% CI 0.69 to 0.98).

------Insert Table 4 at about here------

When models were estimated using only respondents who participated in every wave, referred to as the balanced panel, results were similar. This suggests that attrition from the panel did not introduce too much bias into our estimates of the relationships between economic insecurity and each of the outcomes (Appendix Table 3).

Tobacco expenditure

Increases in household income were associated with a slight increase in tobacco expenditure of 20 cents per week (95%CI 0.08 to 0.33) across all households (Table 5). When housing became unaffordable, employment became insecure or a household became unemployed, there was a substantial decrease in tobacco expenditure. The largest effect was seen for unemployed households who decreased their expenditure on tobacco by $2.19 (95%CI 4.21 to 0.16).

Alcohol expenditure

The same patterns in spending were observed for alcohol. Increases in household income were associated with an increased weekly household expenditure on alcohol of around $1.16 per week (95%CI 1.01 to 1.32) across all households (Table 5). When housing became unaffordable, employment became insecure or a household became unemployed, there was a substantial decrease in expenditure. As for tobacco expenditure, the largest effect was seen for unemployed

This article is protected by copyright. All rights reserved.

Author Manuscript

households who decreased their expenditure on alcohol by $7.96 (95% CI 9.66 to 6.26); however, both unaffordable housing and insecure employment were related to significant reductions in expenditure.

------Insert Table 5 at about here------

DISCUSSION

In this study, we re-examined the patterning of tobacco and alcohol consumption and expenditure by household income in the Australian working-age population and investigated the potential for economic insecurity to better explain the relationship. Consistent with previous research, we found clear evidence of income-based differences in drinking and smoking. Our descriptive findings confirm that higher household income is associated with less tobacco and more alcohol use.

Examination of the impact of a household's economic security adds more detail to this picture. It reveals that patterns of tobacco and alcohol use change when housing and employment circumstances become insecure and, importantly, that the direction of this change varies by the type of security considered. For example, unemployment is a strong predictor of increased smoking and decreased alcohol consumption. Insecure employment and unaffordable housing are associated with decreased alcohol consumption but have no discernible effect on tobacco use. All forms of economic insecurity, whether they be related to income, housing or employment, are related to lower weekly household expenditure on tobacco and alcohol. This creates an interesting anomaly. Unemployed households decrease their tobacco expenditure but individual's in these household's report increased use of tobacco; whether this is due to people

This article is protected by copyright. All rights reserved.

Author Manuscript

finding cheaper tobacco products or bias in reporting of either individual consumption or household expenditure requires further research.

In any case, for tobacco in particular, our findings suggest very different pathways exist between income and smoking compared to economic insecurity and smoking. For people who live in households that become unemployed, their increased likelihood of tobacco use could be attributed to the psycho-social stressors resulting from their shifting economic prospects. Our findings suggest that public health programmes and legal policies that reduce the prevalence of smoking among unemployed people should consider the range of reasons why rates are higher in this group and build this into their efforts to intervene. Increased use of tobacco might be attributable to psychosocial stressors, more time spent with other people who are smokers or more opportunity to smoke.

There are several important strengths as well as some limitations to our analyses. This paper uses a nationally representative longitudinal dataset and causally robust methods to examine changing socio-economic circumstances in relation to health behaviours. We use measures of consumption and expenditure and find similar patterns across each. We also acknowledge the limitations, first, tobacco and alcohol use are self-reported and prone, therefore, to mismeasurement. We assume that any tendency to misreport is consistent within individuals over time and therefore, that by using fixed effects regression models we have reduced as much as possible, the bias in our models. Second, there is likely attrition from the longitudinal sample overtime, and this may be greater for people who experience economic insecurity. This would cause bias in our effect estimates if there was a differential effect of economic insecurity on the outcomes of interest for those who are lost to follow-up compared to those who remain in the

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

sample. When our estimates were compared to those generated from models estimated from a balanced panel, free of attrition, the results were similar and in the same direction offering reassurance that bias from attrition has minimally affected our findings. Finally, we estimate 20 models in this paper in our efforts to examine combinations of exposures that measure insecurity and outcomes across the domains of substance use and household expenditure. There is the risk that with multiple testing, we are more likely to identify associations, some of which may be chance.

In framing this analysis, we suspected that income alone was an insufficient explanation for the consumption patterns observed across many studies, and that and that a more nuanced understanding of socio-economic vulnerability may provide more insight. Further, that the apparently conflicting results in earlier studies were generated by an imprecise operationalization of socio-economic disadvantage, whereby various proxy variables have been used (for example, income, education, or employment status). We hypothesized that the variation in health behaviour results seen across the literature was at least partly related to the uncritical use of these simple proxy variables, and that socio-economic disadvantage should be regarded as a more complex construct. To test this, we designed an analysis based on a broader definition of socio-economic disadvantage, that included both relative material advantage and economic security. Our results suggest that these broader components are distinct in their effect on health behaviours and are likely to be working together in the creation of any health behaviours.

Our findings have particular salience with population-wide COVID-19 lockdowns, and with changes to economic security resulting from loss or reduced employment being associated with increased alcohol consumption (28). Given our work demonstrates that unemployed individuals

This article is protected by copyright. All rights reserved.

are more likely to smoke, we have not only identified a key population group that would benefit from well-designed anti-smoking campaigns and interventions, but more importantly, our study provides a health-based rationale for greater attention to employment policies that while sitting outside health, have a significant role to play in determining detrimental health behaviours and outcomes.

ACKNOWLEGEMENTS

The authors thank Elena Swift and Tania King of the University of Melbourne for their early contributions to developing the analytical approach used in this paper.

FUNDING

This research was supported by the National Health and Medical Research Council Centre of Excellence in Healthy Housing APP1196456. RB was supported by Australian Research Council Future Fellowship (FT150100131).

This article is protected by copyright. All rights reserved.

Author Manuscript

Author Manuscript

REFERENCE

1. Böckerman P, Hyytinen A, Kaprio J, Maczulskij T. If you drink, don't smoke: Joint associations between risky health behaviors and labor market outcomes. Soc Sci Med. 2018;207:55-63.
2. Health UDo, Services H. The health consequences of smoking—50 years of progress: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, Centers for Disease …; 2014.
3. Bagnardi V, Rota M, Botteri E, Tramacere I, Islami F, Fedirko V, et al. Alcohol consumption and site-specific cancer risk: a comprehensive dose–response meta-analysis. British journal of cancer. 2015;112(3):580-93.
4. Boffetta P, Hashibe M. Alcohol and cancer. The lancet oncology. 2006;7(2):149-56.
5. Seitz HK, Becker P. Alcohol metabolism and cancer risk. Alcohol Research & Health. 2007;30(1):38.
6. Vinson DC, Mabe N, Leonard LL, Alexander J, Becker J, Boyer J, et al. Alcohol and injury. A case-crossover study. Archives of family medicine. 1995;4(6):505-11.
7. Boschloo L, Vogelzangs N, Smit JH, van den Brink W, Veltman DJ, Beekman AT, et al. Comorbidity and risk indicators for alcohol use disorders among persons with anxiety and/or depressive disorders: findings from the Netherlands Study of Depression and Anxiety (NESDA). Journal of affective disorders. 2011;131(1-3):233-42.
8. Conner KR, Pinquart M, Gamble SA. Meta-analysis of depression and substance use among individuals with alcohol use disorders. Journal of substance abuse treatment. 2009;37(2):127-37.
9. Foulds JA, Adamson SJ, Boden JM, Williman JA, Mulder RT. Depression in patients with alcohol use disorders: systematic review and meta-analysis of outcomes for independent and substance-induced disorders. Journal of affective disorders. 2015;185:47-59.
10. Marmot M. Social determinants of health inequalities. The lancet. 2005;365(9464):1099-104.
11. Casetta B, Videla AJ, Bardach A, Morello P, Soto N, Lee K, et al. Association Between Cigarette Smoking Prevalence and Income Level: A Systematic Review and Meta-Analysis. Nicotine & tobacco research : official journal of the Society for Research on Nicotine and Tobacco. 2017;19(12):1401-7.
12. Sreeramareddy CT, Harper S, Ernstsen L. Educational and wealth inequalities in tobacco use among men and women in 54 low-income and middle-income countries. Tob Control. 2018;27(1):26-34.
13. Probst C, Kilian C, Sanchez S, Lange S, Rehm J. The role of alcohol use and drinking patterns in socioeconomic inequalities in mortality: a systematic review. The Lancet Public Health. 2020;5(6):e324-e32.
14. Beard E, Brown J, West R, Kaner E, Meier P, Michie S. Associations between socio-economic factors and alcohol consumption: A population survey of adults in England. PLoS One. 2019;14(2):e0209442.
15. Khan S, Murray RP, Barnes GE. A structural equation model of the effect of poverty and unemployment on alcohol abuse. Addictive behaviors. 2002;27(3):405-23.
16. Jung Y, Oh J, Huh S, Kawachi I. The effects of employment conditions on smoking status and smoking intensity: The analysis of Korean Labor & Income Panel 8th–10th wave. PloS one. 2013;8(2):e57109.

This article is protected by copyright. All rights reserved.

Author Manuscript

17. Ding D, Hovell MF, Ji M, Hofstetter CR, Zheng P, Fu H, et al. Employment and social "determinants" of smoking in urbanizing China: a representative survey. Nicotine & Tobacco Research. 2009;11(7):779-84.
18. Summerfield M, Freidin S, Hahn M, Ittak P, Li N, Macalalad N, et al. HILDA user manual–release 18. Melbourne Institute of Applied Economic and Social Research, University of Melbourne. 2019.
19. Baker E, Mason K, Bentley R. Measuring housing affordability: A longitudinal approach. Urban policy and research. 2015;33(3):275-90.
20. Meen G, Whitehead C. Understanding affordability: The economics of housing markets: Policy Press; 2020.
21. Statistics ABo. Census of Population and Housing: Directory of census statistics: Australian Bureau of Statistics; 2016.
22. Housing Occupancy and Costs [Internet]. Australian Bureau of Statistsics. 2019. Available from: https://www.abs.gov.au/statistics/people/housing/housing-occupancy-and-costs/latest-release.
23. LaMontagne AD, Smith PM, Louie AM, Quinlan M, Ostry AS, Shoveller J. Psychosocial and other working conditions: Variation by employment arrangement in a sample of working Australians. American journal of industrial medicine. 2012;55(2):93-106.
24. Louie A, Ostry A, Quinlan M, Keegel T, Shoveller J, LaMontagne A. Empirical study of employment arrangements and precariousness in Australia. Relations Industrielles/Industrial Relations. 2006;61(3):465-89.
25. 6401.0 - Consumer Price Index, Australia, Dec 2018 [Internet]. Australian Bureau of Statistics. 2019. Available from: https://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/97DE913203378356CA2583E5001D660C?opendocument#:~:text=6401.0%20%2D%20Consumer%20Price%20Index%2C%20Australia%2C%20Dec%202018&text=rose%200.5%25%20this%20quarter%2C%20compared,to%20the%20September%20quarter%202018.
26. Council NHMR. Draft Australian guidelines to reduce health risks from drinking alcohol. Commonwealth of Australia; 2019.
27. Gunasekara FI, Richardson K, Carter K, Blakely T. Fixed effects analysis of repeated measures data. International journal of epidemiology. 2014;43(1):264-9.
28. Biddle N, Edwards B, Gray M, Sollis K. Alcohol consumption during the COVID-19 period: May 2020. 2020.

This article is protected by copyright. All rights reserved.

Author Manuscript

This article is protected by copyright. All rights reserved.

Author Manuscript

FIGURES AND TABLES

Figure 1: STROBE diagram

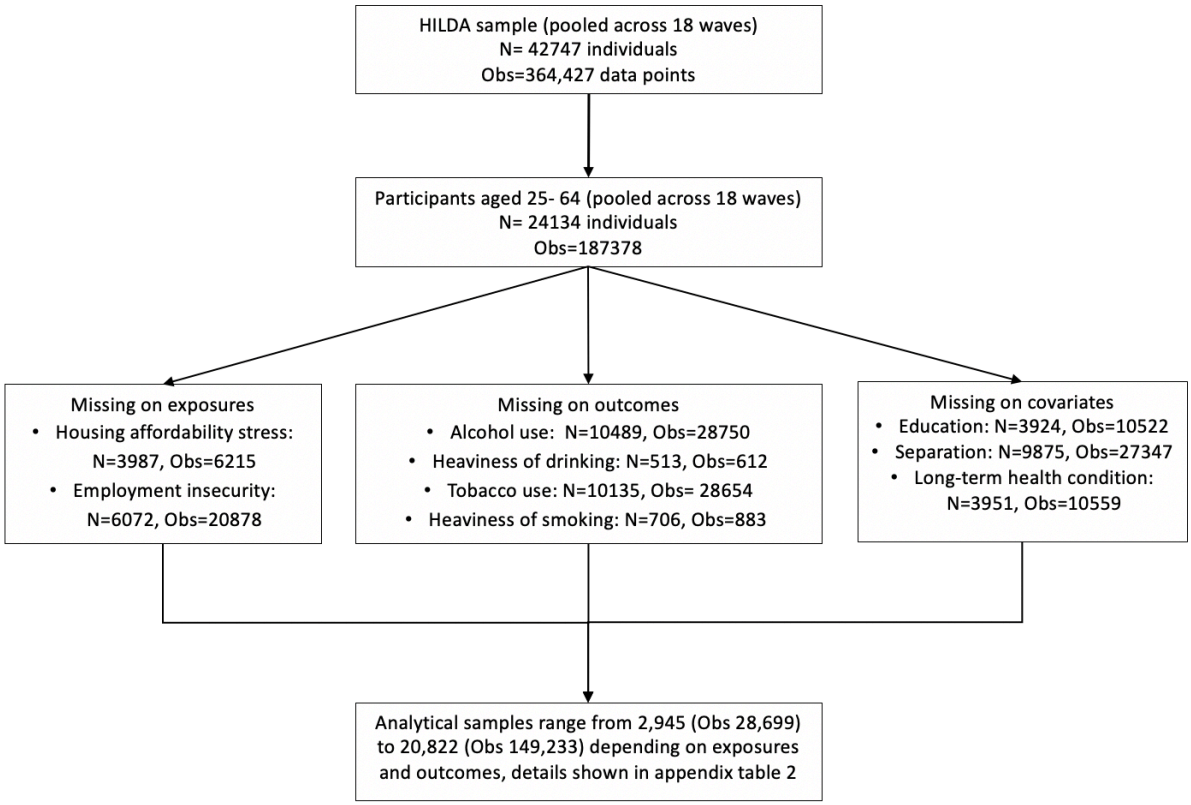
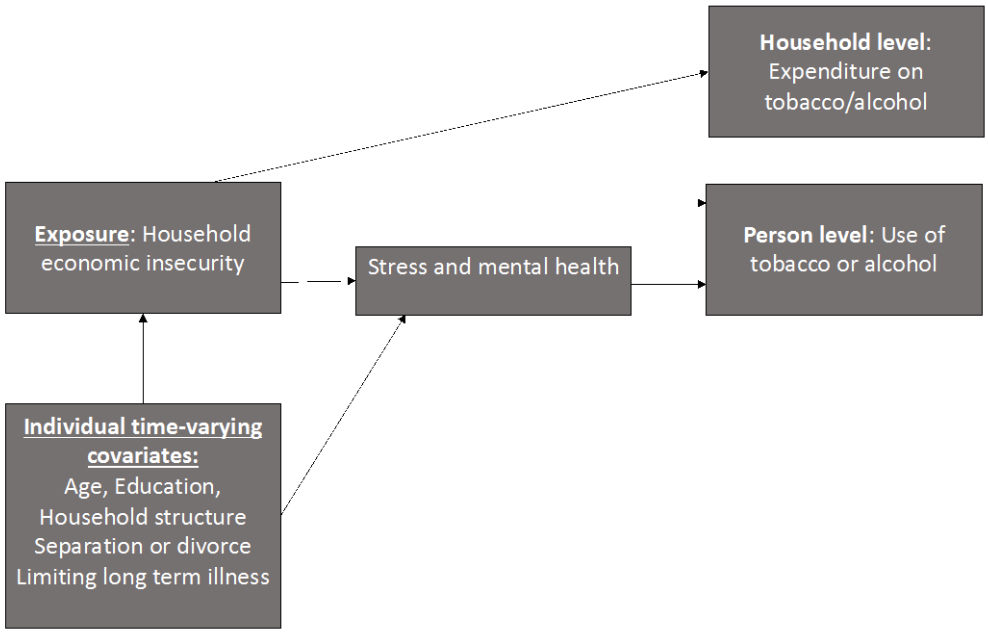


Figure 2: Conceptual diagram underpinning our analyses

This article is protected by copyright. All rights reserved.

Author Manuscript



This article is protected by copyright. All rights reserved.

Author Manuscript

Table 1. Socio-demographic profile by prevalence of tobacco and alcohol use and expenditure at baseline

	Tobacco use (Yes) (%), 2001	Alcohol use (Yes) (%), 2001	Risky alcohol consumption (Yes) (%), 2002	Weekly tobacco expenditure among smokers (mean, AUSD) [1], 2005	Weekly alcohol expenditure among drinkers (mean, AUSD) [1], 2005
Age					
25-29	34.6	87.6	37.2	65.4	45.3
30-34	31.9	90.5	35.1	65.9	36.6
35-39	28.6	87.2	32.7	71.8	36.5
40-44	27.9	87.2	34.5	71.1	36.7
45-49	22.0	88.7	33.7	71.3	36.6
50-54	20.0	87.2	32.6	63.8	37.9
55-59	17.8	84.7	30.5	67.0	39.5
60-64	13.7	81.8	35.1	55.7	31.8
Sex					
Male	28.5	90.2	47.0	68.3	40.4
Female	23.0	84.6	21.3	67.1	35.0
Education					
Degree or higher	13.8	89.7	26.8	51.1	41.5
Diploma, certificate or Year 12	26.3	88.7	37.2	68.2	38.0
Year 11 or below	25.6	84.0	35.0	73.0	33.3
Employment					
Secure	23.3	89.9	33.6	70.9	40.2
Insecure	31.8	83.2	33.4	58.3	26.5
Unemployed	48.9	78.7	39.4	59.2	24.4
Tenure					
Owner	20.2	88.5	32.1	66.4	37.1
Private renter	41.4	85.7	41.0	71.3	41.5
Public renter	46.5	72.1	38.9	64.5	21.4
Other	30.7	84.9	33.0	65.3	37.7
Indigenous					
No	26.4	89.6	34.3	69.4	37.7
Yes	52.0	80.9	52.0	65.7	40.6

[1] Numbers reported in 2017-2018 dollars, adjusted by Consumer Price Index.

Table 2. Income by smoking and tobacco expenditure adjusted for age and gender, pooled across the HILDA survey

Quintiles of income	Odds of Smoking (N=21176)		Cigarettes per week (N=7085)		Weekly expenditure on tobacco ($) [1] (N=7085)	
	OR	95% CI	Mean	95% CI	Mean	95% CI
1 (Lowest)	(REF)	(REF)	80.1	78.3-81.9	64.9	63.0-66.8
2	0.87	0.79-0.95	77.9	76.1-79.7	67.4	65.6-69.2
3	0.77	0.70-0.86	77.7	75.8-79.5	66.8	64.9-68.7
4	0.70	0.63-0.78	77.0	75.0-78.9	68.0	66.0-70.0
5 (Highest)	0.52	0.46-0.59	73.2	70.9-75.6	69.9	67.5-72.3

This article is protected by copyright. All rights reserved.

[1] Numbers reported in 2017-2018 dollars, adjusted by Consumer Price Index.

Table 3. Income by alcohol consumption and expenditure adjusted for age and gender

Quintiles of income	Odds of drinking alcohol (N=21182)		Standard drinks per week (N=19243)		Weekly expenditure on alcohol ($) [1] (N=19243)	
	OR	95% CI	Mean	95% CI	Mean	95% CI
1 (Lowest)	(REF)	(REF)	8.66	8.48-8.84	31.2	30.3-32.1
2	1.36	1.26-1.48	8.77	8.60-8.94	34.6	33.8-35.4
3	1.68	1.53-1.84	8.76	8.59-8.92	37.4	36.7-38.2
4	2.00	1.81-2.21	8.88	8.72-9.05	41.8	41.0-42.5
5 (Highest)	2.25	2.01-2.52	8.93	8.76-9.10	46.4	45.6-47.2

[1] Numbers reported in 2017-2018 dollars, adjusted by Consumer Price Index.

Table 4. The effect of economic security on tobacco and alcohol consumption estimated from fixed effects regression analyses of HILDA, 2018

	Smoking Status (0-no,1-smokes) OR *(95% CI)*	Number of Cigarettes per week *β (95% CI)*	Drinking Status (0-no,1-drinks alcohol) *OR (95% CI)*	Number of Standard drinks per week *β (95% CI)*	Risky drinking *OR (95% CI)*
Income (whole population) [1]	1.01 (0.99,1.03)	0.21 (-0.17,0.58)	1.03 (1.01,1.05)	0.03 (0.01, 0.05)	1.02 (1.01,1.03)
Income (for Upper 60%) [1]	1.00 (0.97,1.02)	0.20 (-0.29, 0.68)	1.01 (0.99,1.03)	0.02 (0.005,0.05)	1.01 (0.99,1.03)
Income (for Lower 40%) [1]	1.13 (1.03, 1.23)	0.47 (-1.16, 2.09)	1.12 (1.04,1.20)	-0.06 (-0.21,0.09)	1.04 (0.97,1.12)
Number of Observations	33,060	31,911	37,782	125,824	56,053
Housing					
Affordable	REF	REF	REF	REF	REF
Unaffordable	1.01 (0.90,1.15)	0.99 (-1.21, 3.19)	0.84 (0.75,0.93)	-0.15 (-0.34,0.04)	0.90 (0.81,0.99)
Number of Observations	32,099	31,391	36,591	122,807	54,384
Employment					
Secure	REF	REF	REF	REF	REF
Insecure	1.01 (0.88,1.14)	-1.13 (-3.34, 1.09)	0.87 (0.77,0.98)	0.002 (-0.17,0.18)	0.98 (0.89,1.08)
Unemployed	1.32 (1.07,1.62)	-0.55 (-3.81, 2.71)	0.66 (0.55,0.80)	-0.29 (-0.61,0.03)	0.82 (0.69,0.98)
Number of Observations	28,699	27,820	31,199	115,077	50,906

This article is protected by copyright. All rights reserved.

Author Manuscript

[1] One-unit change in income= 10k AUD change in annual income

Note: Models are adjusted for separation, long-term health condition, education, age, household structure.

Table 5. The effect of economic security on weekly alcohol and tobacco expenditure estimated from fixed effects regression analyses of HILDA (wave 5 to wave 18), 2018

	Weekly Alcohol Expenditure ($)		**Weekly Tobacco Expenditure ($)**	
	β (95% CI)	Robust SE	***β*** (95% CI)	Robust SE
Income (whole population) [1]	1.16 (1.01,1.32)	0.08	0.20 (0.08, 0.33)	0.06
Income (for Upper 60%) [1]	1.03 (0.83,1.23)	0.10	0.24 (0.09, 0.38)	0.07
Income (for Lower 40%) [1]	0.40 (-0.12,0.91)	0.26	-0.06 (-0.72,0.59)	0.33
Number of Observations	149,233		149,233	
Housing				
Affordable	REF		REF	
Unaffordable	-2.72 (-3.56, -1.87)	0.43	-0.71 (-1.73, 0.31)	0.52
Number of Observations	144,242		144,242	
Employment				
Secure	REF		REF	
Insecure	-3.30 (-4.21, -2.39)	0.46	-1.31 (-2.35, -0.27)	0.53
Unemployed	-7.96 (-9.66, -6.26)	0.87	-2.19 (-4.21, -0.16)	1.03
Number of Observations	133,529		133,529	

[1] One-unit change in income= 10k AUD change in annual income
Note: Models are adjusted for household structure.

This article is protected by copyright. All rights reserved.

Author Manuscript

Appendix Table 1. Description of variables in the analysis

Variable	Type	Time of measurement
Exposure		
Household income	Continuous	Wave 1 to 18
Housing affordability stress	Binary	Wave 1 to 18
Employment insecurity	Categorical	Wave 1 to 18
Household income	Continuous	Wave 1 to 18
Outcome		
Tobacco use	Binary	Wave 1 to 18
Heaviness of smoking	Continuous	Wave 2 to 18
Alcohol use	Binary	Wave 1 to 18
Heaviness of smoking	Continuous	Wave 2 to 18
Heaviness of drinking	Continuous	Wave 2 to 18
Risky drinking	Binary	Wave 2 to 18
Tobacco expenditure	Continuous	Wave 5 to 18
Alcohol expenditure	Continuous	Wave 5 to 18
Covariates		
Age	Categorical	Wave 1 to 18
Household structure	Categorical	Wave 1 to 18
Separation/divorce	Binary	Wave 2 to 18
Education level	Categorical	Wave 1 to 18
Long-term health condition	Binary	Wave 1 to 18

Author Manuscript

This article is protected by copyright. All rights reserved.

Appendix Table 2. Sample sizes for each model estimated

Exposure	Outcome	Change in exposure (if binary)	Number changes in outcome status (if binary)	Total number of people in estimated regression model	Average number of people per household in the analytical sample
Household equivalised income	Smoking status (binary)	n.a.	3245/20204	3245	1.15
Housing affordability stress	Smoking status (binary)	3576/ 20077	3198/20038	3198	1.16
Employment insecurity	Smoking status (binary)	4322/ 19077	2945/19042	2945	1.16
Household equivalised income	Heaviness of smoking	n.a.	n.a.	6581	1.20
Housing affordability stress	Heaviness of smoking	1297/ 6592	n.a.	6513	1.20
Employment insecurity	Heaviness of smoking	1817/ 6604	n.a.	6124	1.22
Household equivalised income	Drinking status (binary)	n.a.	3838/20216	3838	1.13
Housing affordability stress	Drinking status (binary)	3576/ 20077	3778/20049	3778	1.12
Employment insecurity	Drinking status (binary)	4322/ 19077	3341/19050	3341	1.13
Household equivalised income	Heaviness of drinking	n.a.	n.a.	18309	1.49
Housing affordability stress	Heaviness of drinking	2843/ 18152	n.a.	18152	1.49
Employment insecurity	Heaviness of drinking	3599/ 17389	n.a.	17347	1.52
Household equivalised income	Risky drinking	n.a.	5909/18309	5909	1.18
Housing affordability stress	Risky drinking	2843/ 18152	5833/18152	5833	1.18
Employment insecurity	Risky drinking	3599/ 17389	5501/17347	5501	1.19
Household equivalised income	Alcohol/tobacco expenditure	n.a.	n.a.	20822	1.65

This article is protected by copyright. All rights reserved.

Author Manuscript

Housing affordability stress	Alcohol/tobacco expenditure	n.a.	3245/20204	3245	1.15
Employment insecurity	Alcohol/Tobacco expenditure	2843/ 18152	5833/18152	5833	1.18

Appendix Table 3: Fixed effects regression models estimated on the balanced panel, HILDA 2018.

	Smoking Status (0-no,1-smokes) OR *(95% CI)*	**Number of Cigarettes per week *β (95% CI)***	**Drinking Status (0-no,1-drinks alcohol) *OR (95% CI)***	**Number of Standard drinks per week *β (95% CI)***	**Risky drinking *OR (95% CI)***
Income (whole population) [1]	1.03 (1.00,1.07)	0.29 (-0.33,0.92)	1.05 (1.02,1.08)	0.07 (0.04, 0.11)	1.03 (1.01,1.05)
Income (for Upper 60%) [1]	1.02 (0.98,1.07)	0.11 (-0.73, 0.95)	1.05 (1.01,1.09)	0.06 (0.02,0.10)	1.03 (1.01,1.06)
Income (for Lower 40%) [1]	1.22 (1.05, 1.43)	0.61 (-2.14, 3.37)	1.10 (0.97,1.24)	-0.02 (-0.26,0.21)	1.03 (0.90,1.16)
Number of Observations	13538	10352	13697	44055	22133
Housing					
Affordable	REF	REF	REF	REF	REF
Unaffordable	0.88 (0.72,1.09)	2.00 (-1.92, 5.93)	0.93 (0.76,1.13)	-0.38 (-0.70, -0.07)	0.92 (0.77,1.09)
Number of Observations	13212	10140	13344	43086	21507
Employment					
Secure	REF	REF	REF	REF	REF
Insecure	1.00 (0.80,1.24)	-2.34 (-6.23, 1.55)	0.84 (0.68,1.02)	-0.26 (-0.54,0.01)	1.00 (0.85,1.17)
Unemployed	1.59 (1.09,2.32)	0.65 (-5.09, 6.39)	0.46 (0.32,0.65)	-0.09 (-0.62,0.45)	0.69 (0.51,0.93)
Number of Observations	11954	9225	11538	41447	20711

This article is protected by copyright. All rights reserved.

Author Manuscript