

From Substance Use to Homelessness or Vice Versa?*

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Abstract

We investigate the relationship between homelessness and substance use using a unique Australian panel dataset in which information about homelessness and substance use is collected in 4 waves over a timespan of two years for a large sample of ‘at risk’ individuals. The data allow us to investigate dynamics in homelessness and dynamics in substance use. In particular we investigate whether substance use precedes homelessness but also whether homelessness precedes substance use. We find that homelessness and substance use are closely related: homeless individuals are more likely to be substance users and substance users are more likely to be homeless. These relationships, however, are predominantly driven by observed and unobserved individual characteristics which cause individuals to be both more likely to be homeless and to be substance users. Once we take these personal characteristics into account it seems that homelessness does not affect substance use, although we cannot rule out that alcohol use increases the probability that an individual becomes homeless. These overall relationships also hide some interesting heterogeneity by ‘type’ of homelessness.

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1 Introduction

The prevalence of homelessness is difficult to measure, but a recent Department of Housing and Urban Development snapshot estimate for the United States (US) suggested around 630,000 people were sleeping on the streets or in shelters in January 2012 (HUD, 2012). This estimate would be considerably higher were those ‘doubling up’ with family or friends or in other forms of insecure housing included, and higher still if the number in question referred to people experiencing homelessness within a period of time rather than at a single point in time. For example, Link et al. (1994) estimated that 4.6% of the US population had been homeless at some point over the 5 years between 1986 and 1990. More recently O’Flaherty (2012) has again stressed the importance of thinking about homelessness from a dynamic perspective.

Not only does homelessness deprive individuals and families of a basic human need (Curtis et al., 2013), it is also strongly associated with a wide range of other social problems. For example, levels of substance (ab)use are far higher among the homeless than among the wider population (e.g. Greene et al., 1997; Shinn et al, 1998; Early, 2005; Kemp et al., 2006). Indeed there is a widely-held view that homelessness and substance use are self-reinforcing, i.e. that substance use *causes* homelessness (e.g. Allgood and Warren, 2003; Early, 2005), that homelessness *causes* substance use (e.g. Shinn et al., 1998; Johnson and Chamberlain, 2008), or both (e.g. Johnson et al., 1997; Neale, 2001). Whether a causal link exists between homelessness and substance use, and if so of what magnitude and in which direction(s), are obviously crucial questions for policy makers and service providers designing and delivering interventions in this area.

Unfortunately the lack of consensus in this regard reflects an evidence base which is at best patchy. At the heart of this problem lies a dearth of suitable observational (not to mention experimental) data on the substance use of representative samples of individuals experiencing homelessness and individuals at risk of homelessness observed over time. This is not an easy

population to reach, let alone reach repeatedly. As a result many studies are based on small-scale, ad hoc, cross-section surveys (Scutella and Johnson, 2012). These surveys also tend to be of very specific – often acutely homeless or acutely using – populations such as clients of treatment centres, other service providers, or ‘skid row’ communities in urban centres (e.g. Teeson et al., 2000; Booth et al., 2002). This is also the case, albeit to a lesser extent, for larger cross-sections studied in this literature like the National Survey of Homeless Assistance Providers and Clients (NSHAPC) (see e.g. Early 2005). Other studies exploit cross-sections enhanced with retrospective information (including the NSHAPC), but again these tend to be of specific provider-based populations (e.g. Allgood and Warren, 2003; Johnson and Chamberlain, 2008). Studies using longitudinal data also tend to be based on small samples of similarly specific populations, often with a very limited time dimension, and with little attempt made to deal with unobservable confounders (e.g. Allgood et al., 1997; Zlotnick et al., 2003; Rice et al., 2005; Kemp et al., 2006).⁴ The net result is a body of literature from which it is difficult to draw general conclusions and from which we can learn little regarding causality even within the study populations themselves.

Two more promising studies using longitudinal data, covering homeless and at-risk-of-homelessness individuals, are Shinn et al. (1998) and Fertig and Reingold (2008). Fertig and Reingold (2008) exploit data from the Fragile Families and Child Wellbeing Study tracking around 5000 low-income parents from the birth of their child for a further three years. Once they control for a host of observable individual and contextual factors, they find no evidence that mothers with a ‘drug problem’ – those who report that their drinking or drug use interfered with their work or personal relationships over the previous 12 months – are any more likely to be homeless at the one-year follow up interview. Shinn et al. (1998) use survey data on around 250 families requesting shelter accommodation in New York City and a similar number of

⁴ Some studies have also used aggregate city or country level data to examine contextual factors (e.g. housing market) associated with homelessness (e.g. Honig and Filer, 1993; Quigley et al., 2001).

comparison families drawn from welfare records, with both groups re-interviewed 5 years later. They also find little evidence of a substance abuse impact on homelessness once other observable factors are controlled. Neither study, however, examines whether homelessness impacts on substance use in a multivariate model, both draw on only small numbers of people experiencing homelessness (from quite particular populations), and both have limited information on substance use (single dummies in each case, with the bar set high to be counted as a substance abuser).

The current paper is the first to examine the dynamic inter-relationships between homelessness and substance use, potentially running in both directions, in a large-scale, broadly-based longitudinal survey, drawing on a population covering individuals experiencing differing degrees of homelessness and comparable individuals not currently homeless but at risk of homelessness, and with richly detailed data on substance use. The data come from the Australian Journeys Home (JH) study, which is unique in its scale, detail and coverage (see Scutella et al., 2012), and has not previously been used to study the links between homelessness and substance use beyond a handful of descriptive tables and brief accompanying discussions in the in-house research reports linked to the release of the first three waves of data (Scutella et al., 2012; Chigavazira et al., 2013; Johnson et al., 2013).

Specifically, we address four research questions. First, what are the extent, nature and persistence of substance use among homeless people and those at risk of homelessness in the JH sample? Second, what is the association between substance use and homelessness status in the JH sample? Third, to what extent might these associations be driven by causal relationships from substance use to homelessness, from homelessness to substance use, or both? Fourth, do these relationships vary according to type of homelessness?

In addressing these questions we make a number of specific contributions. We provide an in-depth analysis of the use of tobacco, alcohol, cannabis, and other illegal/street drugs among

JH respondents during the first 2 years (4 waves) of the survey, including detailed information on the prevalence, intensity and persistence of use. Second, we demonstrate strong point-in-time and dynamic associations between substance use and homelessness for this broad-based sample. Third, we show that these dynamic associations between homelessness and substance use, in both directions, are predominantly driven by observed and, crucially, unobserved individual characteristics which cause individuals to be both substance users and homeless. Once we take these characteristics into account, and appealing to the arrow of time to infer the direction of any remaining relationship, we conclude that homelessness does not seem to affect substance use, while only risky alcohol use seems to increase the probability that an individual becomes homeless. Finally, we show that some substance use behaviours appear to impact heterogeneously on different types of homelessness. The implication is that conclusions regarding the associations between substance use and homelessness are likely to be sensitive to the definition of homelessness used, in particular whether those ‘doubling up’ with friends and family and those in other temporary accommodation are included along with those sleeping rough.

The remainder of the paper is set out as follows. In section 2 we provide descriptive information about homelessness and substance use starting with a brief description of the JH survey. We also provide information about the prevalence of substance use among homeless and about dynamics in homelessness and substance use. Section 3 discusses our exploratory analysis of the determinants of homelessness while section 4 does the same for the determinants of substance use. Section 5 discusses sensitivity analyses and extensions to examine whether the associations between homelessness and substance use are heterogeneous by homelessness type, and also by gender. Section 6 concludes.

2 Homelessness and substance use

2.1 *The JH Data*

JH is a longitudinal dataset with information on a sample of recipients of any income support (i.e. welfare) payment who are either homeless or at-risk of homelessness (Scutella et al., 2012). Here we use the first four waves collected between September 2011 and May 2013 focussing on the balanced panel, i.e. respondents who were interviewed in all four waves of the survey. We aim to explore whether, to what extent, and how substance use is associated with homelessness. Appendix A provides more details about the JH Survey.

Homelessness can be defined in different ways and with different thresholds. Here we follow Johnson and Chamberlain (2008) in adopting the so-called ‘cultural definition’ of homelessness as used by the Australian Bureau of Statistics in their efforts to enumerate the homeless population in Australia. This definition distinguishes three ‘types’ of homelessness. Primary homelessness is defined as sleeping rough or squatting in abandoned buildings. This is essentially the acute unsheltered homelessness of Curtis et al. (2013) or the street homelessness of Early (2004). Secondary homelessness is defined as staying with relatives or friends temporarily with no alternative, i.e. the ‘doubling-up’ of Fertig and Reingold (2008) and Curtis et al. (2013). Tertiary homelessness is defined as staying in a caravan, boarding house, hotel or crisis accommodation, a category which includes but is not limited to the acute sheltered homeless of Curtis et al. (2013). Together these three categories constitute a broad conceptualization of homelessness very similar to that under the 2009 Homeless Emergency Assistance and Rapid Transition to Housing Act, and similar to that used by Link et al. (1994) and Curtis et al. (2013).

Specifically, we construct dummies for primary homeless, secondary homeless, tertiary homeless, and their union, for each of the four waves. In wave 1 the dummies are equal to 1 if

the individual has been primary/secondary/tertiary homeless in the last 6 months and 0 otherwise. In waves 2-4 the dummies are equal to 1 if the individual has been primary/secondary/tertiary homeless since the last interview.⁵

Similarly, substance use can be defined in different ways and with different thresholds. Many studies specify a single generic dummy for a substance use *disorder* – sometimes but not always reflecting data limitations – whether based on self-reports of whether one’s own drinking or drug use interferes or has interfered with work or personal relationships (Fertig and Reingold, 2008), interviewer/case worker reports as to whether the individual is receiving or has received treatment for substance dependency or whether they meet diagnostic criteria for alcohol or drug dependency (e.g. Allgood et al., 1997; Shinn et al., 1998; Early, 2005; Johnson and Chamberlain, 2008), or some closely related information (e.g. Johnson et al., 1997). Other studies define separate dummies along these lines for alcohol and drug disorders, and interestingly, their interaction (e.g. Booth et al., 2002; Allgood and Warren, 2003; Zlotnick et al., 2003). By setting a high bar to be counted as a ‘problem substance user’, and not distinguishing between different levels of substance use below this threshold, these studies are focussing attention very much on the right hand tail of the substance use intensity distribution.⁶

In contrast, here we sidestep the question of whether an individual’s substance use represents a disorder, and define variables based purely on (self-reported) use and frequency/intensity of use, separately identifying use of tobacco, alcohol, cannabis, and illegal/street drugs other than cannabis.⁷ Specifically, we construct dummies for whether respondents smoked tobacco daily at any stage of their life and during the last six months/since the previous wave, whether they drank alcohol at risky levels (defined as three or more standard

⁵ Interviews are 6 months apart on average.

⁶ Definitions based on receipt of treatment also confound substance use with individual and institutional *responses* to substance use.

⁷ For a definition of the latter category see Scutella et al. (2012). The relevant survey question asks about use of ‘illegal/street drugs’ then lists examples.

drinks per day on average⁸) ever and since the last wave, whether they used cannabis ever or since the last wave, whether they used illegal/street drugs other than cannabis ever or since the last wave, and whether they injected illegal/street drugs ever or since the last wave. We also test sensitivity to varying the threshold for risky alcohol use and to restricting the cannabis use dummy to those reporting daily use. These are lower bars than those used in the majority of studies cited above, and it seems likely that many of those classed as not having a substance use disorder in these earlier studies would be classed as substance users here. Direct comparisons with these existing studies are therefore unlikely to be particularly informative. Our conjecture, however, is that our comparatively low bar implies that substance use may be a weaker predictor of homelessness, and (tentatively) homelessness a stronger predictor of substance use, than would be the case were we to adopt measures of substance use disorders in the spirit of these earlier studies.

2.2 Prevalence of substance use

Table 1 presents the prevalence of use for the different substances in the JH sample (measured over time but also measured at the snapshots in time associated with each wave of the survey) and the general Australian population (measured at a particular snapshot in time). These descriptive statistics confirm that JH respondents' substance use is much higher than the general population. Smoking is very prevalent among the JH sample at every wave. While only 15 percent of the Australian population smokes daily, in every wave about two thirds of the JH respondents indicates smoking daily. At the same time, there appear to be some transitions in and out of smoking, with 77 percent of respondents smoking at some point in the last two years but only 55 percent smoking throughout the survey period.

⁸ In doing so, we follow the Australian National Health and Medical Research Council who define risky drinking as three or more drinks per day on average, i.e. 21 or more drinks per week.

Table 1 about here

Over the two years of the survey, nearly 1 out of 3 respondents drank at a risky level at some point (31 percent) but only 4.5 percent drank at a risky level over the whole period. This suggests that heavy alcohol drinking may be an important, but largely transitory problem in the JH sample.⁹

Illicit drug use also appears much more prevalent in the JH sample with more than 50 percent having used cannabis during the sample period, more than 25 percent having used illegal/street drugs and almost 9 percent having injected illegal/street drugs in the past 2 years. In the Australian population respectively 14.7 percent used cannabis and/or illegal/street drugs and 0.4 percent injected illegal/street drugs in the past year. Going further back in time than the sample period, 80 percent of JH respondents have tried cannabis and 52 percent have tried illegal/street drugs at some point in their life while almost a quarter of the JH sample have injected illegal/street drugs. Using cannabis on a regular basis occurred among almost half of the JH sample while almost a quarter used illegal/street drugs on a regular basis during their life.

It is clear that a large proportion of JH respondents used some sort of substance at some point in the survey. But how much do they use? To capture intensity of use, Figure 1 shows the distribution of average monthly consumption by substance over the survey period for substance users.

Figure 1 about here

⁹ In terms of alcohol, 20 percent of the Australian population reports drinking more than 2 standard drinks on days they are drinking (which may not be every day). In the JH sample, the equivalent figure is between 55 percent and 59 percent of respondents at each wave.

In the JH sample 23.2 percent of the respondents never smoked daily over the last 24 months. Among those who smoked daily at some point in the past two years, the peak is between 10 to 15 cigarettes per day. Less than 8% of daily smokers smoke more than 25 cigarettes per day. To illustrate the intensity of risky drinking, we use information on binge drinking, which is defined as drinking 5 or more standard drinks on any one occasion. Figure 1b represents the average number of occasions on which respondents report binge drinking in the month preceding the interviews. More than 25 percent of the JH sample reports no binge drinking. Among those who do report binge drinking about 30 percent report binge drinking on only one occasion, but a substantial group report binge drinking on more five occasions.¹⁰ Overall, 50 percent of binge drinkers report having done so on 2.25 days or less in the month preceding the interview on average. Almost half of the JH sample indicates never having used cannabis in the two year survey period. Figure 1c suggests that cannabis users tend to divide into one of two types: those who use a few days per month in at least some periods and those who use every day at every wave (6 percent of cannabis users). Almost three quarters of the sample report no use of illegal/street drugs over the past two years. Also, among users, no-one reported having used every day over the four waves and few reported having used every day in one or two waves. Most users have only used on a few days on average: 50 percent used less than one day per month.

Although Figure 1 provides a clear overview of the intensity of substance use among users, the four-wave averages conceal significant variations in use over time. Table 2 provides some information about the persistence of substance use.

¹⁰ Note that this might reflect a few bouts of binge drinking before each wave or more frequent binge drinking before fewer waves. For example, 4 episodes of binge drinking includes respondents who report binge drinking once in the month preceding the interview at each of the four waves, but also respondents who report binge drinking on 4 occasions in the month preceding the interview at a single wave.

Table 2 about here

Table 2 shows clearly that while a majority of daily smokers smoked at all four waves, the use of other substances is much more transitory. More precisely, 54.8 percent of respondents smoked daily in all four waves compared to 10.7 percent of daily smokers in three waves. In comparison, 4.5 percent reported risky drinking in all four waves, while 5.3 percent reported risky drinking in three waves and 6.9 percent in two waves. About 11 percent report heavy drinking only in one wave. More than half of JH respondents report having used cannabis at some point during the course of the survey. Compared to risky drinking, this is a more persistent behaviour with more than a third of those having used cannabis reporting use in each of the four waves. But there are also significant transitions in and out of cannabis use with the other two-thirds of users quite evenly distributed between usage for one, two and three waves. Similar to alcohol use, use of illegal/street drugs seems to be largely transitory. Here, there is a core population of 2.5 percent of respondents who have used in each of the four waves. But there is also almost 12 percent who used illegal/street drugs during 1 wave only. More than 90 percent of the JH sample did not inject illegal/street drugs in the past year but 8.4 percent report having done so in at least one wave.

Table 3 shows heterogeneity in the strength of the association between homelessness and substance use by *type* of homelessness. The percentage of respondents having used a particular substance over the course of JH is always higher among those who have experienced primary homelessness over the course of JH than among those who experienced secondary or tertiary but not primary homelessness. For example, among those who experienced primary homelessness during the two years of the survey, 67.7 percent had used cannabis, 36.9 percent had used illegal street drugs and 17.1 percent had injected illegal street drugs. This compares

to 50.3 percent, 23.4 and 5.6 percent for those who had experienced secondary or tertiary but not primary homelessness.

Table 3 about here

2.3 *Dynamics of homelessness and substance use*

Table 4 gives the percentage of respondents who use a particular substance among respondents who have been homeless in the past 6 months as reported in wave 1 or since their last interview in waves 2 to 4. For example, 17.2 percent of respondents who were homeless at wave 1 were drinking alcohol at a risky level in this wave, 20.2 percent of the respondent who were homeless in wave 2 were drinking at a risky level in wave 2, etcetera. Off-diagonals give some idea about the transition in substance use across the waves; for example 19.5 percent of respondents who were homeless at wave 2 drank at risky level at wave 1. Table 4 also provides the number of homeless and substance users at each wave. Note that homelessness has decreased by about 150 respondents from 892 to 751 between waves 1 and 2 and then by about 50 respondents in waves 3 and 4 to 650 in wave 4.¹¹ Cannabis and illegal street drug use appear more seasonal with higher levels of use in spring (waves 1 and 3) than in autumn (waves 2 and 4). Seasonal patterns in drug use are not unheard of in the literature, and may in part reflect the timing of the school year (e.g. Grfoerer et al. 2002).

Table 4 about here

¹¹ Given that we restrict our attention to the balanced panel this does not reflect attrition, but the combined effects of time and time since selection into the sample. Specifically, because those flagged as homeless were oversampled in wave 1, and because homelessness is for many a transitory state, we would expect the prevalence of homelessness to fall over time in the balanced panel. In all models that follow we include wave dummies to control for this and for common time effects.

There are no clear patterns in the dynamic associations between tobacco and homelessness. Among the homeless at each wave, however, risky drinking seems to occur mostly before and during the homeless episodes and drops just after a homeless episode. For example, for respondents who were homeless in wave 3, the proportion drinking at risky levels was 19.5 percent in wave 2, 16.0 percent in wave 3 and 15.5 percent in wave 4. This appears consistent both with the possibility of a causal impact of risky drinking on homelessness and a causal impact of homelessness on risky drinking. Cannabis and illegal/street drug use also tend to be higher at the homeless wave and the wave before and marginally lower in the wave following homelessness, although seasonal patterns partly obscure this.

3 Determinants of homelessness

In the previous section we presented evidence of a number of associations between homelessness and substance use. However, these associations are unconditional, i.e. they may be driven by differences in individual and contextual characteristics that influence both homelessness and substance use. To further investigate the association between substance use and homelessness we estimate a series of linear models for homelessness, initially separately for each substance use behaviour with no controls other than wave dummies, then adding observable time invariant and time varying controls, then replacing the time-invariant controls with individual fixed effects. In each case substance use is included both contemporaneously and lagged one wave. Our final (and preferred) model includes all four substance use behaviours¹² in a single equation, with individual fixed effects and time-varying observable controls, as given by (1):

¹² Information on injection of drugs was only collected in waves 3 and 4 of JH, so we omit it from our regression analysis.

$$H_{it} = \beta_1 T_{it} + \beta_2 T_{it-1} + \beta_3 A_{it} + \beta_4 A_{it-1} + \beta_5 C_{it} + \beta_6 C_{it-1} + \beta_7 D_{it} + \beta_8 D_{it-1} + \beta_9 X_{it} + \gamma_i + \tau_t + \eta_{it} , \quad (1)$$

where H_{it} denotes homelessness (whether primary, secondary or tertiary) of individual i at time t , T, A, C and D denote tobacco use, (risky) alcohol use, cannabis use and illegal/street drug use respectively, X_{it} represents observable controls (listed and defined in the appendix), and γ_i and τ_t are individual and time fixed effects respectively.

In estimating (1) we are investigating whether substance use precedes homelessness, controlling for all time-invariant differences between individuals, whether observed or unobserved, and for observable time-varying differences. Conditional on these controls, we interpret a statistically significant relationship from lagged substance use to current homelessness as indicating a potentially causal relationship from substance use to homelessness, appealing to the arrow of time to rule out causation in the opposite direction. Johnson and Chamberlain (2008) discuss possible mechanisms for such a relationship, including breakdown of family relationships and financial strain resulting from substance use. We do not place any casual interpretation on significant contemporaneous associations between homelessness and substance use.

A priori a causal relationship from tobacco use to homelessness seems unlikely. Including tobacco use in (1) therefore gives us a something close to a falsification test in which a significant positive impact of lagged tobacco use on current homelessness could suggest that conditioning on individual fixed effects and time-varying controls has not fully washed out selection as a source of association between substance use and homelessness.

Table 5 shows the resulting estimates of β_1 through β_8 and associated standard errors. Column 1 shows positive and statistically significant associations between homelessness and

contemporaneous tobacco, alcohol, cannabis and illegal/street drug use, and positive and statistically significant associations with lagged alcohol, cannabis, and illegal/street drug use, but not lagged tobacco use. For example, those reporting illegal/street drug use in any given wave are almost 8 percentage points more likely to report being homeless in that wave, and are 9 percentage points more likely to report being homeless in the following wave. Associations between homelessness and current and lagged cannabis use, and also lagged risky alcohol use, are of similar magnitude.

Table 5 around here

Conditioning on observables substantially improves the fit of the model in each case but kills all of the statistically significant correlations with contemporaneous substance use (primarily because the coefficients fall in magnitude). The associations between homelessness and lagged alcohol, cannabis and illegal/street drug use also fall in magnitude, but remain statistically significant at the 90%, 95% and 95% levels respectively. The explanation for this lies in the observable confounders, which take signs largely as we would expect and in line with earlier studies where variables are shared (e.g. Early, 2004). For example, homelessness in the JH sample is negatively associated with age¹³ and positively associated with being male, with dummies for having experienced physical or sexual violence in the last 6 months, and with *sfrstayai*, all of which are also correlated with substance use. There are also some variables that one might expect to be statistically significant that here are not, including employment experience over the last 6 months (positive but not statistically significant), an indigenous dummy (positive but statistically insignificant), and various dummies for parental (or caregiver) behaviour, including alcohol and drug use (positive and statistically insignificant for male

¹³ Some studies, including Early (2004), suggest an inverted u-shape relationship between age and probability of homelessness (or homelessness duration (e.g. Allgood et al., 1997), with the peak at around 30 year of age.

caregivers but negative and statistically insignificant for female caregivers), when the individual was aged 14 years.¹⁴

Although we have a rich set of observable controls, there may of course be unobservable factors that continue to confound the estimated relationships between the lagged substance use variables and homelessness. Conditioning on individual fixed effects washes out these unobserved factors to the extent that they are time-invariant. This has a mixed impact on the estimated substance use coefficients, increasing the magnitudes of the lagged risky alcohol use and illegal/street drugs estimates, decreasing (and rendering statistically insignificant) the magnitude of the lagged cannabis use estimate, and increasing (and rendering statistically significant) the magnitude of the contemporaneous illegals drug use estimate.

Because these substance use behaviours are themselves correlated with one another, however, we cannot be sure whether the remaining significant associations with lagged substance use in column 3 of Table 5 are being driven by risky drinking, illegal drug use, or both. Our preferred fixed effects model therefore includes all eight substance use variables together and the relevant estimates are given in the final column of Table 5. In this model only lagged risky alcohol use remains statistically significant, and we interpret this, somewhat tentatively, as *potentially* indicating a causal effect. The magnitude of this estimated coefficient is pretty stable across the different specifications of the model, suggesting that risky alcohol use increases the probability of homelessness during the next six months by 8 percentage points. The estimated impact of lagged cannabis use on homelessness is less than half the size and nowhere near statistically significant. The estimated coefficient on lagged illegal/street drug use other than cannabis falls in between, and is just below the 90% statistical significance threshold. We interpret these estimates, again somewhat tentatively, as indicating a lack of any causal effect large enough and precisely estimated enough to show up convincingly in our data.

¹⁴Note we lose observations when conditioning on observables, but we show in Section 5 that this in itself does not explain the contrast in results between columns 1 and 2 of Table 5.

Finally, although one can easily envisage causal mechanisms from alcohol, cannabis and other illegal/street drug use to homelessness, such mechanisms seem intuitively unlikely in the case of tobacco use. The estimated coefficient on lagged tobacco use can therefore arguably be interpreted as something akin to a falsification test, where a positive and statistically significant coefficient would suggest the observable controls and individual fixed effects fail to adequately wash out selection effects. Table 5 shows this estimated coefficient to be statistically insignificant and negative. Given positive correlations between tobacco use and the other substance use variables, this supports our interpretation of the risky drinking effect as potentially causal.

4 Determinants of substance use

In the same way we explore potential causal effects of homelessness on substance use, estimating linear models separately for each substance, first including only wave dummies as controls, then including observable time-varying and time-invariant controls as in (1), and finally replacing the time-invariant observed controls with individual fixed effects. Our preferred model – the fixed effects model – is given by (2):

$$S_{it} = \alpha_1 H_{it} + \alpha_2 H_{it-1} + \alpha_3 Z_{it} + \theta_i + \varphi_t + \mu_{it}, \quad (2)$$

where S_{it} denotes substance use at time t , H_{it} and H_{it-1} are dummies for whether respondent i was homeless since the last interview or between the interview in $t-2$ and the interview in $t-1$, respectively, Z_{it} is a vector of controls which overlaps very closely with X_{it} , and θ_i and φ_t are individual and time fixed effects.¹⁵ As in Section 3, if a parameter of lagged homelessness has

¹⁵ Z_{it} and X_{it} share all but one variable: the ‘homeless friends’ variable in the latter is replaced by a ‘using friends’ variable in the former.

a significant effect on substance use, we interpret this as indicating a potentially causal effect of homelessness on substance use. Adapting to a subculture of substance use among the homeless and/or using substances as a coping mechanism are both possible mechanisms for such a causal effect (Johnson and Chamberlain, 2008). Estimates are presented in Table 6.

Table 6 about here

The first column of Table 6 shows positive and statistically significant associations between homelessness at time t and alcohol, cannabis and other illegal/street drug use at time t , consistent with the associations presented in Table 5. There are also positive and statistically significant associations between lagged homelessness and current tobacco and current cannabis use. All but three of these associations are killed, however, by including observable controls (column 2), which substantially increases the model R^2 s. In this case significant controls – which again take intuitive signs – include age (positive for tobacco and alcohol), male (positive for all four substance use behaviours), indigenous status (positive for risky alcohol use), having experienced physical violence in the last 6 months (positive for all four behaviours), having a male caregiver at age 14 with drug or alcohol problems (positive for tobacco and alcohol use), having friends who are mostly drug users (positive for all four behaviours), reporting oneself to have had debt problems over the last six months (positive for cannabis use and other illegal drug use), and reporting having experienced emotional abuse or neglect as a child (positive for cannabis use and other illegal drug use).

The key step in (2), however, is the inclusion of individual fixed effects. This kills *all* remaining associations between lagged homelessness and current substance use: all coefficients on lagged substance use (and for that matter current substance use) are small in magnitude and nowhere near statistical significance at standard levels. We interpret these estimates, in this case

more confidently given the clear and consistent message across all four behaviours, as indicating a lack of *any* causal effect from homelessness as defined here to substance use as defined here.

5 Sensitivity Analysis and Extensions

This section briefly discusses the sensitivity of our main conclusions to tweaking the definitions of some key variables (in particular the thresholds for substance use dummies) and various other specification issues.¹⁶ We then explore the implications of disaggregating the homelessness dummy in (1) and in (2).

First consider sensitivity to the precise definitions of our substance use variables. We explore three specific changes: varying the threshold at which alcohol consumption is defined as risky, replacing the cannabis use variable with a dummy for daily cannabis use, and replacing the other illegal/street drug variable with a dummy for weekly use. Lowering the threshold at which alcohol consumption is defined as risky – setting the dummy equal to 1 for 15+ drinks per week and equal to zero otherwise – results in an additional 6% or so of the sample switching from not risky drinking to risky drinking in each wave. The coefficient on lagged risky drinking in (1) halves in magnitude (in all versions of the model) and is no longer statistically significant in the fixed effects model. Alcohol use impacts on homelessness but only at higher consumption levels. This is consistent with an increased coefficient on lagged risky alcohol use when we raise the threshold to 28+ drinks per week, which is what we observe. Varying the risky drinking definition in this way has no impact on our conclusion of no causal impact from homelessness to risky drinking in (2). Tightening the frequency of use thresholds for cannabis

¹⁶ Results are available from the authors on request.

use and other illegal/street drug use has no effect on our conclusion of zero impact from these behaviours on homelessness in (1) and zero impact of homelessness on these behaviours in (2).

In a second set of sensitivity analyses we replace time-varying controls observed at time t with their lags at $t-1$, in both (1) and (2). In doing so we are primarily concerned with whether any of these ‘controls’, e.g. divorce/separation between $t-1$ and t , might in fact be capturing causal mechanisms through which substance use impacts on homelessness or vice versa. The obvious trade-off is a lesser degree of control for current time-varying factors. As we might expect this increases the magnitude of the estimated coefficients on lagged alcohol, cannabis and illegal/street drug use in (1), and by a factor of around 1.25. The coefficients on lagged cannabis use and lagged other illegal/street drug use become marginally statistically significant in the fixed effects model as a result. There is certainly enough sensitivity here to reinforce the tentative nature of our earlier conclusion of no causal impacts from these behaviours on homelessness, if not quite enough to overturn this earlier conclusion. Lagging the controls has no impact on our conclusion of zero causal effects from homelessness to substance use in (2).

We explore various other potential sources of sensitivity, both to the estimated coefficients and the standard errors, including restricting the sample to be common across all the different specifications of (1) and (2) and clustering at ‘sample cluster’ level in addition to individual level.¹⁷ None of our conclusions are affected by these changes.

Next consider disaggregating the homelessness dummy by type of homelessness. Table 7 presents estimates from our preferred specification of (1) but first with the homelessness dummy replaced by a primary homelessness dummy (equal to 1 if the individual has been primary homeless since the last wave and 0 otherwise), and second with the homelessness dummy replaced by an ordered categorical variable equal to 2 for those having experienced

¹⁷ JH used geographically-clustered sampling, with 36 clusters each containing between 92 and 280 respondents. See Scutella et al. (2012).

primary homelessness since the last wave, equal to 1 for those having experienced on secondary or tertiary homelessness since the last wave, and equal to 0 otherwise. Both models are estimated linearly.

Table 7 around here

The right hand column of Table 7 just confirms our earlier conclusions: there is no statistically significant impact from lagged tobacco, cannabis or other illegal/street drug use on homelessness, and there is a potential causal impact from lagged risky alcohol use, whether homelessness is measured as a single dummy or as an ordered categorical variable.

Replacing the homelessness dummy with a primary homelessness dummy, however, does point to some interesting heterogeneity. This means we are now comparing those primary homeless with those not homeless and those secondary/tertiary homeless pooled together. We find a smaller effect of lagged risky drinking in this case, although it remains statistically significant at the 95% level. The suggestion – which is consistent with the equivalent estimate in the model with the ordered dependent variable for homelessness – is that risky drinking impacts most strongly on secondary and/or tertiary homelessness, and not on primary homelessness. Studies using a broader definition of homelessness might therefore be more likely to find evidence of alcohol use impacts than those using a narrower definition. There is also a somewhat surprising result in the primary homelessness version of (1): the coefficient on lagged illegal/street drug use becomes negative and statistically significant. Our explanation for this is that drug use impacts *positively* on *secondary/tertiary* homelessness – this is what we pick up in the positive but statistically insignificant coefficient in Table 5 – rather than that it impacts negatively on primary homelessness. Restricting the sample to those who are either primary homeless or not homeless at time t gives an insignificant coefficient of -0.11. Excluding

the primary homeless and replacing the primary homelessness dummy with a secondary/tertiary homelessness dummy gives a positive and statistically significant coefficient of 0.91. Evidently, our (admittedly tentative) conclusion of no causal impact from illegal/street drug use on homelessness hides some interesting heterogeneity, where there does appear to be a potentially causal impact on forms of homelessness such as doubling up with friends and family, but not on sleeping rough. Again, the definition of homelessness appears to be critical.

Table 8 presents estimates from the fixed effects version of (2) with the current and lagged homelessness dummies disaggregated into separate dummies for primary, secondary and tertiary homelessness. This makes very little difference to our conclusion of zero impact from homelessness on substance use: only one of the 12 lagged homelessness dummies across the four substance use models is statistically significant, and only at 90%.¹⁸ The marginally significant coefficient is for lagged primary homelessness on cannabis use, but in itself this is insufficient evidence to temper our earlier conclusion.

Table 8 around here

6 Summary and Conclusions

This paper exploits unique longitudinal data for a large and broadly-based sample of homeless and at-risk-of-homelessness individuals to examine the dynamics of substance use and, using standard panel data methods, the associations between substance use and homelessness. In doing it makes a number of significant contributions to a mostly descriptive literature bedevilled by a dearth of suitable data to examine these issues in anything other than small and often very specialised samples. First, the paper provides an in-depth analysis of the use of tobacco, alcohol,

¹⁸ We would expect this from purely random variation.

cannabis, and other illegal/street drugs among survey respondents over a period of 2 years, including on the prevalence, intensity and persistence of use. Second, the paper demonstrates strong associations between substance use and homelessness among this sample. Third, and most importantly, the paper exploits the arrow of time in fixed effect regression models to show that these associations between homelessness and substance use, in both directions, are predominantly driven by observed and unobserved factors which cause individuals to be both substance users and homeless. Once these factors are taken into account it appears that homelessness does not affect substance use, while only risky alcohol use impacts on homelessness. Fourth, we highlight some interesting heterogeneity underlying these overall conclusions: risky alcohol use appears to impact more heavily on secondary and tertiary homelessness than on primary homelessness, and the zero impact of illegal drug use on homelessness overall masks a positive impact on secondary and tertiary homelessness but not on primary homelessness. These conclusions are generally robust, although the size and significance of the alcohol impact on homelessness does depend on the threshold at which we define risky alcohol use.

Direct comparisons with existing studies are difficult given differences in the nature of the data, in the definitions of key variables and in modelling approach. Nevertheless in concluding that there may be a causal link from risky alcohol use to homelessness in the JH sample we are broadly in line with some earlier studies for the US (e.g. Allgood and Warren, 2003; Early, 2005) but not others (e.g. Shinn et al., 1998; Fertif and Reingold, 2008). Similarly, in demonstrating a lack of homelessness effects on substance use we are coming down on the opposite side of the fence to Johnson et al. (1997), Shinn et al. (1998) and Johnson and Chamberlain (2008), although only Johnson et al. (1997) based their conclusions in this regard on a multivariate model for substance use (and one with few controls at that). The heterogeneity by homelessness type demonstrated here is not only of interest in and of itself but also implies

that conclusions regarding the associations between substance use and homelessness elsewhere in the literature are likely to be sensitive to the definition of homelessness used. Recent changes in the way homelessness is defined by the US Administration mean this finding may be particularly timely.

With all the usual caveats about the extent to which these conclusions will generalise across contexts, we draw out three tentative implications for policy. First, high levels of substance use among the homeless may be sufficient grounds to target substance use treatment programs at homeless populations, even in the absence of any causal relationship between substance use and homelessness. Second, the lack of a causal relationship from homelessness to substance use suggests more support for interventions to target reduced substance use among existing users rather than interventions trying to prevent take up of substances by those yet to become users. Third, the possible existence of an economically significant causal relationship from some forms of substance use to homelessness seemingly offers the potential for early interventions on alcohol use among at risk populations to help reduce entry into homelessness, or for interventions on the currently homeless to help increase exit rates from homelessness.

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Data Appendix

The JH sample contains 1,682 in wave 1 and between 86% and 91% of those respondents have been interviewed at further waves. Overall, 1,325 persons have participated in all 4 waves of the study.

It was drawn from the Research Evaluation Database (RED) which contains records for all Centrelink income support customers (i.e. all welfare recipients) since 1st July 2002. This has the distinct advantage that it provides a wide coverage of the homeless population within Australia given the strong likelihood that the large majority of homeless persons will be in receipt of a Centrelink income support payment. The population scope was initially established as all Centrelink customers aged 15 years or older in receipt of any income support payments at any time during the 28-day period prior to 27 May 2011. Individuals were then randomly selected from the three following sub-groups in each cluster:

1. people flagged by Centrelink as homeless¹⁹;
2. people flagged by Centrelink as at risk of homelessness; and
3. people identified by the research team as vulnerable to homelessness sub-sample, i.e.

persons that have not been flagged but nevertheless have characteristics similar to those that have been.

¹⁹ Since 1st January 2010, local Centrelink office staff have been required to flag in their database those customers they determine to be either 'homeless' or 'at risk of homelessness'. A person who is 'homeless' is one that is without conventional accommodation (e.g., sleeping rough, squatting, or living in a car); or lives in, or moves frequently between, temporary accommodation arrangements (e.g., with friends or extended family, emergency accommodation, or youth refuges). A person who is 'at risk' of homelessness is one that lives medium to long term in a boarding house, caravan park or hotel, where accommodation is not covered by a lease; lives in accommodation which falls below the general community standards which surround health and wellbeing, such as access to personal amenities, security against threat, privacy and autonomy; is facing eviction; lives in accommodation not of an appropriate standard which may be detrimental to their physical and mental well-being, or where they have no sense of belonging or connection (e.g., Indigenous Australians living in crowded conditions or disconnected from their land, family / kin, spiritual and cultural beliefs and practices). The combination of these two definitions give a population of 'homeless people' that roughly accords with the cultural definition of homelessness put forward by Chamberlain and Mackenzie (1992) and used by the Australian Bureau of Statistics to enumerate the homeless population in the 1996, 2001 and 2006 Censuses.

A total of 2992 cases were issued to field. Of these, 273 were subsequently determined to be out-of-scope, mainly because the sample members were known to have moved out of the designated survey interview area (i.e., cluster) prior to fieldwork commencing (n=180), but also because the sample member was away for the entire survey period, was in prison or in another institution on more than a short-term basis, was a young person still at home with their parents, or had died. Interviews were successfully obtained from 1682 members of this in-scope group, giving a response rate of 61.9%. Overall, and despite the presence of a number of statistically significant differences, the characteristics of the responding sample mostly do not seem to be so different from the initial selected sample to suggest response bias is a major problem that is either non-ignorable or cannot be dealt with by data users.

In tracking people over time, like most other longitudinal cohort studies, JH only follows those persons who responded at wave 1. In subsequent waves, the only wave 1 respondents who have been excluded from locating efforts are those known to have died or who subsequently withdrew their consent to be contacted. The initial set of contact details for all sample members in wave 1 came from the information contained on the Centrelink customer database. In subsequent waves, the updated contact information provided at regular intervals by DEEWR is supplemented by additional contact information (or ‘anchor points’) collected during the preceding wave interview.

The principal mode of data collection is face-to-face interviews using a questionnaire delivered by Computer Assisted Personal Interviewing (CAPI) tablet consoles. Telephone is used where that is the sample member’s preferred mode or the person has moved to a location outside the reach of the interviewer network. Just 1.6% (n=26) of completed interviews were undertaken by telephone in wave 1. In subsequent waves, however, this proportion is higher given sample member mobility. In wave 4, it was 14.8%.

All sample members are offered a \$40 incentive each time they agree to be interviewed. In the case of face-to-face interviews, the incentive is provided as cash and paid immediately after the sample member agreed to participation. In the case of telephone interviews, the incentive is sent by mail, in cheque form, to the respondent after completion of the interview. All respondents are given the option to decline payment, though only three respondents in wave 1 elected to do so (all of whom were interviewed by telephone).

For more information on the design of the survey, please refer to Wooden et al. (2012).

Scutella et al. (2012) presents wave 1 summary statistics for a handful of current substance use measures (consumes alcohol at risky levels, uses marijuana, uses other illicit drugs, uses both marijuana and other drugs) and one lifetime measure (has ever injected), and their association with lifetime homelessness (using a binary definition) as reported at wave 1. Chigavazira et al. (2013) presents summary information on the same measures of substance use in waves 1 and 2 and examines their association with a simple four-way typology of homelessness dynamics. Johnson et al. (2013) develops a typology of housing instability and provides further analysis of its association with substance use.

We define categories of homelessness using historical and calendar information only based on accommodation type. That differs from the point-in-time definition (see Scutella et al., 2012) because information on tenure and whether the arrangement is temporary is not available for homelessness experiences prior to wave 1. We classified each accommodation type in the homeless type that is the most likely. For example, those currently staying with friends and relatives mostly enter in the second category while those currently staying in a caravan, boarding house, and hotel or crisis accommodation mostly enter the third category. We follow this classification rule throughout this article.

We use the first four waves of the JH for which the data were collected in the spring of 2011, the autumn and the spring of 2012 and the autumn of 2013.²⁰

Table A1 about here

Table A1 defines the time-varying and time-invariant control variables included in (1) and (2) and provides summary statistics for each wave and for the balanced panel. There is little variation in the composition of the sample across waves.

²⁰ Australian Spring is in the period September – November, autumn is in the period March – May.

Table 1: Prevalence of substance use (%)

	Tobacco - daily use	Alcohol - 3+ standard drinks/day	Cannabis	Illegal/ Street drugs	Injecting illegal/ street drugs
Ever tried	-	-	79.6	52.2	23.4
Ever used on a regular basis	84.1	-	49.4	22.8	-
Ever used over survey period (2 years)	76.6	31.0	52.4	25.3	8.6
Always used over survey period (2 years)	54.8	4.5	18.3	2.5	3.2
Wave 1 – Spring 2011	68.2	17.3	38.7	14.2	-
Wave 2 – Autumn 2012	67.4	17.0	34.9	9.9	-
Wave 3 – Spring 2012	67.8	14.8	37.4	14.5	6.4
Wave 4 – Autumn 2013	66.8	15.5	32.7	10.2	5.4
Australian population*	15.1	20.1	14.7		0.4

Notes: Based on 1,325 observations (the balanced panel).

(1) Regular use is considered to be daily use for cannabis, and weekly use for street drugs.

(2) These figures are from the Australian Institute of Health and Welfare (AIHW) (2011b) 2010 National Drug Strategy Household Survey and give use for the last 12 months. The AIHW (2011b) defines risk levels of alcohol consumption according to the recently revised Australian Alcohol Guidelines: “For healthy men and women, drinking no more than 2 standard drinks on any day reduces the lifetime risk of harm from alcohol-related disease or injury”. Respondents having on average more than 2 standard drinks per day are considered at risk.

Table 2: Distribution of the number of waves in which respondents used (%)

	Tobacco - daily use	Alcohol 3+ standard drinks/day	Cannabis	Illegal/Street drugs	Injecting illegal/street drugs
0 wave	23.2	63.5	47.1	73.4	90.2
1 wave	3.8	11.3	10.6	11.8	5.2
2 waves	6.0	6.9	9.7	5.4	3.2
3 waves	10.7	5.3	12.4	5.1	-
4 waves	54.8	4.5	18.3	2.5	-
Total	98.5	91.5	98.1	98.3	98.6

Note: Based on 1,325 observations (the balanced panel); for injection, data is only available for waves 3 & 4. The columns do not sum up to 100 percent because some respondents have missing information for some substances.

Table 3: Percentage of respondents using substances by homeless experience during Journeys Home (%)

	Tobacco - daily use	Alcohol - 3+ standard drinks/day	Cannabis	Illegal/ Street drugs	Injecting illegal/ street drugs	N
Never homeless	69.3	25.3	41.0	17.5	8.5	220
Ever secondary or tertiary	75.3	27.4	50.3	23.4	5.6	804
Ever primary	85.5	44.1	67.7	36.9	17.1	290

Note: Based on 1,325 observations (the balanced panel).

Table 4: Transitions between homelessness and substance use across waves

Tobacco - daily use	Wave1 Spring 2011	Wave2 Autumn 2012	Wave3 Spring 2012	Wave4 Autumn 2013	N
Homeless W1	70.3	70.3	69.9	69.6	892
Homeless W2	69.4	70.0	69.4	69.0	751
Homeless W3	69.4	69.9	69.4	70.2	706
Homeless W4	68.4	68.4	68.0	67.8	650
N	903	893	899	885	1,325
Alcohol - risky drinking					
Homeless W1	17.2	17.1	15.1	15.0	892
Homeless W2	19.5	20.2	15.8	16.0	751
Homeless W3	18.0	19.5	16.0	15.5	706
Homeless W4	17.9	19.2	16.2	17.1	650
N	229	225	196	206	1,325
Cannabis use					
Homeless W1	41.0	37.5	39.4	36.1	892
Homeless W2	43.3	39.2	39.8	37.6	751
Homeless W3	43.7	40.5	40.8	38.3	706
Homeless W4	42.7	39.2	41.1	38.2	650
N	513	462	496	434	1,325
Use illegal/street drugs					
Homeless W1	15.0	10.6	15.2	10.8	892
Homeless W2	16.9	11.1	14.6	10.9	751
Homeless W3	15.7	11.7	16.0	12.3	706
Homeless W4	14.4	10.3	15.8	12.3	650
N	187	131	192	135	1,325

Note: Based on 1,325 observations (the balanced panel).

Table 5: Determinants of homelessness at time t

	No controls	Observable controls	Fixed effects	Fixed effects, all substances together
<u>Tobacco - daily use</u>				
In t	0.044* (0.024)	0.022 (0.027)	-0.055 (0.039)	-0.068* (0.040)
In t-1	0.014 (0.024)	-0.018 (0.027)	-0.056 (0.038)	-0.062 (0.039)
N	3,916	3,054	3,054	2,930
R ² / within R ²	0.005	0.074	0.020	0.032
<u>Alcohol - 21+ standard drinks/wk</u>				
In t	0.043* (0.026)	0.037 (0.029)	0.047 (0.039)	0.033 (0.040)
In t-1	0.080*** (0.025)	0.054* (0.028)	0.083** (0.040)	0.083** (0.041)
N	3,765	2,944	2,944	2,930
R ² / within R ²	0.008	0.078	0.026	0.032
<u>Cannabis</u>				
In t	0.073*** (0.022)	0.024 (0.024)	-0.009 (0.033)	-0.012 (0.034)
In t-1	0.072*** (0.021)	0.054** (0.023)	0.039 (0.030)	0.038 (0.031)
N	3,908	3,049	3,049	2,930
R ² / within R ²	0.018	0.078	0.020	0.032
<u>Illegal/ Street drugs</u>				
In t	0.077*** (0.028)	0.025 (0.032)	0.082** (0.042)	0.071 (0.044)
In t-1	0.093*** (0.027)	0.063** (0.029)	0.074** (0.037)	0.060 (0.039)
N	3,913	3,050	3,050	2,930
R ² / within R ²	0.011	0.076	0.022	0.032

Notes: The table reports estimated coefficients and clustered standard errors (at the individual level) for different versions of (1). The first three models are estimated separately by substance. The first model includes only wave dummies. The second adds the full set of observable time-invariant and time-varying controls described in the appendix: experienced physical violence in last 6m, experienced sexual violence in last 6m, proportion of time employed in last 6m, dummy for all/most friends homeless in t, sex, indigenous status, parents were div/sep at age 14, parents were dead at age 14, conflict with parents at age 14, emotional abuse/neglect, physical or sexual violence as a child, male caregiver had an alcohol or drug problem, male caregiver spent time in jail, male caregiver spent time in hospital overnight because had mental health pbs, male caregiver was unemployed more than 6 months, male caregiver had a gambling problem, female caregiver had an alcohol or drug problem, female caregiver spent time in jail, female caregiver spent time in hospital overnight because had mental health pbs, female caregiver was unemployed more than 6 months, female caregiver had a gambling problem. The third model drops the time-invariant controls and replaces with individual fixed effects. The fourth model is identical to the third model, but with all substance use variables entered together.

Table 6: Determinants of substance use at time t

	No controls	Observable controls	Fixed effects
		<u>Tobacco - daily use</u>	
Homelessness in t	0.019 (0.017)	-0.021 (0.019)	-0.019 (0.016)
Homelessness in t-1	0.059*** (0.017)	0.049** (0.019)	-0.001 (0.016)
N	3,904	3,037	3,037
R ² / within R ²	0.006	0.076	0.007
		<u>Alcohol - 21+ standard drinks/wk</u>	
Homelessness in t	0.048*** (0.014)	0.032** (0.016)	0.001 (0.018)
Homelessness in t-1	-0.012 (0.014)	-0.007 (0.015)	-0.022 (0.017)
N	3,832	2,986	2,986
R ² / within R ²	0.004	0.114	0.014
		<u>Cannabis</u>	
Homelessness in t	0.081*** (0.017)	0.013 (0.017)	-0.011 (0.019)
Homelessness in t-1	0.056*** (0.017)	0.049*** (0.017)	0.006 (0.018)
N	3,899	3,035	3,035
R ² / within R ²	0.018	0.260	0.036
		<u>Illegal/ Street drugs</u>	
Homelessness in t	0.042*** (0.012)	0.018 (0.013)	0.023 (0.016)
Homelessness in t-1	0.007 (0.012)	-0.005 (0.012)	-0.004 (0.016)
N	3,899	3,035	3,035
R ² / within R ²	0.010	0.154	0.035

Notes: The table reports estimated coefficients and clustered standard errors (at the individual level) for different versions of (2), estimated separately for each substance use behaviour. In each case the first model includes only wave dummies. The second adds the full set of observable time-invariant and time-varying controls described in the appendix and listed in the notes to Table 5. The third model drops the time-invariant controls and replaces with individual fixed effects.

Table 7: Determinants of primary homelessness and degree of homelessness at time t, fixed effects model

	Primary homelessness	Degree of homelessness
<u>Tobacco - daily use</u>		
In t	-0.005 (0.012)	-0.070 (0.045)
In t-1	-0.008 (0.014)	-0.069 (0.044)
<u>Alcohol - 21+ standard drinks/wk</u>		
In t	0.009 (0.014)	0.045 (0.043)
In t-1	0.039** (0.016)	0.122*** (0.046)
<u>Cannabis</u>		
In t	-0.021 (0.017)	-0.030 (0.040)
In t-1	-0.003 (0.012)	0.033 (0.035)
<u>Illegal/ Street drugs</u>		
In t	0.025 (0.016)	0.096* (0.050)
In t-1	-0.043*** (0.014)	0.016 (0.044)
N	2,943	2,928
R ² / within R ²	0.029	0.032

Notes: The table reports estimated coefficients and clustered standard errors (at the individual level) for (1) with individual fixed effects, time-varying controls, and all substance use variables entered together (corresponding to model 4 of Table 5). The first model replaces the standard homelessness dependent variable with a binary dummy for primary homeless. The second model replaces the binary homelessness dummy with an ordered dependent variable equal to 0 for not homeless, 1 for secondary or tertiary homelessness, and 2 for primary homelessness (estimated linearly).

Table 8: Determinants of substance use at time t, by type of homelessness, fixed effects model

	Tobacco - daily use (1)	Alcohol - risky drinking (2)	Cannabis (3)	Illegal/ Street drugs (4)
<u>Primary homelessness</u>				
Homeless in t	-0.008 (0.017)	0.021 (0.018)	-0.003 (0.020)	0.038** (0.016)
Homeless in t-1	-0.018 (0.016)	-0.024 (0.017)	0.034* (0.018)	-0.004 (0.016)
<u>Secondary homelessness</u>				
Homeless in t	-0.036 (0.026)	-0.072** (0.034)	-0.002 (0.035)	-0.026 (0.027)
Homeless in t-1	0.024 (0.024)	0.019 (0.028)	0.004 (0.028)	0.023 (0.026)
<u>Tertiary homelessness</u>				
Homeless in t	0.008 (0.015)	-0.034** (0.016)	0.056*** (0.017)	0.052*** (0.015)
Homeless in t-1	-0.001 (0.021)	-0.019 (0.023)	0.035 (0.025)	0.027 (0.022)
N	3,020	2,971	3,018	3,018
Within R ²	0.011	0.022	0.040	0.043

Notes: The table reports estimated coefficients and clustered standard errors (at the individual level) for estimates of (2) with individual fixed effects and time varying controls (corresponding to model 3 of Table 6) but with homelessness dummies at time t and time t-1 disaggregated into primary, secondary and tertiary dummies.

Figure 1: Substance Use (average over the four waves)

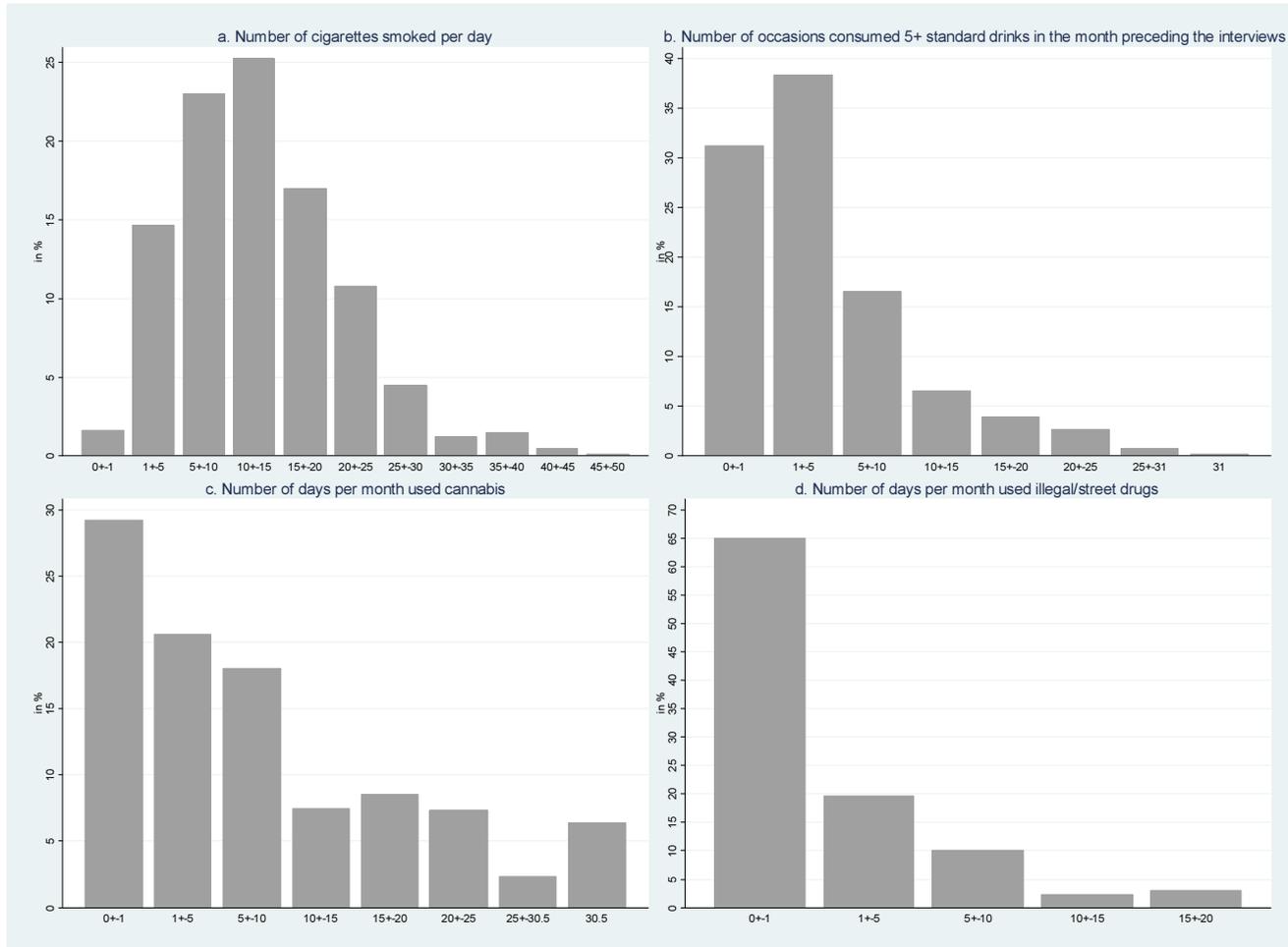


Table A1: Characteristics by wave

	Wave 1 respondents	Wave 2 respondents	Wave 3 respondents	Wave 4 respondents	Balanced panel
Male	59.1	58.8	59.0	58.5	58.7
Female	40.9	41.2	41.1	41.5	41.3
Average age	32.0	32.0	31.9	31.8	31.7
15-20	23.7	23.8	23.9	24.5	24.7
21-34	37.0	36.8	36.7	36.3	36.3
35-44	21.3	21.2	21.5	21.4	21.0
45-54	12.7	12.9	12.6	12.6	13.0
55+	5.3	5.3	5.2	5.2	4.9
Indigenous (including Torres Strait Islander)	21.6	21.6	21.1	20.7	19.4
Australian born	91.8	91.7	92.0	92.0	91.9
Married/defacto	16.8	17.0	16.8	16.8	15.7
Divorced/separated	19.6	19.3	19.5	19.7	19.9
Have dependent children	17.1	17.4	17.2	17.3	17.5
<i>Highest education qualification</i>					
Tertiary qualification	28.6	28.3	28.1	28.4	29.7
Completed Yr 12 or equivalent	11.4	11.9	11.6	12.1	12.6
Completed Year 10 or 11 or equivalent ²	38.6	38.6	39.0	38.8	38.6

Completed Year 9 or below ³	20.1	19.8	20.1	19.5	18.1
Undetermined	1.4	1.4	1.2	1.2	1.0
<i>Labour force status</i>					
Employed	21.5	21.9	22.4	22.4	22.1
<hr/>					
Number of observations	1,682	1,529	1,478	1,456	1,325

Notes: Figures are weighted using (respectively) the wave 1, 2, 3 and 4 response weights for the first 4 columns and the balanced panel weight for the last column.