



UNIVERSITY OF

LIVERPOOL

The Socioeconomic Patterning of Alcohol Use and Mental Health Comorbidity

Thesis submitted in accordance with the requirements of the University of Liverpool for the degree of Doctor in Philosophy (or other degree as appropriate) by Jo-Anne Puddephatt.

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Declaration

PSYCHOLOGY (SCIENCE)

DECLARATION IN HIGHER DEGREE THESES

I hereby declare that this thesis is the result of my own work. The material has not been and will not be submitted, in whole or in part, for any other degree or qualification at this or any other University or Institute of Learning.

Signed: Ms Jo-Anne Puddephatt (Candidate)

A handwritten signature in black ink, appearing to read 'J. Puddephatt', written in a cursive style.

Date: 31st May 2022

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I would like to dedicate this thesis to my son, Harrison, who came into the world in the middle of a global pandemic and in the final year of my PhD. He has made my world a better place and I hope to have done him proud. Harrison, I hope that you follow your own path of happiness just as I have, whatever that may be.

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List of Abbreviations

| Abbr | Abbreviation |
|---------|---|
| ADHD | Attention Deficit Hyperactivity Disorder |
| AIC | Akaike's Information Criteria |
| APMS | Adult Psychiatric Morbidity Survey |
| ASPD | Anti-Social Personality Disorder |
| AUD | Alcohol Use Disorder |
| AUDIT | Alcohol Use Disorder Identification Test |
| BIC | Bayesian Information Criterion |
| BLRT | Bootstrapped Likelihood Ratio Test |
| BPD | Borderline Personality Disorder |
| CI | Confidence Interval |
| CIS-R | Clinical Interview Schedule-Revised |
| CMD | Common Mental Disorder |
| CORE-Q | COnsolidated criteria for Reporting Qualitative research |
| DHSC | Department for Health and Social Care |
| DSM | Diagnostic Statistical Manual |
| ENTREQ | Enhancing Transparency in REporting the synthesis of Qualitative research |
| GAD | Generalised Anxiety Disorder |
| ICD | International Classification of Diseases |
| ICO | Information Commissioner's Office |
| IPA | Interpretative Phenomenological Analysis |
| LCA | Latent Class Analysis |
| LMR-LRT | Lo-Mendell-Rubin adjusted Likelihood Ratio Test |
| MAR | Missing At Random |
| MCAR | Missing Completely At Random |
| MDD | Major Depressive Disorder |
| MOR | Multinomial Odds Ratio |
| NMAR | Not Missing At Random |
| OCD | Obsessive Compulsive Disorder |
| OHID | Office for Health Improvement Disparities |
| OR | Odds Ratio |
| PAG | Project Advisory Group |
| PCL-C | PTSD Checklist-Civilian |
| PPI | Participatory Involvement Group |
| PTSD | Post-Traumatic Stress Disorder |
| QOF | Quality Outcomes Framework |
| SABIC | Sample-size Adjusted Bayesian Information Criteria |
| SAD | Social Anxiety Disorder |
| SES | Socioeconomic Status |
| SEM | Structural Equation Model |
| SMI | Severe Mental Illness |
| SRQR | Standards for Reporting Qualitative Research |
| STROBE | Strengthening the Reporting of Observational Studies in Epidemiology |
| SUD | Substance Use Disorder |
| US | United States of America |
| UK | United Kingdom |

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Abstract

The socioeconomic patterning of alcohol use and mental health comorbidity by Jo-Anne Puddephatt

Some individuals with a mental health problem are more likely to drink at harmful levels and report using alcohol to cope with declines in their mental health whilst others no longer use alcohol due to declines in their mental health. Individuals of lower socioeconomic status (SES) are disproportionately more likely to experience alcohol harms and poorer mental health, respectively, compared to those of higher SES. It is also suggested that other factors, such as neighbourhood disadvantage and social support, play a role in these co-occurrences. This thesis aims to understand the prevalence of alcohol use across a range of mental health problems in the general population, examine the role of SES and other factors on this co-occurrence, and explore experiences of alcohol use and how it is used over time among individuals with a mental health problem living in the general population.

Using a multi-methods approach, this thesis conducts a systematic review and meta-analysis to establish the prevalence of alcohol use among individuals with and without common mental disorders (CMD). A secondary data analysis using a large, representative survey in England, 2014 Adult Psychiatric Morbidity Survey, is then used to establish the prevalence of alcohol use (including non-drinking) across a range of mental health problems. This thesis then focusses on individuals who meet criteria for a mental health problem to establish how i) individuals are clustered based upon different indicators of SES, ii) SES is associated with alcohol use and, iii) the indirect effect of social support and neighbourhood disadvantage on this co-occurrence. Finally, qualitative interviews explore changes in drinking based upon the mental health symptoms individuals experience and how these differ among drinkers and non-drinkers who have a severe mental illness (SMI).

Findings from the thesis show that individuals with a CMD are twice as likely to report an alcohol use disorder compared to those without. Secondary data show that those meeting criteria for a range of mental health problems are more likely to be non-, hazardous or harmful/probable dependent drinkers, compared to low-risk drinkers. This data also shows that, among those with a mental health problem, lower SES groups are more likely to be non-drinkers, compared to those of higher SES. Qualitative findings show that alcohol is used to cope specifically with trauma, mental health symptoms or stress among individuals with a SMI. Non-drinkers change their drinking habits before or during getting formal support and after experiencing significant declines in their mental health. Whereas drinkers change their drinking habits either during or after getting formal support and now currently drink alcohol for enjoyment and in a controlled way.

The evidence lends support for the self-medication and drinking motives models and highlights that the co-occurrence of alcohol and mental health problems are complex. Findings have important implications for how drinking habits may change over time and the role of mental health, previous trauma and appropriate and timely support.

Contributor statement

This thesis is submitted in fulfilment of the conditions for a PhD by published papers. JP wrote all Chapters of this thesis. In accordance with the University of Liverpool guidelines and regulations, Chapter 4 and 5 are submitted as published papers. Chapter 6 is due to be submitted to Psychological Medicine. Chapter 7 has been submitted for publication in Drug and Alcohol Review and is currently under review. Each of these Chapters are discrete articles, meaning some statements are repeated. Each empirical Chapter is preceded by a foreword which justifies the research undertaken and how it links with previous Chapters.

Empirical work in peer reviewed publication form

Chapter 4 is published in Addiction as:

Puddephatt, J. A., Irizar, P., Jones, A., Gage, S. H., & Goodwin, L. (2021). Associations of common mental disorder with alcohol use in the adult general population: a systematic review and meta-analysis. *Addiction*. 117(6):1543-1572. DOI: 10.1111/add.15735.

The author contributions are as follows:

JP conceptualised, designed and pre-registered the study protocol in PROSPERO (ref. CRD42019126770). JP conducted the searches, screened all titles, abstracts, and full-text articles against the inclusion and exclusion criteria. JP extracted all data of the included studies, independently assessed the quality of each study, conducted all meta-analyses, and sensitivity analyses and wrote the manuscript. PI screened 10% of all titles, abstracts, and full-texts, and provided feedback on the manuscript. LG, AJ and SHG contributed towards the conceptualisation of the study protocol, provided comments on the analyses and manuscript. All authors approved the final manuscript as submitted.

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JP conceptualised and designed the study and established links with community mental health organisations to facilitate recruitment for the study. JP created the interview schedules and sought ethical approval. JP conducted all interviews with participants, transcribed seven interviews, developed the codebook, analysed the data, interpreted the findings and wrote the manuscript. HM contributed to the data analysis, development of the codebook, interpretation of the findings and provided comments on the manuscript. AJ, SHG, and LG contributed towards the study design, interpretation of findings and provided comments on the manuscript. All authors approved the final manuscript as submitted.

Chapter 1: General Introduction

1.1 Overview of alcohol use in the general population

1.1.1 Prevalence of alcohol consumption

Approximately 47% of the global population consume alcohol making it one of the most frequently used substances (Manthey et al., 2019) yet the harms are considerable compared to many illicit substances (Nutt, King, & Phillips, 2010). However, there is variation in the prevalence of alcohol consumption across countries and a recent study using data from Global Information System on Alcohol and Health reported that use is highest in Central and Eastern European countries and lowest in North African and Middle Eastern countries (Manthey et al., 2019). A recent systematic review supported these findings whereby the prevalence of alcohol consumption varied by location socioeconomic status (SES), with levels of consumption highest in high income countries (Griswold et al., 2018). Global estimates suggest that Western Europe reported the third highest alcohol consumption out of 195 territories (Griswold et al., 2018). More specifically, in the United Kingdom (UK) in 2018, approximately 82% of adults in the UK consumed some alcohol in the last 12 months (Scholes & Gebert, 2019).

While alcohol is highly prevalent globally, recent evidence has shown changes in consumption from 1990 to 2017 whereby increases have been found in South East Asia and Western Pacific regions and decreases in European regions (Manthey et al., 2019). More specifically, population-level data reported increases in consumption in the United States of America (US)(Dawson, Goldstein, Saha, & Grant, 2015), however, decreases have been reported in Spain (Llamosas-Falcón, Manthey, & Rehm, 2020), and the UK (Holmes, Ally, Meier, & Pryce, 2019). Nonetheless, recent evidence in the UK suggests that trends in alcohol consumption differed by age, time period and birth cohort (Holmes et al., 2019). More specifically, in the UK it has been shown that alcohol consumption peaks at around 25 years of age and declines during mid-life (Britton, Ben-Shlomo, Benzeval, Kuh, & Bell, 2015). However, more recent evidence indicates a global decline in alcohol consumption among younger age groups (Loy et al., 2021; Norström & Svensson, 2014; Oldham et al., 2020) and an increase in consumption among older age groups (Breslow, Castle, Chen, & Graubard, 2017; Han, Moore, Sherman, Keyes, & Palamar, 2017). There are gender differences in alcohol consumption, with a modelling study using global data showing the current gender gap (with higher consumption in males) is expected to decrease by 2030 (Manthey et al., 2019). Trend in consumptions also appear to differ by the type of drinker, a UK study showed that among women, there was a decrease in consumption for light drinkers but an increase for heavier drinkers. In males there is a trend of decreasing consumption regardless of the initial level of drinking (Holmes et al., 2019). These findings suggest that alcohol use and changing trends may vary dependent on gender and age.

While alcohol consumption is broadly defined as the drinking of beverages containing ethyl alcohol, alcohol can be consumed in different ways which can be detrimental to an individual's health. Binge-drinking is defined as drinking eight or more units of alcohol for men, and six or more units for women, in one drinking occasion (Office for National Statistics, 2018), though there are some variations to this definition globally. A recent review found that 18.4% of adults reported binge-drinking, globally (Peacock et al., 2018). Like alcohol consumption, the prevalence of binge-drinking differed across regions, with the highest rates reported in Europe and the lowest in North Africa and the Middle East (Peacock et al., 2018), where 30.5% of adults in Western Europe reported binge-drinking. Further, binge-drinking is more common among men than women (Kuntsche, Kuntsche, Thrul, & Gmel, 2017). More specifically, 28.7% of men and 25.6% of women in the UK reported binge-drinking on their heaviest drinking day (Office for National Statistics, 2018) and a comparison of binge-drinking showed a higher prevalence in the North of England compared to the rest of England (Castillo, Jivraj, & Ng Fat, 2017), irrespective of gender.

The definition of alcohol use disorder (AUD) varies across different classification systems. For example, the United States system, the Diagnostic and Statistical Manual (DSM) of Mental Disorders, previously categorised AUD as two separate disorders; alcohol abuse and alcohol dependence. However, the most recent version, DSM-5, defines AUD where alcohol use is on a continuum known as mild, moderate, severe AUD. Whereas other international systems such as the International Classification of Diseases (ICD) use the terms hazardous alcohol use, harmful alcohol use (defined as a pattern of use that damages physical or mental health) and alcohol dependence (defined as craving, lack of controlling using alcohol, preoccupation with alcohol) (Degenhardt, Bharat, Bruno, Glantz, Sampson, Lago, Aguilar-Gaxiola, et al., 2019). Despite differences in classification systems used globally, a recent study showed excellent concordance between ICD and DSM classifications for measuring AUD (Degenhardt, Bharat, Bruno, Glantz, Sampson, Lago, Aguilar-Gaxiola, et al., 2019). For the purpose of this thesis, the term "AUD" will be used in all except research Chapters to broadly encapsulate hazardous, harmful, probable dependent, and AUD terms.

Despite its wide consumption, alcohol is a known depressant and recent evidence suggested that approximately 5.3% of deaths and 5% of disability adjusted life years were alcohol attributable (Shield et al., 2020). While there are differences in consumption between countries and declines in consumption among specific groups, globally, alcohol was ranked seventh in contributing towards disability compared with other risk factors (Griswold et al., 2018), with the impact of alcohol costing £21 billion to individuals, communities and families (Public Health England, 2018).

Considering the impact of alcohol, a review found that alcohol was the more prevalent substance of dependence with 63.5 million estimated cases in 2015 (Peacock et al., 2018), and 28% of regular alcohol users in the general population reported an AUD in their lifetime (Degenhardt, Bharat, Bruno, Glantz, Sampson, Lago, Aguilar-Gaxiola, et al., 2019). A recent study of observational data in the US reported that 13.9% of the population met criteria for an AUD in the past twelve months, with the prevalence highest for mild AUD (7.3%) and lowest for moderate AUD (3.2%) (Grant et al., 2015). Elsewhere the prevalence of AUD varied from 7.5% in South Korea (Hahm & Cho, 2005), to 1.5% in China (Cheng, Deng, Xiong, & Phillips, 2015) with men more likely to report an AUD. Whereas data using the alcohol use disorder identification test (AUDIT) showed that 21% of adults in the UK drank harmfully (Davis et al., 2020) compared to 7.9% in Brazil (Mendoza-Sassi & Béria, 2003).

Despite differences between countries, alcohol is widely consumed and a recent systematic review found that the international economic cost of alcohol consumption was approximately \$1306 per adult, with around one-third being direct costs, such as healthcare, and two-thirds being indirect, such as loss of productivity and premature mortality (Manthey et al., 2021). While the prevalence of AUD varied across countries, the aforementioned research shows that AUD was the most prevalent substance use disorder and a recent review reported that 1.54% of countries' gross domestic product was due to mild AUD (Mohapatra, Patra, Popova, Duhig, & Rehm, 2010), globally, indicating that alcohol is a burden on both society and the economy. Given the cost of AUD, it is important to understand the mechanisms behind this and factors which may increase the likelihood of reporting an AUD.

1.1.2 Risk factors of AUD

There are different models of AUD; genetic, social and environmental (Kendler, Prescott, Myers, & Neale, 2003). The genetic model argues that individuals inherit AUD and evidence showed that AUD was 49% heritable (Verhulst, Neale, & Kendler, 2015). A retrospective study of male twins found that alcohol-specific genetic risk factors increased through to mid-adulthood at around the age of 30-33 (Kendler, Gardner, & Dick, 2011) though other observational evidence suggested a lower age of onset depending on the severity of AUD (Grant et al., 2015). However, other models argue that the development of AUD is influenced by social and environmental factors. This has been shown in genome-wide research where an interaction between traumatic life events with genetic variation and an increased risk for AUD was found (Polimanti et al., 2018) and associations between trauma and AUD have been found elsewhere (Fetzner, McMillan, Sareen, & Asmundson, 2011). Further, a recent systematic review examined gene-environment interaction, that is the effect of a genetic factor depends on the presence of an environmental factor, which found some evidence to suggest that the environment contributed towards alcohol use (Pasman, Verweij, & Vink, 2019).

An overview of the treatment of AUD suggested that social and environmental risk factors such as parental drinking (Agrawal & Lynskey, 2008), alcohol availability (Kendler et al., 2011), and peer drinking, should be considered (Witkiewitz, Litten, & Leggio, 2019). In terms of parental drinking, this may be a risk factor through a child observing the parent drinking. Indeed, longitudinal research showed that exposure to AUD through the parents during childhood increased the risk of the child reporting an AUD in young adulthood (Valente, Cogo-Moreira, & Sanchez, 2019; Yule, Wilens, Martelon, Rosenthal, & Biederman, 2018). Parental drinking, through supplying alcohol, has also been shown in a recent umbrella review (Solmi et al., 2021), though authors note that these were weak associations. Nonetheless, parental drinking may act as role modelling for the child hence the current findings. Another social and environmental risk factor is the availability of alcohol which can work through the availability of purchasing alcohol in a neighbourhood or through the number of alcohol outlets in an area. A systematic review reported that reductions in the availability of take-away alcohol reduced alcohol consumption (Sherk et al., 2018). While longitudinal evidence reported an increased risk of AUD where there were increased numbers of alcohol outlets in a neighbourhood, though gender differences have been found in these associations (Karriker-Jaffe, Ohlsson, Kendler, Cook, & Sundquist, 2018).

Link and Phelan argue a need to consider other risk factors, such as social conditions, to understand why individual's may be at an increased risk of AUD (Link & Phelan, 1995). They define social conditions as those which involve an individual's relationship to other people, including life events and social support (Link & Phelan, 1995). Consistent evidence has shown associations between experiencing traumatic events and an increased incidence of AUD (Keyes, Hatzenbuehler, Grant, & Hasin, 2012). However, the risk may depend on the type of traumatic event, for example an integrative review showed that AUD was higher among individuals who reported experiencing childhood trauma. More specifically, childhood maltreatment impacted the severity and duration of AUD even after controlling for confounders (Moustafa et al., 2021). It may also depend upon the presence of other mental health problems, where longitudinal research showed that experiencing traumatic events at baseline was associated with an increased incidence of reporting AUD at follow-up, though this became non-significant after adjusting for baseline mental health (Asselmann, Wittchen, Lieb, Perkonig, & Beesdo-Baum, 2018).

Another potential social risk factor of AUD is social support. Increased social support from either parents or other networks can help promote self-regulatory behaviour which in turn can be a protective factor of reporting an AUD (Coley, Votruba-Drzal, & Schindler, 2008). But this might depend on the quality and characteristics of those providing social support, as it has been found that, among those in alcohol treatment, participants reported fears

around returning to friends and family who were drinkers (Brooks, Magaña Lòpez, Ranucci, Krumlau, & Wallen, 2017). Elsewhere, reviews found that having friends who engaged in substance use or illegal activities were a predictor of alcohol use (Leung, Toumbourou, & Hemphill, 2014) and binge-drinking (Kuntsche et al., 2017). These findings indicate that, theoretically, social support could act as a buffer towards AUD, but evidence suggests that this may be dependent on the characteristics of available social support.

It is argued that risk factors, such as those discussed in this section, need to be contextualised in terms of what resources are available to determine the extent to which individuals can minimise the risk of reporting an AUD (Link & Phelan, 1995). It is evident that there are several risks associated with an AUD, some of which could be modified or addressed, such as some environmental and social factors. Therefore, understanding the ways in which these factors are associated with AUD will provide a better understanding of how they can be addressed to minimise this risk.

1.1.3 Implications of alcohol use on health

There are previous theories about the reported benefits of low-level alcohol use, known as the “J-shaped curve” (Ronksley, Brien, Turner, Mukamal, & Ghali, 2011; Smyth, Teo, et al., 2015; Wood et al., 2018), however, the use of Mendelian randomisation techniques (a genetic variant as a proxy for alcohol consumption to establish causal relations with other diseases), of these benefits have been disputed where it has shown that there was no protective effect of alcohol on cardiovascular disease (Holmes et al., 2014) and other physical conditions (Chikritzhs et al., 2015). Further, when studies have excluded ex-drinkers (who may have stopped drinking due to poorer physical health) or occasional drinkers from a non-drinker reference group, there was limited evidence of the protective effect of alcohol use on physical conditions (Fillmore, Kerr, Stockwell, Chikritzhs, & Bostrom, 2006).

As mentioned previously, alcohol use was recently ranked the seventh leading risk factor for premature death and disability with an increased risk physical conditions such as cancer, with higher alcohol consumption (Griswold et al., 2018). Case-control studies have shown that increases in binge-drinking was associated with alcohol-related injury (Rossow, Bogstrand, Ekeberg, & Normann, 2013) and an integrative review found evidence to suggest binge-drinking was associated with cardiovascular disease, myocardial infarction and other health conditions (Piano, Mazzuco, Kang, & Phillips, 2017). Similarly, systematic reviews have shown that heavy alcohol consumption was associated with increased mortality (McCambridge, McAlaney, & Rowe, 2011) and risk of stroke (Patra et al., 2010). This indicates that different patterns of drinking are associated with declines in physical health.

Alcohol use, specifically AUD, have also been found to have implications beyond physical health. It has been established that AUD was associated with mental health problems (Grant et al., 2015). Reviews have consistently reported significant increased associations between AUD and depression (Boden & Fergusson, 2011; McHugh & Weiss, 2019) though the direction of the association has been debated. Elsewhere, research showed a two-fold increased risk in the odds of psychotic experiences after reporting AUD (McGrath et al., 2016), though this study relied on age of onset which may not reliably indicate the year an individual received a diagnosis. Twin research also found that AUD was longitudinally associated with most anxiety disorders (Torvik et al., 2019). Having co-occurring alcohol and mental health problems may also compound successful recovery (McHugh & Weiss, 2019). Therefore, it is evident that AUD may increase the risk of worsened mental health.

Physical and mental effects of alcohol can also be more short-term, such as a hangover, which typically involves physical symptoms, such as fatigue, and mental symptoms, such as depression and irritability (Swift & Davidson, 1998). A recent study adopted a naturalistic design and showed that compared to students without a hangover, those with a hangover reported increased emotion dysregulation (Gunn, Fairchild, Verster, & Adams, 2020), while qualitative interviews found participants reported low mood and avoided people they had drunk with in the days after heavy drinking (Griffin, Freeman, Adams, & Smith, 2018). These findings indicate that there are both long- and short-term physical and mental health effects from AUD.

With regards to binge-drinking, the evidence of implications on mental health is less clear; some longitudinal research has not shown binge-drinking to worsen mental health (Bell, Orford, & Britton, 2015; Berg, Kiviruusu, Lintonen, & Huurre, 2019), however, a study which assessed the longitudinal association of alcohol consumption and mental health showed stronger evidence of declines in mental health and subsequent increased alcohol consumption rather than vice versa (Bell & Britton, 2014). Further, a recent genome-wide study found alcohol consumption quantity was genetically associated with schizophrenia, bipolar disorder, depression and attention deficit hyperactivity disorder (ADHD), however, frequency of alcohol consumption was associated with a reduced risk of depression and ADHD (Marees et al., 2020). This suggests that the pattern of associations between mental health problems and types of drinking are less well understood. Nonetheless, the implications of alcohol use are wide-reaching and alcohol use, particularly AUD, increases the risk of physical and mental health problems. However, there may be differences by the type and level of drinking, and the type of physical or mental health problem examined.

1.1.4 Groups at risk of experiencing alcohol harms

Early research showed that the prevalence of alcohol consumption and AUD differs between countries, but also between demographic groups within a population, e.g. the higher prevalence amongst males (Griswold et al., 2018). However, recent research suggested a narrowing of the gender difference gap of alcohol consumption, binge-drinking, and AUD. For example, a study which examined cohort and gender-specific age effects of alcohol abstinence and consumption in the UK found that post-1985 cohort females reported both increased abstinence and increased consumption (Meng, Holmes, Hill-McManus, Brennan, & Meier, 2014). These findings have also been supported by recent reviews which found declines in gender differences in recent generations (Erol & Karpyak, 2015; Keyes, Li, & Hasin, 2011). The decline in gender differences may be explained by changes in gender roles with more women in employment (Holmes et al., 2019). Meanwhile, a meta-analysis of SES, gender and alcohol-attributable deaths found no gender differences in alcohol-attributable deaths among lower SES groups (Probst, Kilian, Sanchez, Lange, & Rehm, 2020) which suggests that some of the current trends may depend on how advantaged an individual is. There are demographic groups, for example, some racial and ethnic minority groups who were at an increased risk of alcohol-related deaths (Bayley & Hurcombe, 2010; Gleeson, Thom, Bayley, & McQuarrie, 2019) and alcohol-related liver disease (Gleeson et al., 2019) despite these groups typically reporting lower levels of alcohol use compared to White British populations.

In the last decade there has also been a focus on the risk of alcohol harms based on an individual's SES; specifically the notion that those of a higher SES (e.g. higher educational level) are more likely to report increased alcohol consumption but less likely to experience alcohol harms (Beard et al., 2016) compared to those of lower SES. This has been coined the "Alcohol Harm Paradox" whereby those from social economically disadvantaged backgrounds are more likely to experience alcohol harms despite reporting drinking less than those from more advantaged backgrounds (Bellis et al., 2016). SES can be measured by a range of indicators, such as income, highest educational attainment, and housing tenure. Such indicators can be used individually or collectively to define how advantaged or disadvantaged an individual is in society (Collins, 2016). The alcohol harms paradox can be explained by i) patterns of alcohol use, ii) other health behaviours, iii) access to services, and iv) co-occurring health problems.

In terms of patterns of alcohol use, a recent Australian study showed a higher prevalence of AUD among those from the poorest backgrounds compared to middle and richest backgrounds (Hashmi, Alam, Gow, & March, 2021). Other research found those with lower educational attainment and household income was associated with an increased odds of binge-drinking (Haque et al., 2021), though this pattern may depend on the age of the sample

(McKetta & Keyes, 2020). Differences in associations between SES and patterns of alcohol use based upon the type of SES measured have been observed. For example, a study examined cross-sectional associations of different categories of alcohol use with a range of SES indicators; the strongest predictor of frequency of alcohol consumption was social grade, educational qualification was the best individual predictor for quantity of alcohol consumed, frequency of binge-drinking and mean average weekly unit consumption (Beard et al., 2016). Elsewhere, lower educational attainment was associated with a two-fold increase in the odds of reporting alcohol abuse/dependence, compared to college or higher educational attainment, while the associations with household income was non-significant (Chen, Kessler, et al., 2019). Nonetheless, another study using data from the English general population, reported that 7.8% of non-working individuals had an AUD compared to 5.1% of working individuals (Rhead et al., 2020). This research highlights the complexity of assessing the socioeconomic patterns of alcohol use due to variations in how SES can be measured.

Some groups may also be at greater risk of alcohol harms through other health behaviours, such as smoking and poor diet (Bellis et al., 2016), which are also known to contribute towards illness. For example, a study using data of the general population in England found that there was a disproportionate increase in current smoking among people from lower SES increased- and higher-risk drinkers, compared with those from higher-SES groups, though this was not found for poor diet (Bellis et al., 2016). While a literature review found consistent evidence of a higher prevalence of drinking, smoking, poor diet and lack of exercise amongst lower SES groups which subsequently led to a 14-year reduction in life expectancy (Smith & Foster, 2014). This evidence suggests that the increased alcohol harms individuals of lower SES experience may be compounded by other health behaviours.

Increased risk of alcohol harms may also be compounded by access to services whereby those of higher SES are more likely to have better access to services and a reduced risk of adverse health conditions (Collins, 2016). This may subsequently increase the risk of other health issues. For example, a recent systematic review of alcohol use and SES reported that the highest proportion of all-cause mortality was explained by alcohol use, including binge-drinking (Probst et al., 2020). Research has consistently shown that those of lower SES were at an increased risk of alcohol-attributable admission or death (Katikireddi, Whitley, Lewsey, Gray, & Leyland, 2017; Probst, Parry, Wittchen, & Rehm, 2018), and a recent systematic review found increased all-cause mortality rates by alcohol consumption among individuals with low compared to high SES, irrespective of the SES measure used (Probst et al., 2020).

Groups may also be at an increased risk of alcohol harms through having co-occurring health problems. For example, mental health problems. A study conducted in Singapore found weak to moderate associations between mood, and anxiety disorders and binge-drinking, respectively (Lee, Wang, et al., 2020). Elsewhere, an analysis of SES among individuals living in South London found that lower SES groups were more likely to report harmful drinking. However, associations among “economically inactive renters” and harmful drinking were explained by having a common mental disorder (CMD; typically defined as depression or anxiety disorder) (Boniface, Lewer, Hatch, & Goodwin, 2020). This evidence suggests that to attempt to understand alcohol use and groups at most risk of experiencing alcohol harms, there is a need to consider other health behaviours and conditions to better understand this.

The aforementioned research has examined the alcohol harm paradox and SES through individual associations or using a composite (or total) score which may not be the most appropriate method for assessing a complex phenomenon. More recently, research combined similar measures of SES to develop SES profiles of participants which allows researchers to explore associations with AUD in a more nuanced way as such indicators can be intertwined in the social environment (Bloomfield, 2020). One example is reported by Boniface and colleagues which conducted a latent class analysis using multiple indicators of SES, such as income, employment status and housing tenure, and examined associations with AUD. The authors found that “economically inactive renters” were three times more likely to report severe AUD than professional homeowners (Boniface et al., 2020). A similar method was used among a Norwegian sample whereby the class defined by being of younger age, male and having lower educational attainment were more likely to report higher levels of alcohol consumption and negative alcohol consequences (Skogen, Bøe, Thørrisen, Riper, & Aas, 2019). Given the complexity of SES, exploring the role of SES through using multiple indicators to develop groups of individuals provides a better understanding of how different SES indicators relate together with AUD.

1.2 Overview of mental health problems in the general population

1.2.1 Prevalence of mental health problems

It can be argued that mental health problems occur on a continuum from mild problems, which might occur for a short period of time to more severe and chronic problems which may become worse over time, but these problems may not be linear and may occur in episodes (Patel et al., 2018). Nonetheless, it is also common for mental health problems to be treated as binary, which is particularly useful for clinicians, for example the Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) defines mental health problems as a, “*syndrome characterized by clinically significant disturbance in an individual’s cognition, emotion regulation, or behavior that reflects a dysfunction in the psychological, biological, or*

developmental processes underlying mental functioning. Mental disorders are usually associated with significant distress or disability in social, occupational or other important activities.” (American Psychiatric Association, 2013). However, there are variations in the definition and classification of a mental health problem as other classification systems focus on mental health problems in the context of health professionals, such as the International Classification of Diseases, 11th Revision (ICD-11).

Approximately one fifth of adults had a depressive, anxiety or substance use problem, globally, in the past 12 months while nearly one third had one in their lifetime (Steel et al., 2014). In 2015, around 4.4% and 3.9% of adults globally reported having a depressive or anxiety disorder (otherwise known as a CMD) with rates increasing by around 18% and 14% from 2005, respectively (World Health Organization, 2017) and this has also been supported in a recent systematic review (Richter, Wall, Bruen, & Whittington, 2019). Similar to alcohol use, research has shown variations in the prevalence of mental health problems globally (Scott, de Jonge, Stein, & Kessler, 2018). For example, a review of the prevalence of mental health problems in South Asia reported the prevalence ranged from 0.95%-31% depending on the country (Hossain et al., 2020), variations have also been found in Europe (Boyd et al., 2015). In England specifically, a recent study reported that 16% of the general population had a CMD (Rhead et al., 2020). While around 0.6% and 0.3% of adults reported having bipolar disorder and schizophrenia, respectively (also known as severe mental illness, SMI, (National Institute for Mental Health, 2020; Zumstein & Riese, 2020) and that estimates of SMIs globally represented approximately 46 and 20 million adults (Roser, 2018). Despite differences in the prevalence of specific mental health problems, mental health problems are known to contribute towards living with a disability (Whiteford, Ferrari, Degenhardt, Feigin, & Vos, 2015), increased mortality (Walker, McGee, & Druss, 2015) and suicide (Chesney, Goodwin, & Fazel, 2014), while those from the poorest SES backgrounds more likely to report a mental health problem (Hashmi et al., 2021).

1.2.2. Differences between the types of mental health problems

As discussed briefly above, the prevalence of specific types of mental health problems varies. For example, the World Health Organisation reported that depression was one of the most prevalent mental health problems globally, and 4.4% of adults met criteria for depression and this has been demonstrated in other large surveys (Scott et al., 2018). Whereas some problems may be less prevalent but can result in serious functional impairment and interfere with major life activities (National Institute for Mental Health, 2020). For example, a recent systematic review and meta-analysis reported the global point prevalence of schizophrenia in 2016 was 0.28% yet contributed to 1.7% of total disability associated burden (Charlson et al., 2018). As such, classification systems, such as the DSM-5, group mental health problems based on

shared pathophysiology and characteristics (Regier, Kuhl, & Kupfer, 2013). For example, under the DSM-5, agoraphobia, specific phobia, social anxiety disorder (SAD), panic disorder, specific phobia and separation anxiety disorder are classed as an anxiety disorder (American Psychiatric Association, 2016). Therefore, mental health problems may also be grouped more broadly and across separate classifications based on prevalence and impairment (National Institute for Mental Health, 2020); CMD and SMI.

A CMD is broadly defined as a depressive or anxiety problem (World Health Organization, 2017), however, different categorisations have been used. For example, the World Health Organisation defined the following as a CMD; major depressive disorder (MDD)/depressive episode, dysthymia, generalised anxiety disorder (GAD), panic disorder, phobias, SAD, obsessive-compulsive disorder (OCD), and post-traumatic stress disorder (PTSD). However, according to the DSM-5, OCD and PTSD are now distinct mental health classifications, and some may argue that these are not classed as a CMD (Regier et al., 2013). A systematic review and meta-analysis reported the pooled lifetime prevalence of CMD was 17.6% (Steel et al., 2014) though other estimates suggested a prevalence of 4.4% and 3.6% for depressive or anxiety problems, respectively (World Health Organization, 2017). When examining the prevalence of CMD by the type of CMD, the 12-month prevalence of MDD was 7.4% and 4.5% for dysthymia in Finland (Markkula et al., 2015). In other regions, the prevalence of MDD was higher as one study reported a lifetime prevalence of 25.7% in England (Sarkar, Webster, & Gallacher, 2018). With regards to anxiety disorders, an overview of population surveys reported the prevalence of lifetime and 12-month anxiety disorders ranged from 14.5%-33.7%, and 8.4%-21.3%, respectively (Bandelow & Michaelis, 2015). A recent systematic review reported a global prevalence of 11.6% (Baxter, Scott, Vos, & Whiteford, 2013) and another review reported specific phobia and GAD had the highest lifetime prevalence rates, globally, (4.9% and 6.2%, respectively) and panic the lowest (1.2%, (Remes, Brayne, Van Der Linde, & Lafortune, 2016)). The aforementioned evidence shows that while CMD is prevalent in the population, there are marked differences when looking at specific categories of CMD.

According to the National Institute for Mental Health, a severe mental illness (SMI) is defined as a mental, behaviour or emotional disorder resulting in serious functional impairment, which substantially interferes with or limits one or more major life activities (National Institute for Mental Health, 2020). Similar to CMDs, mental health problems included as a SMI can vary, though broadly they include bipolar disorder, schizophrenia and other psychotic conditions (Hardoon et al., 2013; National Institute for Mental Health, 2020). Regarding the prevalence of SMI's globally, there were some variations depending on the type of SMI. A systematic review reported a median point prevalence rate of 3.89% for SMI

(excluding bipolar disorder, (Moreno-Küstner, Martín, & Pastor, 2018)) with the prevalence highest for probable psychosis (17.24 per 1000) and lowest for schizophrenia (6.35 per 100). While a meta-analysis reported the lifetime prevalence of bipolar disorder was 1.02% (Moreira, Van Meter, Genzlinger, & Youngstrom, 2017). Whereas a review of current evidence suggested the prevalence of bipolar disorder was approximately 1% in the general population, though the authors noted variations depending on the type of bipolar disorder and country of study (Rowland & Marwaha, 2018). The current evidence suggests, similar to the prevalence of CMDs, the prevalence of SMIs differ depending on the type of SMI.

It is known that the aetiology and symptoms of specific mental health problems can vary across disorders which may have implications on the extent to which a mental health problem interferes with daily life whereby research has shown that those with a CMD or SMI were more likely to have had a physical health condition in the past year (Buhagiar, Templeton, & Osborn, 2020). The broad categorisations of CMD and SMI acknowledge that there are differences in the prevalence of specific mental health problems and the ways in which this may impact an individual. Indeed, evidence suggested that those with an SMI had higher rates of mortality due to their mental health (Walker et al., 2015), and experienced physical conditions (De Hert, Detraux, & Vancampfort, 2018). With this in mind, it may be that there are further differences in the way in which an individual with a CMD or SMI copes with their condition.

1.2.3. Risk factors of mental health problems

There are several known risk factors of developing mental health problems which broadly encompass genetic, social and environmental factors. The first of which being genetics whereby family studies have shown that genes explained the variance of developing a mental health problem (Guffanti et al., 2016; Hilker et al., 2018; Nivard et al., 2015). However, the extent to which genetics explained these effects appeared to differ depending on the type of mental health problem (Uher & Zwicker, 2017). For example, Hilker and colleagues reported the heritability of schizophrenia was 79% (Hilker et al., 2018), whereas for CMDs, this ranged from 60-70% in childhood and decreased to 40-50% in adulthood (Nivard et al., 2015). These findings suggest that genetics play a role in the risk of developing a mental health problem, particularly for SMI's, though authors also argued that there was an increase in environmental variance as individuals aged (Nivard et al., 2015).

Whereas Uher & Zwicker posit that social and environmental factors including urban environment, low SES, and long-term unemployment contribute to the risk of developing any mental health problem (Allen, Balfour, Bell, & Marmot, 2014; Uher & Zwicker, 2017). A systematic review of reviews found evidence to suggest that neighbourhood level

socioeconomic deprivation, urbanicity and exposure to community level violence was associated with an increased prevalence of mental health problems (Lund et al., 2018). Among individuals with an SMI, research has shown that those living in more disadvantaged neighbourhoods reported higher psychiatric symptoms scores (Von Mach et al., 2020). While a review of the literature found that the physical environment, such as overcrowding, may increase stress and indirectly worsen mental health (Allen et al., 2014). The authors also found that other social and environmental factors, such as adverse conditions in childhood and childhood maltreatment were consistently associated with mental health problems (Allen et al., 2014). Research has supported this whereby cumulative childhood trauma exposure was found to be associated with anxiety problems (Copeland et al., 2018). Elsewhere, research has shown that the prevalence of MDD, PTSD and anxiety problems were higher among participants who reported higher exposure to childhood maltreatment events (McLaughlin, Conron, Koenen, & Gilman, 2010). While a systematic review reported that individuals with bipolar disorder were two-and-a-half-times more likely to have previously experienced childhood maltreatment, compared to those without bipolar disorder (Palmier-Claus, Berry, Bucci, Mansell, & Varese, 2016). It is important to note that much of the research on childhood maltreatment and mental health problems, and of environmental risk factors, reported cross-sectional associations therefore, it is not possible to imply causality.

Other traumatic events have also been associated with the development of mental health problems; a meta-analysis showed associations between experiencing sexual assault and bipolar disorder, PTSD, depressive and some anxiety disorders, respectively (Dworkin, 2018). While it is a requirement to have experienced a traumatic event to be diagnosed with PTSD, these findings found specific events such as being raped, being beaten up by partner, were associated with an increased risk of PTSD, particularly if an individual reported experiencing more than one traumatic event (Darves-Bornoz et al., 2008; McGrath et al., 2017).

Taken together, the current evidence suggests that, like AUD, there are a range of social and environmental factors which contribute towards the development of specific mental health problems which should be taken into consideration to provide a better understanding of mental health problems.

1.2.4 Groups at risk of having a mental health problem

It has been consistently shown that the prevalence of CMDs was higher among women compared to men (Fleury, Grenier, Bamvita, Perreault, & Jean, 2011; Steel et al., 2014) whereas there is some evidence to suggest that the prevalence of SMIs was higher among men, particularly for schizophrenia (Cascio, Cella, Preti, Meneghelli, & Cocchi, 2012; Ochoa, Usall,

Cobo, Labad, & Kulkarni, 2012), but the evidence was mixed for bipolar disorder (Di Florio & Jones, 2010). Nonetheless, the age at which an individual develops a mental health problem differs by the type of problem with a recent meta-analysis of the age of onset of mental health problems reported that the median age of onset for phobia was 8 compared to 13 for social anxiety, compared to 30 for depression and 33 for bipolar disorder (Solmi et al., 2022). While other characteristics, such as ethnicity, have indicated a higher incidence of psychosis particularly among Black African and Black Caribbean groups (Morgan, Knowles, & Hutchinson, 2019).

The social selection/drift hypothesis posits that individuals with a mental health problem (e.g. through family SES) have lower educational attainment and that having a mental health problem makes it more difficult for individuals to improve their SES because of their poor mental health and lower SES (Eaton, Muntaner, & Sapag, 1999; Mossakowski, 2014). Whereas the social causation hypothesis argues that conditions, such as low income and low educational attainment, associated with lower SES subsequently increase the risk of developing a mental health problem due to a lack of resources an individual has which are compounded by low SES factors (Eaton et al., 1999; Goldman, 1994). Therefore, the former argues that individuals experience mental health problems which inhibits their ability to improve their SES whereas the latter argues the reverse and that lower SES conditions increase the likelihood of experiencing mental health problems.

A recent multi-cohort study found that, compared to high SES, low SES was associated with an increase in psychotic disorders and depressive disorders (Kivimäki et al., 2020). While a study examining the prevalence of broad types of mental health problems in Australia across SES groups found that anxiety-related disorders were most prevalent among those of low SES (20.04%) compared to high SES (16.34%) and a similar pattern was found for depressive-related disorders, higher among low SES groups (20.19%) compared to high SES groups (9.96%), (Hashmi et al., 2021). Additionally, there was support from the World Mental Health Surveys for the notion that those of lower SES may be less likely to seek mental health care, though this was most notable through highest education attainment as opposed to income (Evans-Lacko et al., 2018). This indicates that there may be differences in the associations between SES and mental health problems depending on the way in which SES is measured.

When considering broad types of mental health problems, current evidence provides support for the association between SES and CMDs. For example, an observational study used multiple indicators of SES, such as educational attainment and employment status, reported that higher SES was a protective factor of CMD (Hatch et al., 2011). While a study using the

same dataset found that unemployment, low income, low educational attainment, in debt and living in social housing was associated with an increased odds of having a CMD (Goodwin et al., 2018). When examining the prevalence of CMD among working and non-working groups, the prevalence was higher among non-working individuals (25.9%) compared to working groups (13.3%) (Rhead et al., 2020). Elsewhere, observational research has shown that indicators of multiple deprivation and living alone was associated with depression and anxiety (Giebel et al., 2020). Whereas for SMIs, a recent longitudinal study found those of lower SES, as defined by area deprivation and urbanity, were more likely to report an SMI compared to those of higher SES though they did not find support for the social selection/drift theory which may be explained by the measures used to assess SES (Lee, DelPozo-Banos, et al., 2020). In contrast, a longitudinal study of urban African Americans found those with comorbid major depression and substance use disorder (SUD, including alcohol) in youth were more likely to report periods of unemployment and lower household income in midlife (Dagher & Green, 2015), though this study was restricted to African Americans only and included illicit drugs as a SUD. Elsewhere, a review of the relationship between SES and schizophrenia, and major depression found support for the social/selection drift hypothesis and schizophrenia, whereby family studies showed that those admitted with schizophrenia were of a lower SES group than their grandparents, indicative of a drift down the SES ladder (Saraceno, Levav, & Kohn, 2005). However, Saraceno and colleagues found more support for the social causation hypothesis for MDD, where those of lower SES were nearly twice as likely to report MDD compared to those of higher SES. The review also reported further differences in findings when considering other demographic characteristics, such as gender and ethnicity. Nonetheless, the evidence for the social selection/social drift is currently mixed and depend on the type of mental health problem and SES measure.

It is also known that other lifestyle behaviours may increase the risk of developing mental health problems. A recent meta-review of health behaviours found some evidence to suggest that higher levels of sedentary behaviour increased the risk of depression over time (Firth et al., 2020). The authors also found that smoking increased the risk of depression and schizophrenia, respectively, while insomnia increased the risk of depression, anxiety and psychotic disorders (Firth et al., 2020). This indicates that groups who were less active, smoked and had difficulty sleeping may be at an increased risk of experiencing mental health problems and these may be exacerbated by an individual's circumstances, particularly if they were from a more disadvantaged background. Indeed, a recent multi-cohort study in the general population reported that after adjusting for such lifestyle factors, individuals of lower SES, compared to higher SES, had an increased risk of mood and psychotic disorders (Kivimäki et al., 2020).

The aforementioned research indicates that there are differences in the risk of developing a mental health problem depending on demographic, SES and lifestyle factors. Nonetheless, there is consistent evidence to show that even when adjusting for lifestyle factors, those of lower SES are more likely to report poorer mental health and are also less likely to seek help for this. With this in mind, SES should be considered when seeking to understand mental health problems, specifically how associations of SES with mental health problems differ across specific types of mental health problems beyond broad problems such as CMDs.

1.3 Overview of co-occurring alcohol and mental health problems in the general population

1.3.1 Prevalence of co-occurring alcohol and mental health problems

While both AUD and mental health problems are prevalent in the general population, it is also known that these frequently co-occur. Early national surveys conducted in the general population showed that the prevalence of AUD was higher among those with a mental health problem, compared to those without (Burns & Teesson, 2002; Kessler et al., 1997; Regier et al., 1990). This pattern has continued as more recent surveys have shown associations between AUD across a range of mood, anxiety and personality disorders (Grant et al., 2015). More recently, a large survey of households in the UK, the UK Biobank, reported variations in the prevalence of severity of AUD among those who met criteria for depression, hypomania/mania, anxiety disorder or PTSD, where the prevalence was highest for hypomania/mania (28%) and lowest for depression (22%, (Davis et al., 2020). Meta-analyses have supported these findings whereby the odds of reporting AUD were between two and three-fold depending on the type of mental health problem and severity of AUD (Di Florio, Craddock, & van den Bree, 2014; Lai, Cleary, Sitharthan, & Hunt, 2015; Schneier et al., 2010). Much of the evidence was cross-sectional, however, the temporal onset of AUD and mental health problems using the World Mental Health Surveys found the mental health problem occurred before the development AUD, though this was not the case for bipolar disorder, panic disorder and GAD (Glantz et al., 2020).

While it is evident that alcohol and mental health problems co-occur, the extent to which they co-occur according to severity of AUD and type of mental health problem (e.g., major depression or bipolar disorder) varies. For example, Grant and colleagues examined the prevalence and associations of AUD according to severity across different types of mental health problems. They reported stronger associations for more severe levels of AUD while associations for specific mental health problems were stronger for more severe problems, such as bipolar disorder (Grant et al., 2015). This study showed that those with any mood disorder were one-and-a-half times more likely to report any AUD, but when stratified by severity and specific type of mood disorder, associations were two and a half fold for severe AUD and

bipolar I disorder and one and a half fold for MDD indicating differences in the associations between AUD and specific types of mood disorder (Grant et al., 2015). Such differences may be explained by the severity of the mental health problem whereby those with an SMI may be more likely to report an AUD compared to those with a CMD. This indicates that the relationship between AUD and mental health problems may be more complex with differences found when examining the relationship by severity and the type of mental health problem.

1.3.2 Co-occurring alcohol and mental health problems by severity of AUD

Previous research which has examined the prevalence and associations between mild levels of AUD and mental health problems have been mixed. Data from early national surveys found that those with a mental health problem were not more likely to report mild levels of AUD (Regier et al., 1990), with the exception of specific types of phobia (Kessler et al., 1997). While more recent cross-sectional data reported one and a half fold associations between mild levels of AUD and specific types of anxiety disorder, namely GAD, and borderline personality disorder respectively (Grant et al., 2015). Longitudinal data found that only those with ADHD or antisocial personality disorder were twice as likely to report mild levels of AUD ten years later whereas individuals with other mental health problems, such as depression or anxiety disorder did not (Swendsen et al., 2010). Such mixed findings suggest that, as previously mentioned, having a mental health problem may not necessarily increase the likelihood of reporting AUD at mild levels. Further, several studies examining the prevalence and associations between mild AUD and mental health problems have also examined this for moderate levels of AUD.

Early national survey data shows that those with a mental health problem were more likely to report moderate or severe levels, and this was evident across mood, anxiety and psychotic disorders (Kessler et al., 1997; Regier et al., 1990). Specifically, Regier and colleagues reported over three-fold associations of reporting moderate or severe levels among those with schizophrenia or bipolar disorder while associations with other mood disorders were non-significant (Regier et al., 1990), whereas Kessler and colleagues reported five-fold associations among men with bipolar disorder (Kessler et al., 1997). These studies reported either no or weak associations with anxiety disorder indicating differences in associations between severity of AUD and the type of mental health problem. More recent data showed similar patterns (Swendsen et al., 2010) where those with any mood or anxiety disorder were around three times more likely to report moderate or severe levels, however, associations seemed driven by bipolar and panic disorder, respectively. In addition, a recent study found that having a CMD explained the increased risk of more severe levels (Boniface et al., 2020). These findings indicate that those with a mental health problem are more likely to report more severe levels of AUD and that associations differ between the specific type of mood and

anxiety disorder. Such differences strengthen the notion that co-occurring AUD and mental health comorbidity is complex and that consideration for the type of mental health problem should be considered when exploring the nature of this relationship.

1.3.3 Co-occurring alcohol and mental health problems by the type of mental health problem

The aforementioned evidence has shown that AUD and mental health problems do co-occur, particularly when considering the severity of AUD. With broad categorisations of types of mental health problems, such as CMD and SMI, and genetic research establishing variations in the heritability of such problems. Genome-wide research has shown a causal link of major depression on more severe levels of AUD (Polimanti et al., 2019) and these findings have been shown in twin studies (Prescott, Aggen, & Kendler, 2000). However, there may be ethnic differences in the genetic risk variants of co-occurring moderate and severe levels of AUD and major depression (Zhou et al., 2017). Longitudinal evidence has also shown an increased associations of incident moderate and severe levels of AUD among those who drank to cope with mood symptoms (Crum et al., 2013). Elsewhere, longitudinal research found 57% of individuals with co-occurring major depression and AUD, major depression preceded AUD indicating that alcohol was used to cope with poor mental health (Brière, Rohde, Seeley, Klein, & Lewinsohn, 2014). Observational research has shown associations between major depression and AUD, with associations strongest for more severe levels (Boschloo et al., 2011; Grant et al., 2015). Compared to other common mood disorders, such as dysthymia, research has found associations with major depression and moderate and severe AUD, but this was not found for mild levels (Blanco et al., 2010). With regards to other anxiety disorders, the relationship with mild levels of AUD is unclear. Among those with SAD, associations were nearly three-fold for moderate or severe levels of AUD and one-and-a-half-fold for mild levels (Alonso et al., 2004; Schneier et al., 2010). While data from a French dataset reported an overall prevalence of mild AUD of 4.4% among those with an anxiety disorder, though rates ranged from 3.6%-6.5% depending on the type of anxiety disorder (Leray et al., 2011). These findings support early evidence that those with a mental health problem are more likely to report AUD at more severe levels, and that the extent to which they do may depend on the type of CMD.

Early research using national data from an American sample found that those with schizophrenia were nearly four times more likely to report an AUD, while associations for bipolar disorder were even greater at five and a half times more likely (Regier et al., 1990). More recent research has continued to report higher prevalence rates and associations between SMIs and mild levels of AUD. One study in Australia reported that 58% of those with an SMI reported daily/almost daily alcohol use during their heaviest use period, with the prevalence

highest for those who had an “other psychosis” diagnosis (65.2%, (Moore, Mancuso, Slade, Galletly, & Castle, 2012). While research in the United States reported that 54% of those with bipolar disorder reported an AUD (Oquendo et al., 2010). Other research have reported those with an SMI were four times more likely to report heavy drinking (Hartz et al., 2014). Elsewhere, research have shown those with bipolar I disorder were two and a half times more likely to report severe levels of AUD (Grant et al., 2015) and a systematic review reports that those with bipolar disorder were four times more likely to report AUD with stronger associations for more severe levels (Hunt, Malhi, Cleary, Lai, & Sitharthan, 2016).

These findings show that there are differences in the associations between specific mental health problems and AUD, with evidence consistently showing an association between MDD, bipolar disorder, and schizophrenia with AUD. However, associations with types of anxiety disorders are less clear. Stronger associations between mental health problems and more severe AUD have been consistently shown but there are few studies which have examined associations across the spectrum of specific CMDs and SMIs. Nonetheless, research has shown that alcohol and mental health problems co-occur and it may be that this happens because individuals with a mental health problem use alcohol to cope (Dyer, Heron, Hickman, & Munafò, 2019; O'Hare & Sherrer, 2011; Thornton et al., 2012).

1.3.4 Multimorbidity

Individuals with co-occurring alcohol and mental health problems are also defined as having a multimorbidity, that is having two or more long-term health conditions which can include mental and physical health conditions, alcohol or substance misuse, sensory impairment or symptom complexes (National Institute for Health and Care Excellence). The global pooled prevalence of multimorbidity in any age group has been estimated at 33.1% (Nguyen et al., 2019). Depression and anxiety disorder have been found to be the second most prevalent multimorbidity disorders in primary care settings in England (Cassell et al., 2018). Research has shown that multimorbidity was more common among females and increased with age (Cassell et al., 2018; Nguyen et al., 2019; Wang et al., 2019) though research has also shown that approximately 35% of individuals aged 55-64 and 55% of those aged 65 to 74 have multimorbidity (Jindai, Nielson, Vorderstrasse, & Quiñones, 2016). More recently, a multi-cohort study in Finland found that the most common temporal sequences of multimorbidity began with mental health and substance use problems which were followed with physical conditions, such as liver disease and types of cancer (Kivimäki et al., 2020). It has also been consistently shown that those of lower SES were more likely to experience multimorbidity (Cassell et al., 2018; Schiøtz, Stockmarr, Høst, Glümer, & Frølich, 2017; Violan et al., 2014; Wang et al., 2019). This indicates that the implications of having co-occurring alcohol and

mental health problem are far-reaching and that there are specific groups of individuals who may be more likely to experience this.

1.3.5 Help-seeking

It has been established that co-occurring alcohol and mental health problems are prevalent, and that there are implications of this. It is important to then understand the extent to which individuals with a co-occurring problem seek help and under what conditions as research has indicated that individuals with a mental health problem were more likely to seek help from general health services rather than specialty mental health services and that there were associations between the severity of the problem and the probability of seeking help (Wang et al., 2007). More recently, evidence suggested that help-seeking also varied by the type of problem, with those with types of anxiety (excluding social phobia and adult separation anxiety disorder) and depressive (excluding bipolar disorder) problems more likely to seek help, whereas individuals with an AUD less likely (Evans-Lacko et al., 2018). Similar findings have been shown elsewhere with 74% of individuals with a mood or anxiety disorder accessed services, specifically mental health services, whereas 65% of those with a SUD did not seek services (Reavley, Cvetkovski, Jorm, & Lubman, 2010; Sheerin et al., 2016; Urbanoski, Inglis, & Veldhuizen, 2017). This suggests that there may be a reluctance in seeking help depending on the type of mental health problem an individual has and the type of service they seek.

A lack of identification has been shown to be an important contributing factor towards seeking help, even in severe cases (Andrade et al., 2014; Roberts et al., 2018). Qualitative research has identified that among individuals with a co-occurring alcohol and mental health problem, they did not believe that their drinking was a problem (Motta-Ochoa et al., 2017). In addition, individual's with a mental health problem have been found to prefer managing the problem themselves, particularly if they have lower education (Steele, Dewa, & Lee, 2007) while findings in the general European population suggest that individuals did not believe professional treatment was effective for serious mental health problems (ten Have et al., 2010). Elsewhere, qualitative research has found that both self and institutionalised stigma contributed towards their relationship with healthcare professionals, and found peer support more comfortable (Huggett et al., 2018). Indeed, a literature review identified personal (beliefs, vulnerabilities) and structural (service availability, identification of co-occurring problem, service provision) barriers to service utilization for individuals with a co-occurring mental health problem (Priester et al., 2016). The evidence suggests that identifying a need to seek help is important, particularly for co-occurring alcohol and mental health problems, and that there is some preference for more informal support.

This suggests that there is a need to understand how we can increase awareness for identifying a problem among individuals with a co-occurring alcohol and mental health problem and how we can make services more approachable for these groups. This is particularly important as previous reviews have shown that current treatment for co-occurring alcohol and mental health problems was sequential (e.g. stop drinking first or vice versa) and those with alcohol problems were excluded for treating their mental health problem (Dixon, Holoshitz, & Nossel, 2016; Priester et al., 2016). The integrated treatment model, that is both problems being treated at the same time, is recommended and has been shown to enhance engagement with treatment (Dixon et al., 2016), however, this requires specialist training and access to services. Nonetheless in adopting such approach, we may be able to better treat individuals and address both alcohol and mental health problems in one service which may minimise the potential impact of not treating both conditions.

1.4 Theories of co-occurring alcohol and mental health problems

There are several theories that may explain the relationship between alcohol and mental health comorbidity and there is debate as to whether poor mental health increases alcohol use or alcohol use decreases mental health. Longitudinal and genome-wide research has tested both theories and found poor mental health increased alcohol use (Bell & Britton, 2014; Brière et al., 2014). Motivational theories have long argued that individuals may be motivated to use alcohol or other substances for social, conformity or to cope, and this may particularly be the case among those with mental health problems. While this is the common assumption among motivational theories, there are nuances in the reasons why this may be the case.

1.4.1 Incentive-motivation model

The incentive-motivation model posits that the decision to drink alcohol is based on incentives associated with using that substance outweighing benefits of not using it (Cox & Klinger, 1988). Further, the decision to drink alcohol is based on a combination of sociocultural, environmental and biological factors as well as past experiences with alcohol and their expectations of drinking alcohol. Thus, if the net expected affective change is more positive than other incentives, then the individual is more likely to choose to drink (Cox & Klinger, 2004). They also argue that the decision to drink alcohol is motivated by a desire to either increase positive affect or decreased negative affect and either internally focused towards oneself or externally focused towards other individuals (Cooper, Kuntsche, Levitt, Barber, & Wolf, 2015). Given the multifaceted nature of the decision-making process of drinking alcohol, the extent to which each factor weighs on this decision varies between individuals and the circumstances for which they want to drink alcohol. In the context of co-occurring problems, those with a mental health problem may be motivated to drink alcohol to enhance positive affect. The conceptual validity of this model has been tested by Cooper and colleagues

where four categories of drinking motives were identified; social, enhancement, coping, conformity though did not correspond exactly to Cox and Klinger's model (Cox & Klinger, 2011).

1.4.2 Drinking motives model

An extension of the incentive motivation model is the drinking motives model which was developed and validated using the Drinking Motives Questionnaire by Cooper (Cooper, 1994). The model argues that individuals drink alcohol for either; i) social (drinking to obtain social rewards), ii) enhancement (drinking for pleasure), iii) conformity (drinking to avoid negative social consequences), and iv) coping (drinking to avoid negative emotions) reasons (Cooper, Kuntsche, Levitt, Barber, & Wolf, 2016). This model argues that motives for drinking are defined by reinforcement valence (positive or negative) and source of desired effect (internal or external). Social and enhancement reasons reflect a positive reinforcement through seeking pleasure while conformity and coping reflect a negative reinforcement through avoiding negative consequences. While enhancement and coping reasons reflect an internal desire as a means of improving mood and forgetting bad memories while conformity and social reasons reflect an external desire driven by factors in the environment (Cooper et al., 2016).

In the context of mental health, it could be argued that those with poor mental health are motivated to use alcohol as means of coping with symptoms or to enhance affect. Research has shown that among those with an SMI, drinking to cope mediated the relationship between mental health symptoms and alcohol consumption (O'Hare & Sherrer, 2011). Another study also found that an indirect effect of coping and conformity drinking motives partially accounted for the relation between borderline personality disorder and alcohol problems (Kaufman, Perez, Lazarus, Stepp, & Pedersen, 2020) with similar findings reported by Wycoff and colleagues (Wycoff, Carpenter, Hepp, Lane, & Trull, 2020). Elsewhere, research has shown that coping and enhancement motives acted as mediators and moderators the relationship between PTSD symptoms and alcohol use, and OCD with alcohol consumption and other alcohol outcomes (Bakhshaie, Storch, & Zvolensky, 2021; O'Hare & Sherrer, 2011; Simpson, Stappenbeck, Luterek, Lehavot, & Kaysen, 2014). Similar findings have been reported for other mental health problems and alcohol use, such as ADHD (Grazioli et al., 2019). Based on the current evidence, it seems plausible that the prevalence of co-occurring alcohol and mental health problems may be explained by alcohol being used to cope with poor mental health, however, the motives for doing so may depend on the type of mental health problem.

1.4.3 Self-medication hypothesis

The self-medication hypothesis argues that substances are used to cope, either in terms of managing mental or physical conditions or managing daily life, more specifically, alcohol may be used because of its rapid onset of action and differ according to the individuals' symptoms (Khantzian, 1997). While this hypothesis is similar to the incentive-motivation model and drinking motives model in that it argues that substances act as a coping mechanism. The hypothesis argues that alcohol is used initially as a means of enhancing low mood or poor mental health, however, over time this becomes a coping mechanism for an individual. While alcohol is a depressant, initial consumption may enhance mood and alleviate symptoms of a mental health problem which may encourage an individual to consume more alcohol, however, this can become a maladaptive coping technique and worsen symptoms (Khantzian, 1997).

As mentioned previously, it has been debated whether alcohol worsens mental health or vice versa (Jane-Llopis & Matytsina, 2006), however, qualitative research suggested that alcohol consumption depended on the symptoms of a mental health problem whereby one study exploring alcohol consumption among those with a diagnosis of bipolar disorder found that consumption increased when experiencing low mood and decreased during the manic phase of the condition (Healey, Peters, Kinderman, McCracken, & Morriss, 2009). Another study exploring alcohol use among those with different types of anxiety disorder found that alcohol consumption was only associated with social anxiety rather than other disorders such as GAD (Leray et al., 2011). This suggests that the assumption that alcohol is used to cope with poor mental health may be too simplistic and that there may be differences across the types of mental health problems as found in research noted above. Indeed a recent narrative review of self-medication with alcohol among mood and anxiety disorders reported that 3-15% of those with a specific anxiety disorder used alcohol to cope compared to 12%-24% of those with a type of mood disorder (Turner, Mota, Bolton, & Sareen, 2018).

1.5 Groups at risk of co-occurring alcohol and mental health problems

1.5.1 Demographic characteristics

As mentioned previously, research has shown that there may be sociodemographic differences among individuals who reported AUD or mental health problems, such as gender (Kessler et al., 1997), however, there have been relatively few studies which have examined which sociodemographic groups were more likely to experience co-occurring alcohol and mental health problems (Jane-Llopis & Matytsina, 2006). Of those which have, gender differences have been observed whereby men were more likely to have co-occurring alcohol and depressive problems (Alonso et al., 2004). Other research has shown that a higher frequency of PTSD symptoms at baseline was related to more AUD symptoms later among males but not among females (Bremer-Landau & Caskie, 2019). However, the reverse has been found

for severe psychological distress whereby females with past year severe psychological distress were four times more likely to report a past year AUD compared to males (Verplaetse, Peltier, Roberts, Pittman, & McKee, 2021). Further, in China, research among male participants found those with a mental health problem were less likely to report an AUD (Phillips et al., 2017). Some differences may be explained by the symptoms associated with the co-occurring problems. A study using network analysis found that depressed mood and ability to concentrate were positively associated with AUD and MDD symptoms among men. Whereas psychomotor agitation/retardation and important activities given up or reduced, decrease/increase in weight and important activities given up or reduced, ability to concentrate and drinking more/longer than intended, and ability to concentrate and tolerance were positively associated to AUD and MDD symptoms among women (Shim et al., 2020).

A recent review of self-medicating with alcohol among those with and without an anxiety or mood disorder found certain demographic groups were more likely to report self-medicating, namely male, younger age, separate/divorced/widowed, and White ethnicity (Turner et al., 2018), indicating that co-occurring AUD and mental health problems may be explained by other demographic characteristics. Indeed, research found that being aged 35 was associated with a decreased odds of having a co-occurring anxiety and SUD whereas having a lower secondary school education was associated with a two-fold increase in the odds of reporting a co-occurring anxiety and SUD. Finally, living without a partner, compared to with, were associated with a two-fold increase in the odds of reporting a co-occurring mood and SUD (De Graaf, Bijl, Smit, Vollebergh, & Spijker, 2002). This study, however, included drug use disorder in their definition of SUD which can be problematic as associations with other types of substances might differ. While a study in France reported similar findings whereby being male, aged 18-34, and living alone was associated with an increased risk of co-occurring anxiety disorder and mild levels of AUD (Leray et al., 2011). Whereas in Norway, a higher prevalence of AUD were reported for men and women with a MDD ten years later while a lower prevalence of AUD were reported for both genders with an anxiety disorder ten years later (Gustavson et al., 2018), indicating differences in AUD depending on the age and type of mental health problem.

Current evidence suggests that while demographic characteristics on co-occurring alcohol and mental health problems is still debated, such characteristics may partially explain such associations to such extent that these characteristics should be considered in future research. Particular attention should be paid to how associations with demographic characteristics change when considering the severity of AUD and type of mental health problem.

1.5.2 Socioeconomic characteristics

As discussed above, current theories argue that those of lower SES are more likely to experience alcohol harms, also known as the alcohol harm paradox (Bellis et al., 2016), and worsened mental health, also known as the social causation hypothesis. There is an abundance of research which has examined associations between SES and alcohol use, and mental health problems, respectively. Such research has shown that those of lower SES were more likely to experience alcohol harms but not necessarily report higher consumption (Katikireddi et al., 2017) whilst other research has shown associations between lower SES and worsened mental health (Boniface et al., 2020; Goodwin et al., 2018; Lee, Herrenkohl, Kosterman, Small, & Hawkins, 2013). For example, a study which used a large US survey found having a less than graduate or professional degree was associated with an increased likelihood of reporting an AUD, while having some college or high school education was associated with mood and anxiety disorder, though this effect seemed driven by bipolar disorder and social phobia, respectively (Erickson et al., 2016). Further, a genome-wide study reported that increased educational attainment was associated with reduced frequency of binge-drinking, and total drinks consumed per day (Rosoff et al., 2021). However, there is a lack of research which has examined the relationship between SES, alcohol use and mental health problems despite previous research showing associations between such variables, respectively.

Of the limited research that has examined the relationship between SES, alcohol use and mental health problems, it is suggested that associations depend on how SES is measured. For example, one study showed associations between depressive symptoms and increased alcohol consumption among those with middle-level education, but associations were found regardless of whether an individual was in employment (Martinez, Neupane, Perlestenbakken, Toutoungi, & Bramness, 2015). This study also showed associations between depressive symptoms and binge-drinking among those either unemployed or in part-time employment, however, no association was found with indicators of education (Martinez et al., 2015). Elsewhere, a study examining youth SES as a predictor of later in life co-occurring alcohol and mental health problems found a higher SES disadvantage score, as indicated by family income, parental employment and parental education, compared to a lower SES disadvantage score, was associated with a five-fold increase in the odds of reporting later in life co-occurring alcohol and mental health problems (Salom, Williams, Najman, & Alati, 2014).

Based on the aforementioned research, compared to higher SES groups, lower SES groups were more likely to experience co-occurring alcohol and mental health problems. However, associations may differ depending on how SES is measured as previous research indicates differences in associations between education and employment status and this should

be explored in more detail to better understand the role of SES on co-occurring alcohol and mental health problems.

1.5.3 Social support

The role of social support was initially recognised by Cohen and Wills (Cohen & Wills, 1985) in their review of evidence of social support as a “buffer” against poor health outcomes or in times of stress, this is also known as the stress-buffering hypothesis. The hypothesis argues that alcohol acts as a non-specific tension reduction technique and viewed as a behavioural outcome as a result of the stress that an individual experiences rather than a coping mechanism (Chan, Chen, Ip, & Hall, 2020; Neff, 1993). The hypothesis suggests that factors, such as social support, mitigates or buffers against the likelihood of maladaptive behaviours when under stress, for example AUD (Cohen, Hammen, Henry, & Daley, 2004). Social support is known as the social resources that an individual perceives as being available to serve their needs, such support can be used to meet emotional, informational or instrumental needs (Gottlieb & Bergen, 2010). Cohen and Wills’ review found evidence to suggest that social support protects individuals from the negative effects of events, such as stress (Cohen & Wills, 1985). However, research indicates that there may be preferences the type of support sought, e.g. peer networks (Huggett et al., 2018).

The relationship between social support and AUD is mixed. A recent study of associations between social support and alcohol and mental health problems showed no association with moderate levels of AUD (Smyth, Siriwardhana, Hotopf, & Hatch, 2015). This was also found in a cohort study whereby social support when experiencing a significant life event was not associated with later AUD (Maulik, Eaton, & Bradshaw, 2010). These findings may be explained by the specificity of who the social support networks and specific life events are. For example, research among individuals who received treatment for substance abuse found perceived social support by family and friends was associated with lower internalized stigma of substance abuse, depression and anxiety (Birtel, Wood, & Kempa, 2017).

Cohen and Wills’ review found that social support was negatively related to mental health (Cohen & Wills, 1985) which was further supported by a more recent review whereby social support reduced psychological distress and promoted psychological adjustment to chronically stressful conditions (Taylor, 2011). Research on social support has become more prevalent recently, particularly with regards to its association with mental health problems. For example, Smyth and colleagues also found that social support, specifically emotional support, was associated with a decreased risk of a CMD (Smyth, Siriwardhana, et al., 2015). A similar pattern was reported by Maulik and colleagues whereby increased social support was associated with an 80% reduction in the odds of panic disorder when experiencing a

significant life event, however, this was not found for other anxiety or depressive problems (Maulik et al., 2010). A systematic review of social support and loneliness and outcomes of mental health problems using longitudinal evidence found that poorer social support at baseline was a predictor of higher symptom severity, lower rates of recovery for CMDs at follow up, though the authors noted some differences with SMIs (Wang, Mann, Lloyd-Evans, Ma, & Johnson, 2018). While other research has shown implications of social support on functioning whereby social support fully mediated the negative association between full-time employment and depression (Perreault, Touré, Perreault, & Caron, 2017).

The mixed findings may be explained by the type of social support an individual receives, how it is perceived and the type and severity of alcohol and mental health problem. As mentioned previously, Gottlieb and colleagues (Gottlieb & Bergen, 2010) argue that social support presents in different forms; emotional, instrumental and informative. It may be that specific types of social support are more useful for some mental health problems than others as reported by Smyth and colleagues (Smyth, Siriwardhana, et al., 2015). Taylor (Taylor, 2011) highlighted the importance of measuring perceived and actual social support. Social support may be more useful for CMDs whereas more severe problems, such as schizophrenia, may be more complex, such as stigma, and compound the mental health problem. Nonetheless, the level of social support an individual experiencing mental health problem may contribute towards their coping response; that is individuals with greater social support may be less likely to use maladaptive approaches such as drinking to cope.

1.5.4 Neighbourhood disadvantage

Much like individual social support, it is proposed that neighbourhood disadvantage can be a risk factor for co-occurring AUD and mental health problems. The social causation hypothesis posits that individuals living in neighbourhoods with increased poverty may be more likely to experience stress and report poor mental health (Eaton et al., 1999), or report a higher prevalence of AUD, as proposed by the self-medication theory (Khantzian, 1997), or both (Bloomfield & Stock, 2013). Indeed, research exploring the relationship between neighbourhood disadvantage and AUD thus far has shown that men from the most disadvantaged neighbourhoods were more likely to report more alcoholic drinks weekly (Matheson, White, Moineddin, Dunn, & Glazier, 2012) while young adults living in neighbourhoods with high rates of property crime were nearly twice as likely to report binge-drinking (Fairman et al., 2020). However, as reported by Matheson and colleagues (Matheson et al., 2012), individual characteristics such as gender may play a role in these associations. Indeed, a study using cross-sectional data in the US found that gender moderated the association between neighbourhood disadvantage and alcohol harms to others (Karriker-Jaffe & Greenfield, 2014). While a recent review also reported that individual SES characteristics

explained differences in neighbourhood disadvantage such as, living in social housing or having no educational qualifications (Jones & Sumnall, 2016). A similar trend has also been found among studies examining associations between neighbourhood disadvantage and mental health problems (Haines, Beggs, & Hurlbert, 2011; Jokela, 2014; Silva, Loureiro, & Cardoso, 2016) whereby other factors such as social support, social networks and individual characteristics partially explained these associations. Santiago and colleagues (2011) argue that discrepancies between findings, particularly for studies focussing on mental health problems, may be explained by the type of neighbourhood disadvantage, such as poverty-related stress and income-to-needs (Santiago, Wadsworth, & Stump, 2011).

When considering the type of neighbourhood disadvantage, characteristics such as a lack of cohesion and integration, poverty and low social control, may increase stress and crime which could extend to an increase in mental health problems and misuse of alcohol and other substances as posited by the social disorganisation theory (Kubrin, 2009; Kubrin & Weitzer, 2003; Sampson & Groves, 1989). Research of neighbourhood disorganisation has shown that individuals who lived in high crime neighbourhoods were more likely to report a CMD (Stockdale et al., 2007). However, the relationship between neighbourhood disorganisation and AUD is more complex, for example, Stockdale and colleagues reported no association between high crime neighbourhoods and AUD (Stockdale et al., 2007) and a similar finding was reported among an adolescent population (Brenner, Bauermeister, & Zimmerman, 2011). Whereas a longitudinal study of AUD symptoms, neighbourhood disorganisation and psychological distress over 18 years reported individuals living in more disorganised neighbourhoods were more likely to report severe AUD symptoms while psychological distress partially mediated this relationship (Cambron et al., 2017).

As noted by Santiago and colleagues (Santiago et al., 2011), the mixed evidence may also be explained by the indicators used to assess both AUD and neighbourhood disorganisation or it may be that other factors may contribute towards this relationship, such as social support. In this sense, the extent to which a neighbourhood is organised may also be considered alongside social support as Lin and colleagues (1999) found that structures, such as community ties, developed social networks, and thus increased social support within the neighbourhood. Lin and colleagues reported that such structural support, through belonging, bonding and social relations affected levels of depression (Lin, Ye, & Ensel, 1999). These findings may also be explained by individual SES as this may contribute towards where an individual lives. For example, a study of public sector employees found that living in disadvantaged areas was associated with co-occurrence risk behaviours (such as heavy alcohol use) but individual SES, such as occupation, explained some of this variance (Halonen et al., 2012). Therefore, both neighbourhood- and individual-level factors should be considered.

While current evidence of neighbourhood disadvantage and alcohol and mental health problems are mixed, the theory behind such relationships are partially supported elsewhere in other theories of AUD and mental health problems more broadly, such as the social causation hypothesis. Further, given that research has consistently shown that individual-level SES is associated with AUD and mental health problems, it may be that the mixed evidence of neighbourhood-level SES is explained by large variations in the way in which it is measured. It is, therefore, important to consider such contextual factors when seeking to understand the relationship between alcohol misuse, mental health problems and SES.

1.6 Summary of background

1.6.1 What is known

It has been shown that both AUD and mental health problems are prevalent in the general population, respectively. It has also been shown that those with a mental health problem are more likely to report AUD and that this may arise due to individuals using alcohol to cope. Further, individual characteristics as defined by demographics and SES contributed towards this co-occurrence and that differences in the prevalence of co-occurring alcohol and mental health problems may depend on the severity of AUD and the type of mental health problem. Despite the prevalence of co-occurring alcohol and mental health problems, there are differences in the uptake of services to address these issues and this may be explained by the type of problem an individual has and the type of professional or personal service they seek.

1.6.2 What is not known

Firstly, there is limited evidence to show whether those with a mental health problem are more likely to drink harmfully across different types of drinking patterns, such as binge-drinking and AUD. It is difficult to determine whether those with a mental health problem drink in the same way, for example those with a mental health problem could drink more harmfully but not necessarily. Secondly, despite research showing differences in the prevalence of AUD based on the type of mental health problem, there is a lack of evidence examining whether those with specific mental health problems are more likely to report AUD within the same dataset, for example GAD and MDD. Therefore, it is not known whether alcohol is used in the same way across the types of mental health problem. Thirdly, given that individual characteristics, such as SES, have been found to be associated with both AUD and mental health problems, respectively, little is known about the social patterning across co-occurring alcohol and mental health problems. As a result, it is not known whether those of lower SES are more likely to experience a co-occurring problem, as found when examining these associations separately. Fourthly, it has been suggested theoretically that contextual factors, such as social support and neighbourhood disadvantage exacerbate co-occurring alcohol and mental health problems, but this has not been formally examined. Finally, of the available

research, much has focussed on using quantitative analysis to examine associations between co-occurring alcohol and mental health problems which makes it difficult to understand why these patterns are occurring, particularly given that the uptake of specialist services is low.

1.6.3 Implications

By firstly establishing the patterns of drinking among individuals with a mental health problem, we will be able to understand if there is a particular pattern among those with poor mental health. Further, by then examining the patterns of AUD by the specific type of mental health problem, we will be able to establish whether having any mental health problem is associated with AUD or whether there are nuances by the type of mental health problem. For example, it may be that individuals with a specific type of mental health problem drink more harmfully than those with other types of problems. By also taking into consideration SES and other contextual factors, we will be able to identify whether particular social groups are at most risk of having a co-occurring alcohol and mental health problem. Finally, using qualitative methods will also allow us to better understand individual experiences and under what circumstances alcohol is use among individuals with a mental health problem, the role of specific mental health symptoms and measures taken to cope with their mental health. These qualitative techniques will provide more context to the quantitative evidence and establish potential mechanisms that can be targeted for interventions.

Chapter 2: Aims of the thesis

2.1 Aim one: Review of the existing literature

This thesis first aims to review the literature on the prevalence of AUD, binge-drinking and excessive alcohol consumption among individuals with and without a CMD. Chapter 4 aims to i) report global associations of alcohol use (AUD, binge drinking and consumption) comparing those with and without a CMD, (ii) examine how this differ among those with and without specific types of CMDs and (iii) examine how results may differ by study characteristics. This review was pre-registered on PROSPERO (ref. CRD42019126770).

2.2 Aim two: Estimating the level of co-occurring alcohol and mental health problems

This thesis then aims to estimate the prevalence of alcohol use, including non-drinking, among individuals meeting criteria for specific mental health problems in the general population. Chapter 5 aims to i) examine the prevalence and associations of non-drinking, hazardous and harmful/probable dependent drinking in individuals who do and do not meet criteria for different mental health problems, ii) compare associations across different mental health problems, and iii) determine whether associations remain after adjustment for SES. The aims were pre-registered on Open Science Framework (DOI: 10.17605/OSF.IO/32XKA).

2.3 Aim three: Examining SES, alcohol use and the indirect effect via social support and neighbourhood disadvantage among individuals with a mental health problem

This thesis aims to explore SES profiles of individuals meeting criteria for a mental health problem and to examine how these profiles are associated with alcohol use and whether there is an indirect effect via social support and neighbourhood disadvantage. Chapter 6 aims to i) understand how individuals are clustered based upon multiple indicators of SES to define latent classes, ii) determine associations between SES classes and alcohol use, and iii) examine whether there is an indirect effect of SES on alcohol use via social support and neighbourhood disadvantage. The aims were pre-registered on Open Science Framework (DOI: 10.17605/OSF.IO/H3NTF)

2.4 Aim four: Understanding alcohol use among individuals with a severe mental health problem

The final research chapter of this thesis is a qualitative exploration of alcohol use over time among individuals with a severe mental health problem and how alcohol has been used to cope with mental health. Chapter 7 aims to explore i) how current and previous drinkers with a SMI used alcohol, ii) how people's drinking patterns change when experiencing symptoms of their SMI and, iii) whether drinking patterns have changed since receiving their diagnosis.

Chapter 3. General Methods

3.1 Methodological approach

A multi-methods approach is utilized within this thesis and involves the use of both quantitative and qualitative methods. A multi-methods approach is driven by an overall research question which uses complementary methodologies (Anguera, Blanco-Villaseñor, Losada, Sánchez-Algarra, & Onwuegbuzie, 2018). Multi-methods can be defined as the use of two or more research methods which can involve all quantitative methods, all qualitative methods or a mix of quantitative and qualitative methods (Brewer & Hunter, 1989). While both quantitative and qualitative methods have strengths, quantitative research is deductive in its nature (Creswell, Klassen, Plano Clark, & Smith, 2011), and it is difficult to understand the reasons underpinning such findings. Whereas qualitative methods focusses on obtaining an in-depth understanding of a problem (Creswell et al., 2011), but it is not possible to understand the magnitude of such problem. Using a multi-methods approach allows the researcher to address different parts of a research question while using approaches which provide solutions to problems from each research method (Brewer & Hunter, 1989; Morse, 2015).

In the context of this thesis, it is known that AUDs and mental health problems co-occur, and that particular groups are more likely to develop these individual problems. There is also some evidence to suggest that other factors, such as social support and the environment an individual lives in, can worsen mental health or encourage alcohol use. However, it is not known to what extent these co-occurring problems exist when comparing people with different mental health problems, what other factors are involved in this co-occurrence, and why individuals are likely to have co-occurring problems. Quantitative and qualitative methods can be taken together to understand the extent of a problem and the mechanisms underlying this (Neale, Allen, & Coombes, 2005), in the context of alcohol and mental health, without being fixed to a specific perspective.

Multi-methods is distinct from other alternative approaches, such as mixed-methods, as it does not require integration of methods (Anguera et al., 2018). Instead, the use of two or more quantitative and/or qualitative methods can be used to answer different parts of a research question (Morse, 2015). In the context of this thesis, the extent to which co-occurring problems exist when considering the type of mental health problem an individual has, and what other factors are involved in this co-occurrence can be examined using quantitative methods whereas understanding why this may happen can be understood through qualitative methods. While data is not integrated in this thesis, each research study is conducted in a sequential way where findings from the previous study are used to inform

the following aim and design of the next stage to ensure that the overall research question is addressed.

The aims of the thesis are outlined in Chapter 2. The first aim of the thesis is to establish what previous research has shown with regards to the co-occurrence of alcohol use across the range of mental health problems, and the role of SES. From reviewing the previous literature outlined in Chapter 1, it was clear that there are a range of mental health problems which can be broadly categorized into CMDs and SMIs, but that much of the research has examined the co-occurrence of alcohol use for some specific mental health problems making it difficult to understand what the patterning of alcohol use is among individuals with and without a mental health problem. A systematic review and meta-analysis aimed to address aim one by synthesizing the existing literature to identify the extent to which individuals with and without a CMD report an AUD and other types of alcohol use, compared to those without a mental health problem. In addition, it is clear from previous literature that there is more focus on depression and SMIs but there is less understanding of alcohol use with CMDs (e.g., anxiety) even though these are more prevalent in the general population. With this in mind, the systematic review and meta-analysis focused on only CMDs. In doing so, it can be established what the prevalence of alcohol use is across different types of CMDs and how SES differs among those with co-occurring alcohol and CMDs.

Findings from the first aim are used to establish whether individuals with a CMD are more likely to report alcohol use, and how this patterning may change based on an individual's SES. Aim one informs the second aim of the thesis which extends on aim one's findings through examining the prevalence and associations of alcohol use across a range of mental health problems, beyond CMDs, in the context of England. The findings from aim two can provide a template for future research in other countries given the aforementioned global differences.

The findings from aim two informed aim three as it identifies that individuals with a mental health problem are more likely to report alcohol use, therefore, aim three focusses on this population. Findings from aim two also suggest that SES plays a role in the co-occurrence of alcohol and mental health problems, but it was difficult to examine this in more detail in aim two because adjustments for separate SES measures were made. In addition, discussions with a participatory involvement group following the findings of aim two highlight the importance of SES and identified other factors, such as social support and the environment an individual lives in, as also important. Specifically, discussions around managing co-occurring alcohol and mental health problems without financial and emotional resources were highlighted. As a result, aim three focusses on understanding the SES classes

of individuals who meet criteria for a mental health problem and how these are associated with alcohol use and whether there is an indirect effect of other factors on these associations.

Findings from aims two and three informed aim four as it shows strong associations between mental health problems and non-drinking and harmful/probable dependence. This is particularly novel because there has been a lack of research which has focused on non-drinking among individual with and without a mental health problem, however, these findings showed that non-drinking is more prevalent among those with a mental health problem. It also showed that SES and other factors play a role in alcohol use, but it is difficult to understand these findings with quantitative data. Therefore, these findings suggest that qualitative data is needed to provide a better understanding of alcohol use among people with more severe mental health problems. The order of the research conducted is outlined in a flow diagram (see figure 1).

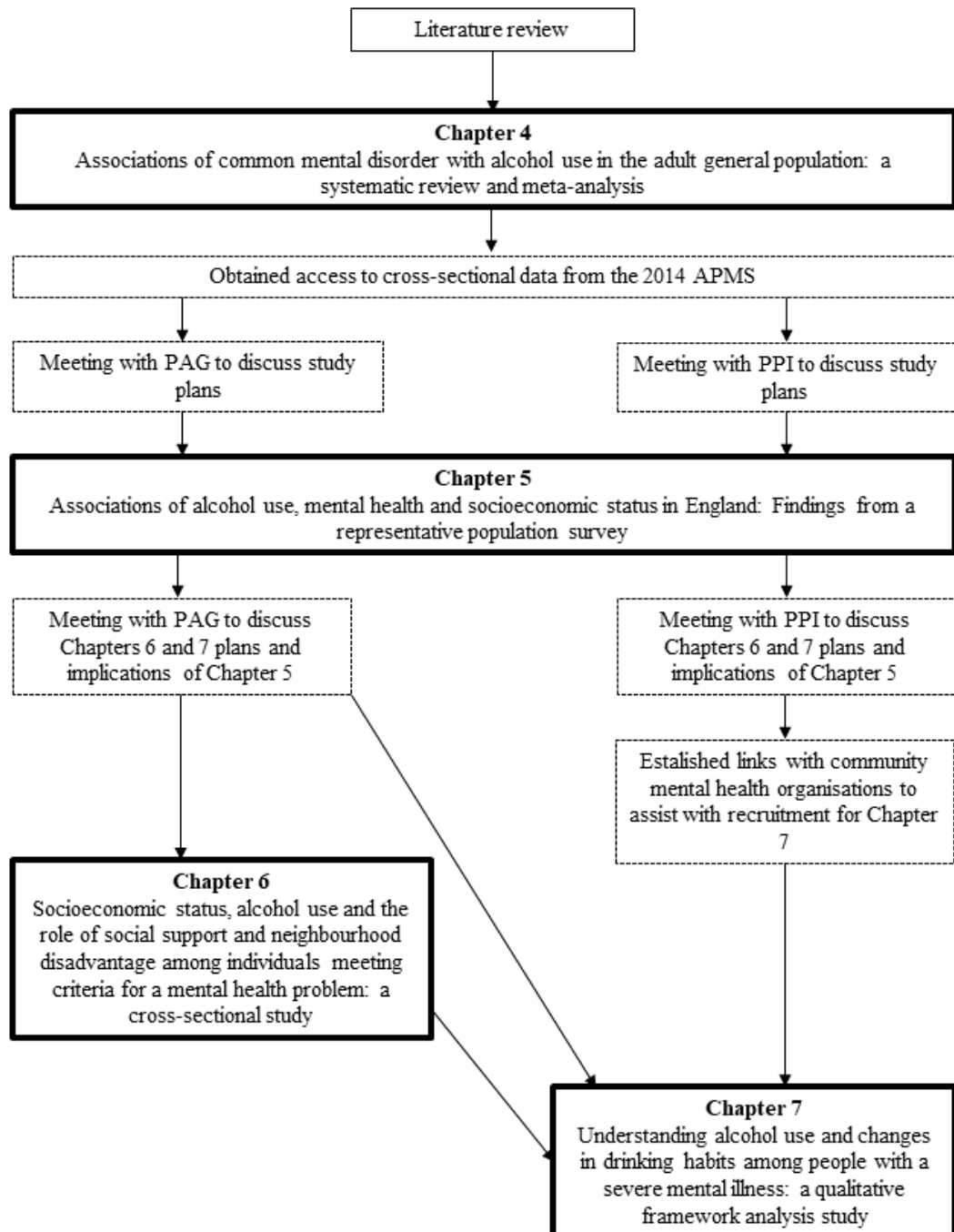


Figure 1: Flow diagram of order of studies conducted in this thesis

3.2 Theoretical approach

The theoretical approach guiding this thesis is pragmatism. Pragmatism prioritizes the research questions and is not fixed to traditional paradigms (Florczak, 2014; Morgan, 2007). Instead pragmatism focusses on the methodology that would be most suitable to address issues and acknowledges that using a fixed paradigm or approach may not be appropriate for a topic or research question (Morgan, 2007). Traditionally, researchers hold an epistemological position relating to their understanding of a phenomenon which contributes

towards the subsequent method and theory of research, otherwise known as methodolatry (Chamberlain, 2000), most discussed are positivism versus constructionism (Yvonne Feilzer, 2009). The former is objective in its nature and seeks to measure a phenomenon (Florczak, 2014). The latter is subjective and seeks to understand phenomenon that are socially constructed (Florczak, 2014). However, taking a methodolatry approach to research can be problematic as adopting a particular viewpoint during the development of a study could subsequently constrain a researcher to alternative methods and phenomenon which may be more suitable to the research question (Yvonne Feilzer, 2009). While there are some differences in pragmatism, this approach accepts that there are both singular and multiple realities, therefore, the approach is free of mental and practical restraints (Yvonne Feilzer, 2009). With these issues in mind, this thesis utilized a pragmatic and inductive approach where each research study informs the next study using the most appropriate research methods. Conducting the thesis in this way ensures that the overarching aim of understanding the socioeconomic patterning of alcohol use and mental health problems is examined in a holistic way (McFee, 2009; Punch, 2013).

This thesis utilizes both quantitative and qualitative approaches whereby taking either a positivist or constructivist approach would contradict one approach. An emerging and alternative approach, critical realism, was also considered. Critical realism is based on a priori beliefs about the world through which theories can be tested and seeks to explore causal mechanisms underlying a phenomenon through empirical investigation and theory construction (McEvoy & Richards, 2006), however, this thesis does not seek to test a theory of the socioeconomic patterning of co-occurring alcohol and mental health problems. Instead, this thesis seeks to understand the extent to which alcohol and mental health problems co-occur, whether there are specific SES groups at most risk of having this co-occurrence, and experiences of alcohol use over time among those with a mental health problem. With this in mind, a pragmatic approach is most suitable because it is not testing a specific theory and instead emphasises on the research questions and consideration of how best to answer these without being fixed to a specific epistemological position (Morgan, 2014).

3.3 Participatory involvement

In the last two decades there has been increasing acknowledgement and need for participatory involvement from patients or members of the public who have expertise in a given area. Both patients and members of the public can provide valuable knowledge due to their lived experience with either a particular condition or of being in services. Participatory involvement involves research that either works with or by the patient or member of the public and can involve these individuals being a member of the research team, a reference

group, in discussions around the development of a study, sharing expertise (Staniszewska, Denegri, Matthews, & Minogue, 2018). This thesis took the approach of involving PPI members at the beginning of the design process for Chapters 5, 6 and 7 and then discussing subsequent findings and their implications on the next aim. The wealth of information a patient or member of the public can provide can help to develop research that is more applicable to the general population and may help to identify key issues that may not otherwise be apparent to the research team.

This thesis acknowledges the value that participatory involvement can add to research, particularly in the field of alcohol use and mental health problems as Chapter 1 outlines several mechanisms through which these issues may co-occur. Therefore, this thesis involves a participatory involvement (PPI) group of members of the public who have lived experience with mental health problems and who drank alcohol. The group meets at the beginning of the development of each study to discuss study plans and how data will be used. As data from Chapters 5 and 6 uses existing data, the group discussed the aims and whether any other issues need to be considered. While for Chapter 7, the aims, data collection methods and interview schedules are developed with the participatory group. At the end of each study, discussion groups are held with the PPI group to discuss the findings and what the implications might be. All members of the participatory group are reimbursed for their time.

3.4 Stakeholder engagement

In line with the emergence of participatory involvement, there has been an increase in the use of stakeholder engagement within research. Engaging stakeholders in research projects can help to narrow the gap between research and system changes. Stakeholders can be policymakers, practitioners and other academics who have expertise in areas relevant to the research topic. Indeed, stakeholder engagement can be particularly useful in highlighting different groups' interest, positions on policy and enhancing the understanding of current processes in place.

As there are recommendations by the Office for Health and Improvement Disparities (OHID, formerly Public Health England) for alcohol and mental health services to be better aligned and closely connected, and that individuals with a co-occurring alcohol and mental health problem should be able to access support from presenting to a range of services (Public Health England, 2017), this thesis involves a project advisory group (PAG). This group consists of stakeholders from third sector and academic backgrounds who have expertise in the field of either alcohol or mental health. Members of the group include Prof Mark Gabbay (University of Liverpool), Prof Matt Field (University of Sheffield), Prof Nicola Fear (King's

College London), Dr Orla McBride (Ulster University), Andrew Misell (Alcohol Change UK), Sally McManus (NatCen), Dawn Lawson (Liverpool Health Partners). Similar to the PPI group, meetings take place at the beginning and end of each study to discuss research plans and implications of research findings.

3.5 Quantitative methods

This section discusses the quantitative methods used in this thesis, with a specific focus on observational epidemiology. Quantitative methods are objective measurements which seeks to gather numerical data within a population and generalize this to a wider population. In epidemiology, the aims are to establish the prevalence and aetiology of a problem. Conducting quantitative methods in epidemiology involves accounting for other factors which may have implications on the findings, such as confounding variables that might be linked with the variables of interest. Examples of confounders include gender, age, and ethnicity. Overall, epidemiology is concerned with the health of the individual but with a broader goal of improving the health of populations (Kleinbaum, Kupper, & Morgenstern, 1991).

3.5.1 Systematic review and meta-analysis

A systematic review is a synthesis of evidence that is relevant to a research question which is used to appraise and synthesize results to inform practice and future research. Systematic reviews involve rigorous methods with an aim to minimize bias, it is a structured process and involves use of methods to provide reliable results (Munn, Peters, et al., 2018). Whereas a meta-analysis integrates the results of multiple independent studies which have the same outcome and, therefore, tend to be used after conducting a systematic review. Meta-analyses require consideration of studies eligible for inclusion, for example, characteristics of participants recruited and predictors. Importantly, the outcome measure must be standardized to allow for comparisons between studies (Egger, Smith, & Phillips, 1997). Due to the nature of a meta-analysis, it can provide evidence for a topic of interest and is useful for informing policy and future research.

The process of a systematic review and meta-analysis consists of multiple stages from developing the research question, ensuring search terms are inclusive, determining the eligibility of literature and assessing the quality of the research. There are several guidelines and software which assist in the process of data synthesis, such as RevMan (Munn et al., 2019). In addition, checklists are used alongside the synthesis of the literature to assess the quality of the evidence, such as the Joanna Briggs Institute. Recently, the Joanna Briggs Institute developed a critical appraisal checklist specifically for cross-sectional studies which

assess the study sampled, measurements use and appropriateness of statistical analysis (Joanna Briggs Institute, 2021).

A systematic review and meta-analysis are particularly useful for this thesis as previous literature on the co-occurrence of alcohol use and mental health problems, and the role of SES, are diverse and use different countries and populations. Further, much of the evidence focusses on depression and SMIs rather than CMDs, such as anxiety. Therefore, with current evidence, it is difficult to conclude the extent to which individuals with and without a CMD use alcohol, and how SES differs between these groups. Further, this method allows a researcher to identify any gaps in the literature, for example whether research focusses on some mental health problems.

3.5.2 Observational epidemiology

There are three main types of observational epidemiology designs: cohort, case-control and cross-sectional studies. Cohort studies include a group of individuals who have common characteristics and are then followed up at specified intervals to determine outcomes. Cohort studies are particularly useful at identifying the incidence or likelihood of an outcome over time, but they can also be used to conduct some cross-sectional analysis at a specific timepoint. Case-control studies seek to identify predictors of an outcome and are usually retrospective. Case-control studies typically involve comparing one population with a specific outcome (e.g., have a diagnosis of depression) with a matched population without said outcome (e.g., do not have a diagnosis of depression). Cross-sectional studies involve a population completing measures at one time point which can then be used to estimate the prevalence (e.g. the number) of individuals with a particular condition at a single time point (Mann, 2003).

It is difficult to infer causality when using observational epidemiology designs because there may be bias or other confounding variables, however, these designs allow researchers to understand the extent to which a problem exist and factors which may contribute towards this in large populations which might not be possible with other designs. Given the aims of this thesis are to examine the patterns of alcohol and mental health comorbidity across the spectrum of mental health problems, and whether there are specific SES groups at most risk of this co-occurrence, the most appropriate design is a cross-sectional design as this may not be possible with other observational designs.

3.5.3 Secondary data

Secondary data are data collected by another researcher or team and has typically been designed for a different overarching research question. The use of secondary data by a researcher will often mean that the researcher has not been involved in the research design

or data collection process (Boslaugh, 2007). There are multiple advantages to using secondary data, for example, it is more cost-effective for the researcher as they will not have invested in data collection, salaries, and participant payment. Relatedly, secondary data requires less time and resources from the researcher as data has already been collected. Finally, a key advantage to the use of secondary data is the breadth of information collection which might not have been possible within a small team of researchers, and this results in a greater representation of a given population (Boslaugh, 2007). With greater breadth of information allows researchers to conduct complex analyses, such as latent class analysis and structural equation modelling. While a greater representation of a population also provides sufficient power, through large sample sizes, to test hypotheses that involve multiple variables.

However, there are several disadvantages to using secondary data, for example, some of the information of interest to the researcher may not have been collected. For some secondary datasets, special permission may be required to access data which can be a time-consuming process and it is not guaranteed that access will be granted. Further, the information collected may not have been coded or categorized in a way the researcher would have preferred, therefore, the researcher is required to conduct extensive reading and investigation of the variables within the dataset to establish; i) how it has been collected, ii) how it has been coded, and iii) whether modifications need to be made to address the research question. Finally, because data is collected by someone else, the researcher does not know why there might be issues with some of the data and why some data may be missing unless this information is made available. With these in mind, it is recommended that a researcher considers the research questions, population, and variables of interest prior to identifying a secondary dataset (Boslaugh, 2007).

In the context of this thesis, secondary data is required because it aims to estimate the prevalence and associations of alcohol use across a range of mental health problems in a large representative sample of people in households, and this is not feasible in a small team of researchers with limited research costs. As this thesis aims to specifically examine the prevalence and associations across a range of mental health problems, the Adult Psychiatric Morbidity Survey (APMS) is the most appropriate mental health cross-sectional dataset as it is the largest mental health survey in the UK, and it uses a range of validated measures of mental health, alcohol use and SES. In addition, the APMS is a representative survey of the adult general population in England and has been conducted every seven years, with the most recent survey conducted in 2014. To access the 2014 APMS, special permission from NHS Digital is required and there are stringent data processing requirements of the researcher and institution where the data will be held. This thesis involves applying for access to the data.

This process includes specifying the research aims, variables that will be used and how they will be used, where and how data will be managed, and how the reporting of findings will be presented to minimize the risk of breaching anonymity. This process also involves liaising with the legal department so that data sharing agreements can be put in place. Further, the thesis develops specific privacy notices so that participants who may have taken part in the 2014 APMS are aware of how their data is being used in this thesis.

3.5.4 Bias

Due to the self-reported nature of observational research, there is a risk of bias. Firstly, cross-sectional studies can be subject to non-response bias (that is differences between participants taking part compared to those not) which can occur through sampling error or groups being less likely to take part in studies which may have implications on the representativeness of the sample (Berg, 2005). Secondly, there may be a risk of self-report bias which occurs when a participant under-reports in a study when answering questions around a particular topic, such as alcohol use (Stockwell et al., 2004). This latter bias can be investigated through examining groups (e.g. gender) who have completed these questions to provide a better understanding of the characteristics of those who may have under-reported (Nelli et al., 2020). While non-response bias can be addressed through weighting strategies, such as the inverse probability weight (Kessler, Little, & Groves, 1995) or using propensity score methods (Härkänen, Kaikkonen, Virtala, & Koskinen, 2014).

Other biases more specific to analyses and reporting of findings which are particularly relevant to systematic reviews and meta-analyses include, outcome reporting bias (selective reporting of outcomes), language bias (findings published in a certain language), and publication bias (the publication of results depending on the direction of the findings) and these biases can be assessed through an inspection of funnel plot asymmetry (Sterne et al., 2011)

There are also criterion available, based on the design of the study, which can be used to minimize the risk of researcher bias, such as the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines (von Elm et al., 2014). This criterion requires researchers to explicitly state the aims of the study, variables used and how they have been treated, how bias has been addressed and how findings are similar or different to previous research. By explicitly stating key information, other researchers are able to understand how the study was conducted and how valid the findings are as this can subsequently affect the validity of findings if data is used as part of a meta-analysis.

3.6 Quantitative analyses

This section outlines the quantitative analyses undertaken in this thesis, including meta-analyses, regression analyses, latent-class analysis, and structural equation modelling.

3.6.1 Statistical inference

Statistical inference is the strength of evidence concerning whether a number of observations is consistent with a hypothesized mechanism. Statistical inference can be used to test hypotheses regarding the proposed relationship between two variables through the calculation of a p-value (Makar & Rubin, 2018). The p-value is a measure of probability that a difference could have occurred by random chance and a p-value of less than 0.05 is typically used to indicate that there is a 5% probability that results occurred by chance but researchers conclude are significant (Fisher, 1922; Neyman & Pearson, 1933).

3.6.2 Systematic review and meta-analyses

Chapter 4 of this thesis reports a systematic review and meta-analysis. As mentioned in section 3.5.1, a systematic review collates existing evidence to address research questions and identifies gaps in the literature. There are reporting standards when conducting a systematic review, such as the PRISMA statement, and guidelines are available to conducted systematic reviews depending on the type of studies included in the review (Aromataris & Pearson, 2014).

Where there are enough studies to address a research question, a meta-analysis may be appropriate. Consideration for the quality of the studies should be given when conducting a meta-analysis as this might affect the validity of the results, the effect of this can be explored in a sensitivity analysis. The results of a meta-analysis involve a pooled effect size (Harris et al., 2008) and further tests can be used to assess publication bias (that is studies with significant findings are more likely to be published (Sterne et al., 2011)). As findings of a meta-analysis are based on findings from several studies, these pooled findings provide good evidence for a research question and an understanding of potential gaps in the literature. Given that Chapter 1 identifies differences in the prevalence of AUD among individuals with specific types of CMDs, a systematic review is deemed appropriate for thesis. Further, Chapter 4 also utilizes meta-analyses where there are sufficient studies which report finding of the same outcome.

3.6.3 Regression analyses

Regression analyses are used to predict the value of one variable (dependent variable) using one or more variables (independent variable), that is, to what extent a variable predicts an outcome (Allen, 2004). In the context of this thesis, the independent variable is the presence of a mental health problem, and the dependent variable is alcohol use. There are different

types of regression analyses, such as linear regression, multiple regression, logistic regression and multinomial regression, and the decision on the appropriate regression to use depend on the types of variables used. For example, a linear regression may have a continuous or binary independent variable whereas a multinomial regression may have a categorical dependent variable with more than two categories.

Given that this thesis aims to examine the extent to which those with and without a specific mental health problem report alcohol use (including non-drinking), binary (two categories) or nominal (two or more categories but without an order) independent variables (predictor variables) and nominal outcome variables are used in Chapter 4, 5 and 6. Specifically, having a CMD is treated as a binary independent variable and AUD is treated as a binary dependent variable in Chapter 4. Meeting criteria for a mental health problem is treated as a binary independent variable and alcohol use is treated as a nominal dependent variable in Chapter 5. Whereas responses to SES measures are treated as binary, nominal or ordinal independent variables and alcohol use is treated as a nominal dependent variable in Chapter 6. Therefore, regression models are used throughout this thesis and multinomial regression models are used in Chapter 5 and 6 as it allows for two or more categories of an outcome variable. Multinomial logistic regressions require a minimum of 10 cases per independent variable, further it does not assume normality, linearity or homoscedasticity (Starkweather & Moske, 2011).

Odds ratios (OR) provides a measure of the effect size which are calculated from the probability of a case occurring based upon exposure to an explanatory variable over the probability of a case based upon no exposure to an explanatory variable (Bland & Altman, 2000). An OR of less than 1 indicates that exposure to an explanatory variable is associated with a decreased probability of an outcome, an OR of more than 1 indicates exposure to an explanatory variable is associated with an increased probability of an outcome, and an OR of 1 indicates that an explanatory variable does not affect the probability of an outcome. Confidence intervals (CI) are used alongside an OR to estimate its precision. A small CI indicates a high level of precision, a large CI indicates a low level of precision while a CI overlapping with 1 indicates a lack of association between the exposure and outcome. Research tends to use 95% CIs and that a large sample size provides narrower confidence intervals (Altman, Machin, Bryant, & Gardner, 2013). As outlined above, multinomial logistic regressions are used in Chapters 4, 5, and 6 and these models predict the probabilities of categories, compared to a reference category, which are presented as a multinomial odds ratio (MOR). An OR (and MOR) does not measure statistical inference, rather 95% CI and p-values should be used alongside an OR to determine significance (Szumilas, 2010).

Throughout the quantitative aspects of this thesis, the MOR, 95% confidence intervals and p-values are used to determine statistical significance.

3.6.4 Latent class analyses

Chapter 6 of this thesis reports a latent class analysis (LCA) which is a method used to analyse relationships between variables (McCutcheon, 1987). LCA is particularly useful when understanding an issue that can be defined or measured by multiple characteristics, such as SES. For example, SES can be assessed through an individual's educational attainment, housing tenure, and occupational grade. Each of these measures assess a specific aspect of SES and LCA can be used in this circumstance by combining responses from each of these measures to provide SES classes of a population. LCA is model-based and proposed indicators should be a reflective measure of the unobserved variable.

The main assumption of LCA is local independence, where associations among observed indicators are explained entirely by latent class variable, however, researchers note that this is not always possible. Model parameters of LCA are determined by the latent class probabilities (the distribution of classes of the latent variable) and the conditional item probabilities (the likelihood of an individual being assigned to a given class). Latent class models tend to begin by estimating a one-class (group) and then increasing the number of classes by one while assessing the model fit at each point and then stopping when models no longer converge. There are multiple fit indices which can be used to determine the best-fitting model. Firstly, there are the Akaike's Information Criteria (AIC), Bayesian Information Criterion (BIC) and Sample-size Adjusted Bayesian Information Criteria (SABIC) where lower values indicate better fit (Nylund, Asparouhov, & Muthén, 2007). Secondly, likelihood tests, such as the Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-LRT) and bootstrapped likelihood ratio test (BLRT), assess whether adding a class significantly improves the model (Nylund-Gibson & Choi, 2018). Thirdly, the entropy statistic ranges from 0-1 and assesses the accuracy of assigning participants to classes based on their posterior probabilities. A higher value indicates better classification (Ramaswamy, DeSarbo, Reibstein, & Robinson, 1993). One consideration when conducting a LCA is the sample size, it is recommended that cases of 10 or more for each variable is required and that each class in a model should have no less than 50 cases (Muthén & Muthén, 2000). These indices are used in Chapter 6 to determine the best-fitting latent class model of SES.

In the context of this thesis, the following SES indicators are used to develop latent classes of SES among individuals who met criteria for a mental health problem: social occupational grade, being in debt, being in receipt of out of work benefits, educational attainment, housing tenure, household type (e.g., the number of adults and children living in

the household). These measures are used in Chapter 6 to reflect the multidimensional nature of SES.

3.6.5 Structural equation modelling

Chapter 6 of this thesis reports a structural equation model (SEM) to assess the indirect effect via social support and neighbourhood disadvantage. A SEM is used to assess single or multiple outcomes which can involve latent variables. SEM can be useful towards understanding whether there is an indirect effect of a variable on the associations between an explanatory variable and outcome variables in a regression equation without measurement error (Muthén, 2007). SEMs are typically described using a path diagram (Hox & Bechger, 1998), such as that shown in figure 2.

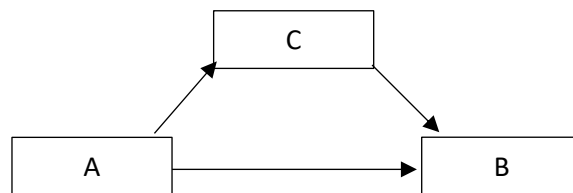


Figure 2: An example of a SEM

In this figure, the direct path is from A to B and the indirect path is A to B via C. Variable C must be associated with both the explanatory (variable A) and outcome variables (variable B) (Muthén, 2011). Models can be estimated through maximum-likelihood, unweighted least squares or weighted least squares or through robust corrections of standard errors and goodness of fit statistics. Robust correction estimation models are appropriate where data are not normally distributed and weighted (Li, 2014). Maximum likelihood robust estimations are used in Chapter 6 as this study applied weights to account for non-response bias and some data was not normally distributed.

As Chapter 6 aims to understand the indirect effect of social support and neighbourhood disadvantage on associations between SES and alcohol use among individuals who met criteria for a mental health problem, SEM models are most suitable. SES groups are treated as nominal independent variables while alcohol use is treated as a nominal dependent variable as low-risk use is the reference group. Social support and neighbourhood disadvantage are treated as continuous variables where a high social support score indicates higher social support while a higher neighbourhood disadvantage score indicates higher neighbourhood disadvantage. Further details of the statistical analysis process are described in Chapter 6, section 6.4.5.

3.7 2014 Adult Psychiatric Morbidity Survey

The 2014 APMS is used in Chapters 5 and 6, with full details of the methodology published (McManus, Bebbington, Jenkins, & Brugha, 2016), and while the dataset is described in

these chapters, this section will outline the study procedures, data collection, study sample and weighting the data.

3.7.1 Design

The 2014 APMS is a cross-sectional survey which has been conducted every seven years since 1993. It is a general population survey, with the 2014 survey being conducted in England only, which adopted a multi-stage stratified probability sampling design. Sample selection was conducted in two stages: the sampling of primary sampling units and then sampling of addresses within these units. One adult aged 16 or older per household was randomly selected for interview. The 2014 APMS consists of two phases of assessment; phase one involved a range of topics which were administered by the interviewer, a self-completion section and a further interviewer administered section while those invited for phase two was based on participants' responses to screening questions on psychosis and autism spectrum probability and whether they were male or female. The phase two interview assessed psychotic disorder, autism, and a further assessment of attention deficit hyperactivity disorder.

3.7.2 Study procedure

An advance letter was sent to each sampled address outlining the survey and that a trained interviewer would be seeking permission to interview. During initial contact, the interviewer clarified the number of households at the address and then randomly selected one adult per household for the interview. The interview took an average of one and a half hours to complete. Some information was collection through self-completion, 75% of participants completed this section alone, 16% had the interviewer read out the section and enter participant's responses, and 3% had the interviewer read out the section and the participant entered their own response. At the end of the interview participants were asked permission for their responses to be linked with other health datasets. At the end of the interview, a high street voucher was given to those who took part in the interview.

3.7.3 Study response

There were 14,717 addresses in the original sample frame, of which 13,122 included at least one private household. There were 7,546 (57%) productive interviews, 3,872 (29%) were refusals, 300 refusals direct to the office, 782 were not contactable, and 813 did not take place for another reason. There were 18 partial interviews where participants completed the treatment, service use and clinical interview schedule-revised modules but did not reach the end of the interview.

There were 7,528 participants who completed the full phase one interview and 78% of these participants agreed to be contacted about the phase two interview. Based on the

sampling design of phase two, 875 participants were invited for a phase two interview, of which 630 (72%) were conducted, 204 refusals and 41 non-contacts.

3.7.4 Data weights

The 2014 APMS was weighted to account for selection probabilities and non-response to ensure the survey were representative of the general population. Weighting at phase one was based on i) address selection (to account for the differential selection probabilities of addresses), ii) household non-response bias (calculated from interviewer observation and area-level variables), iii) selection weights (to account for the selection of participants in different sized households, and iv) composite weight (through calibration). Weighting at phase two was developed based on the presence of psychosis and autism, respectively.

3.7.5 Measures

This section provides an overview of the measures used throughout Chapters 5, 6, and 7, including alcohol use, mental health problems, SES, social support, and neighbourhood disadvantage.

3.7.5.1 Alcohol use

As discussed in Chapter 1, section 1.1, alcohol use encompasses alcohol consumption (drinking of beverages containing ethyl alcohol), binge-drinking (drinking eight or more units for alcohol men, and six or more unit of alcohol for women, in one drinking session, (John, 2018)), or AUD (alcohol consumption, harm to self and others). Given the scale of secondary data and the numbers of participants interviewed, alcohol use is typically assessed through self-report measures, such as the Composite International Diagnostic Interview and Alcohol Use Disorder Identification Test (AUDIT). There is debate around treating alcohol use as a continuous or categorical variable (Dawson, Saha, & Grant, 2010; Fazzino, Rose, Burt, & Helzer, 2014), particularly as previous diagnostic interviews have used classification systems whereas more recent measures of alcohol use, particularly for AUD, acknowledge that this occurs on a continuum (Regier et al., 2013).

However, as this thesis aims to examine alcohol use, including non-drinking, treating alcohol use as a continuous variable is not appropriate as this will not allow for the examination of non-drinkers. The 2014 APMS used the AUDIT and Severity of Alcohol Dependence (SADQ) questionnaires to assess alcohol use, however, the SADQ was only asked to participants with an AUDIT score of 9 or more which excludes non-drinkers and those drinking at lower levels of risk (McManus et al., 2016). Therefore, Chapters 5, 6, and 7, uses the AUDIT to assess alcohol use. The AUDIT is a 10-item questionnaire used in the 2014 APMS which screens for hazardous, harmful and probable dependent drinking. Scores range from 0-40, a score of 0-7 indicates “low-risk use”, 8-15 “hazardous use”, 16-19

“harmful use”, and 20-40 “dependent use (World Health Organization, 2001). The AUDIT has been validated in the general population and, in the 2014 APMS, was found to have good internal reliability (Cronbach’s $\alpha = 0.96$, (Puddephatt, Jones, et al., 2021).

For Chapters 5 and 6, which uses data from the 2014 APMS, participants alcohol use was measured based on responses to the following questions; “*Do you ever drink alcohol nowadays?*”, those who responded “no” were asked an additional question “*Could I just check, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally, perhaps for medicinal purposes or on special occasions like Christmas or New Year?*”. Those who responded “no” did not complete the AUDIT. Those who responded “yes” to the former question or “occasionally” to the latter question completed the AUDIT. For these chapters, alcohol use was categorized in the following way: non-drinker (those who answered “no” to the screening questions or who had an AUDIT score of 0), low-risk use (AUDIT score of 1-7), hazardous use (AUDIT score of 8-15), harmful/probable dependence (AUDIT score of 16-40). The latter category is combined due to small numbers. For Chapter 7, alcohol use among drinkers is assessed using the AUDIT and categorized in the same way, with the exclusion of the screening questions. Non-drinkers in Chapter 7 did not complete the AUDIT. This approach is most suitable so there is consistency in the methods and interpretation of findings across chapters.

As alcohol use was measured through self-report assessment, there is the issue of reporting bias which is discussed in more detail in section 3.5.4. To overcome this, non-response is examined prior to analysis and reported in section 3.7.6.1 where there is a small amount of non-response (3.73%), therefore, a complete case analysis is appropriate for Chapters 5 and 6.

3.7.5.2 Mental health problems

As the purpose of this thesis is to examine alcohol use with a range of mental health problems, Chapters 5 and 6 included all mental health problems measured in the APMS. Chapter 5 examines associations with alcohol use across specific mental health problems outlined in sections from 3.7.5.2.1 to 3.7.5.2.8 below whereas Chapter 6 includes those meeting criteria for all mental health problems outlined in these sections without stratifying by type of mental health problem. Chapter 7 recruits participants who have a diagnosis of a SMI, defined as bipolar disorder, schizophrenia or any other psychotic disorder (Hardoon et al., 2013; National Health Service England, 2019).

3.7.5.2.1 Depression

Depression is measured using the Clinical Interview Schedule-Revised (CIS-R) which assesses the presence of non-psychotic symptoms in the past week and generates 10th

International Classification of Disease (ICD-10) diagnoses of depression (Stansfeld et al., 2016). The CIS-R has been found to have good internal reliability within the community (Lewis, Pelosi, Araya, & Dunn, 1992). Due to small numbers, it is not possible to categorize depression by severity (e.g., mild, moderate, and severe).

3.7.5.2.2 Anxiety

As with depression, anxiety is measured using the CIS-R whereby its classification is generated from the ICD-10 (Stansfeld et al., 2016). While it is possible to use scores from the CIS-R to generate the presence of specific anxiety disorders, such as generalized anxiety disorder, due to small numbers this is not possible in this thesis. Instead, this thesis examined overall anxiety which encompasses more specific anxiety disorders.

3.7.5.2.3 Phobia

Phobia is measured using the CIS-R, as with depression and anxiety, whereby its classification is generated from the ICD-10 (Stansfeld et al., 2016). The CIS-R also measured specific types of phobia, such as social phobia and specific phobia, but due to small numbers this is combined to generate overall phobia.

3.7.5.2.4 Post-Traumatic Stress Disorder (PTSD)

PTSD is assessed using the PTSD Checklist-Civilian (PCL-C) 17-item questionnaire which correspond to symptoms of the Diagnostic and Statistical Manual of Mental Disorders IV (DSM-IV) in the past month. These symptoms are grouped as i) re-experiencing (including recurrent thoughts or perceptions of the event), ii) avoidance and numbing (avoiding activities associated with the trauma, feelings of detachment), and iii) hyperarousal (including difficulty falling asleep and difficulty concentrating). A cut-off score of 50 on the PCL-C and positive responses to at least one item on re-experiencing symptoms, three on avoidance and numbing, and two on hyperarousal is used (Fear, Bridges, Hatch, Hawkins, & Wessely, 2016).

3.7.5.2.5 Bipolar Disorder

The Mood Disorder Questionnaire is used to assess bipolar disorder. It is a 13-item questionnaire which measures lifetime experience of manic or hypomanic symptoms in their lifetime, and if these have been experienced at the same time, caused moderate to serious problems. Those who scored seven or more were also asked; *“Have several of these ever happened during the same period of time?”* and *“How much of a problem did any of these cause you – like being unable to work; having family, money or legal troubles; getting into arguments or fights?”*. Participants screened for bipolar disorder if they answered “yes” to the first additional question, “moderate” or “severe problem” to the second additional question, and have a score of seven or more (Marwaha, Sal, & Bebbington, 2014).

3.7.5.2.6 Anti-Social Personality Disorder (ASPD) and Borderline Personality Disorder (BPD)

Lifetime ASPD and BPD are assessed using the Structured Clinical Interview for DSM-IV. Screening for ASPD is assessed by a score of three or more on questions related to failure to conform to social norms and meeting criteria for conduct disorder before age 15. While BPD is assessed by a score of five or more on questions around the instability of mood and impulsivity in childhood (Moran, Rooney, Tyrer, & Coid, 2014).

3.7.5.2.7 Probable psychotic disorder

Probable psychotic disorder is assessed using the five-item Psychosis Screening Questionnaire. To screen for probable psychotic disorder, participants endorsed any two of the following and who did not complete the follow up interview: 1) currently taking antipsychotic medication, 2) reporting an inpatient stay for a mental or emotional problem in the past three months, 3) having been admitted to a hospital specializing in mental health problems at any time, 4) a positive response to question 5a assessing auditory hallucinations, 5) reporting symptoms suggestive of psychotic disorder or 6) discussing such symptoms with a GP in the last year (Bebbington et al., 2014).

3.7.5.2.8 ADHD

ADHD is assessed using the six-item ADHD Self-Report Scale-v1.1 which measures the frequency of recent symptoms of adult ADHD in the last six months. Specifically, this measure assesses inattention, hyperactivity and impulsivity which are rated on a five-point scale. A score of four or more is used to screen positive of ADHD (Brugha, Asherson, Strydom, Morgan, & Christie, 2014).

3.7.5.3 Demographic characteristics

Chapters 5, 6 and 7 of this thesis outline the demographic characteristics of each study sample. Gender is treated as a dichotomous variable and categorised as “male” or “female”. Age is treated as a nominal variable and categorised as “16-34”, “35-54”, “55-74”, “75+”. Marital status is treated as a nominal variable and categorised as “married or civil partnership”, “single” or “separated/divorced/widowed”. Ethnicity is treated as a dichotomous variable due to small numbers and categorised as “white” or “non-white”. While participants having children aged under 16 years living in the household is measured and categorised as “Has children aged under 16 years living in the household” or “Does not have children aged under 16 years living in the household” in Chapter 6.

3.7.5.4 SES characteristics

A range of SES characteristics are measured for Chapters 5, 6, and 7 given that the aim of the thesis is to understand the role of SES on associations between alcohol use and mental

health problems. Education is measured by the highest education qualification and treated as a nominal variable in Chapters 5 and 6. Occupational grade is derived from questions assessing participants current occupation and whether they have ever had a job, for Chapter 6, this nominal variable is further categorised by also using responses from reasons for not being in work. Housing tenure is also measured for Chapters 5, 6 and 7. While being in debt, being in any out of work benefits and household type is also measured for Chapter 5 to better reflect the socioeconomic profiles of individuals with a mental health problem. There are some differences in the categorisation of some of these variables in Chapter 5 and 6 due to differences in the aims of these Chapters, however, the categories of each SES variable are outlined in each research Chapter.

3.7.5.5 Contextual factors

Chapter 6 of this thesis aims to understand the role of social support and neighbourhood disadvantage among participants with a mental health problem. Social support is measured using a seven-item questionnaire from the 1987 Health and Lifestyle Survey. The questionnaire includes statements about the participant's family and friends which could be scored as "not true", "partly true", or "certainly true" with a maximum score of 21 (Cox et al., 1987). It has been found to have good reliability within the APMS sample (Cronbach's $\alpha = 0.94$). Neighbourhood disadvantage is measured using a 10-item questionnaire which examines levels of social cohesion (level of connectedness) and neighbourhood quality (access to amenities, feeling safe). All items except one ("*The area is kept nice by its residents*") had good item-test correlation with the proposed constructs. One item with lower item-test correlation is removed from Chapter 6, therefore, a nine-item questionnaire with a maximum score of 45 is used and found to be reliable (Cronbach's $\alpha = 0.84$).

3.7.6 Missing data

It is common to have some level of missing data in research, however, it is important to understand why data might be missing to address potential bias particularly where there are large amounts of missing data and this can impact the findings of research (Altman & Bland, 2007). Data can be missing for three reasons. Firstly, data can be missing completely at random (MCAR) where it is assumed that the values on the missing variable are not related to the reason why they are missing. Secondly, missing at random (MAR) where the probability of missing a value on a variable is related to other observed variables in the data. Thirdly, data can be not missing at random (NMAR) where the probability of observing a value for a variable is related to the missing value itself (Pigott, 2009).

Missing data can be handled through complete-case analysis, mean imputation, single imputation or multiple imputation. A complete-case analysis involves cases with

complete data, therefore, cases with any missing data are not used which is otherwise known as listwise deletion. This type of handling of missing data can be used where data is MCAR, however, if data is MAR or NMAR then handling missing data in this way may lead to biased results (Pigott, 2009). Complete-case analysis may also be used where there are few missing observations (Altman & Bland, 2007). Mean imputation calculates the sample mean of the observed participant or variable and uses this as an estimate. Single imputation occurs where a multivariate regression model is used to estimate the distribution of a result, and this is then used to randomly assign a value to impute the missing data in the study sample. While multiple imputation involves the creation of multiple datasets to produce an association with standard error and regression coefficients which are then averaged to obtain a pooled estimate of the association (Donders, van der Heijden, Stijnen, & Moons, 2006). However, it is argued that approaches to handling missing data in research are not without limitations and rely on why data is missing. Therefore, a complete case analysis can be suitable where missing data is minimal (Altman & Bland, 2007).

3.7.6.1 Missing data in the 2014 APMS

Of the 7,546 participants taking part in the 2014 APMS, there were 18 partial interviews. With regards to the variables of interest to this thesis, there is only a small amount of missing data with missing data being largest for alcohol use, PTSD and bipolar disorder. Due to the small amount of missing data with regards to the variables of interest for Chapters 5 and 6 which use this dataset, a complete case analysis is used.

Table 1: A list of variables used in this thesis and the number and percentage of missing data for each variable in the 2014 APMS

| Variable | N missing (weighted %) |
|--------------------|------------------------|
| Alcohol use | 328 (3.73) |
| Depression | . |
| Anxiety | . |
| Phobia | . |
| PTSD | 461 (6.11) |
| Bipolar disorder | 470 (5.45) |
| ASPD | . |
| BPD | . |
| Probable psychosis | 244 (2.83) |
| ADHD | . |
| Education | 82 (0.01) |
| Housing tenure | 51 (0.01) |

| | |
|--|-----------|
| Occupational grade | 47 (0.01) |
| In debt | 27 (0.01) |
| In receipt of any out of work benefits | 58 (0.01) |
| Household type | . |
| Social support | 27 (0.01) |
| Neighbourhood disadvantage | 27 (0.01) |

3.8 Qualitative methods

Qualitative methods aim to provide an in-depth understanding social means attached to a behaviour or phenomenon and the processes through which it is created (Moriarty, 2011; Neale et al., 2005). As mentioned previously, qualitative methods tend to involve taking a particular epistemological position (Rhodes & Coomber, 2010), however, more recently other approaches, such as pragmatism, have been suggested which may be more suitable for studies which use a range of theoretically opposing research methods (Florczak, 2014). Unlike observational epidemiology, qualitative methods tend to use small sample sizes whereby participants are recruited on the basis of meeting specific criteria, and this is because the aim of qualitative methods is to gain a more detailed understanding of behaviour. Qualitative methods are particularly useful in understanding the reasons or processes around a particular behaviour or problem and can provide a unique insight for policymakers. Such methods can be particularly valuable when seeking to understand complex topics such as co-occurring alcohol and mental health problems because of the depth of data obtained (Neale et al., 2005). In the context of this thesis, it has been established in Chapter 1 that there are a range of factors which may influence the extent to which alcohol and mental health problems co-occur, therefore, taking a more in-depth and targeted approach may provide a better understanding of these issues which can then be used by policymakers and organizations who work with these groups.

Qualitative methods may take the form of interviews, focus groups, or observations. Interviews are a commonly used qualitative method, particularly in the alcohol and mental health literature, and may take the form of being structured, semi-structured or in-depth which will be described in more detail in section 3.8.1. The use of interviews can provide a detailed account of a participants' experience, however, it can be time-consuming setting up and preparing for each interview and subsequently analyzing data (Moriarty, 2011). Whereas focus groups are formally facilitated and recorded discussions with between six and eight participants where a broad range of perspectives are obtained based on an open-ended topic (Rhodes & Coomber, 2010). With this in mind, it can be difficult to manage a focus group to ensure discussions stick to related topics and that all participants are involved in

discussions. While observation methods seek to gather naturally occurring data and is focused on learning through immersion in the topic of interest (Rhodes & Coomber, 2010). Observation methods provide considerable value as immersing oneself through the experience of a behaviour can help make sense of actions that other qualitative methods would not allow, nonetheless, this method is time-consuming and may not be practical for some studies (Moriarty, 2011; Rhodes & Coomber, 2010).

Chapter 7 adopts the use of interviews as this Chapter aims to understand individual experiences of i) alcohol use, ii) how specific symptoms changes their drinking and ii) how drinking patterns have changed since their SMI diagnosis, and this requires obtaining detailed accounts of individuals' experiences which may not be possible using other qualitative methods.

3.8.1 Interviews

As mentioned previously, interviews may be structured, semi-structured or in-depth (Green, 2004; Moriarty, 2011; Rhodes & Coomber, 2010). Structured interviews tend to use closed questions which are standardized and seek to minimize bias, however, it is difficult to gain an in-depth understanding of a topic using these types of interviews and lend themselves to a positivist and perhaps more quantitative approach (Rhodes & Coomber, 2010). Semi-structured interviews include open-ended questions about a specific range of issues related to a topic which allows for a more open-ended conversation between the researcher and participant (Green, 2004; Moriarty, 2011). Whereas in-depth interviews are topic guided but only focus on one or two topics to allow for much greater detail (Moriarty, 2011; Rhodes & Coomber, 2010). The latter two approaches are beneficial if a researcher aims to allow new issues to be discussed which they may not have otherwise considered. While in-depth interviews generate detailed accounts of experiences of a particular issue, it aims for depth and not breadth, therefore, the researcher would need to prioritize which topics are of most concern. Whereas semi-structured interviews still allow for a detailed account but across more topics. In the context of this thesis, there are multiple issues to explore, for example, how people with a mental health problem use alcohol, why and under what circumstances do they use alcohol, if and how is alcohol used to cope with their mental health. Therefore, structured interviews are not useful for these questions and in-depth interviews are not possible due to the amount of time it would take to collect accounts of each issue, thus semi-structured interviews are most appropriate for this aim.

Traditionally, interviews take place face-to-face either in participants' homes, a neutral location or at the researcher's site (Moriarty, 2011). Face-to-face interviews have the benefit of being able to create rapport and trust with participants, and observing non-verbal

communication which might be difficult to achieve using other methods (Moriarty, 2011; Rhodes & Coomber, 2010). However, it is common for interviews to take place by telephone as these may be more practical, particularly if participants are located around a region or where participants are not willing or able to travel to the interview site (Knox & Burkard, 2009; Moriarty, 2011). Studies comparing face-to-face and telephone interviews suggest that there was a slight advantage to conducting interviews face-to-face and social desirability may be worse when conducted over the telephone (Knox & Burkard, 2009). It has also been found that telephone interviews tend to be shorter and it was recommended that researchers should actively respond to participants throughout their answers, for example “mmm”, to encourage more detailed responses (Irvine, Drew, & Sainsbury, 2010). However, telephone interviews can be particularly useful where interviews discuss sensitive topics or where populations of interest tend to be reluctant to engage with research (Block & Erskine, 2012; Sturges & Hanrahan, 2004). For this thesis, it was planned that interviews would be undertaken either face-to-face or by telephone, however due to the coronavirus pandemic, face-to-face interviews are not possible.

3.8.2 Sampling in qualitative methods

There are a range of sampling methods in qualitative research which are considered in this thesis for Chapter 7, such as purposive sampling, theoretical sampling, and snowball sampling. Purposive sampling methods seeks to understand issues among small samples sizes, therefore, seeks to include participants who can provide such answers (Patton, 2007). Theoretical sampling involves recruiting participants during the collection and analysis of data whereby new groups of participants are recruited for comparison or to re-structure an existing sample which is typically linked with Grounded Theory (Robinson, 2014). Whereas snowball sampling usually begins with a small number of participants who meet the study criteria and take part in the research and are then asked to invite other potential participants (Parker, Scott, & Geddes, 2019). Given that Chapter 7 aims to understand experiences of alcohol use over time among current drinkers and non-drinkers who have a diagnosis of a SMI, it was felt that purposive sampling is most suitable because the aims outline the characteristics of participants required while there are also potential ethical concerns if participants are recruited through snowball sampling because of their mental health diagnosis and issues around wellbeing.

3.8.3 Bias in qualitative methods

Due to the subjective nature of qualitative research, it has been argued that there is an increased risk of bias in the collection and analysis of data (Roulston & Shelton, 2015). Bias can be found in the sampling (e.g. selection of participants to obtain desired results), observer (e.g. prejudice perspectives of the researcher), confirmation (e.g. the selection and

interpretation of data to support beliefs and hypotheses, (Bergen & Labonté, 2019; Roulston & Shelton, 2015)). Researchers can overcome bias through several techniques. The risk of social desirability bias can be minimized through the research probing and clarifying participant's responses and building a rapport to gain trust (Bergen & Labonté, 2019). Methods to address other bias have been introduced, such as reflexivity which is the process of examining one's subjectivity, thoughts and perceptions and how it shapes the research process, in terms of data collection and analysis (Roulston & Shelton, 2015). Such techniques are used in Chapter 7 where participants were asked additional questions to clarify responses, where required, while field notes were made throughout the interview and analysis regarding the interviewer's interpretation and thought process.

3.8.4 Methodological rigour

As outlined above, there are a range of qualitative methods available to researchers, but it has been argued that the subjective nature of qualitative methods increases the risk of bias. Discussed briefly were some techniques used to improve methodological rigour. As mentioned in section 3.8.3, one method is the use of reflexivity which involves the researcher taking notes on their own subjectivity to increase self-awareness throughout the research process (Roulston & Shelton, 2015). However, it has been argued that this is reliant on the researcher being fully reflexive and the various strategies used within this process (Roulston & Shelton, 2015). While Morse and colleagues argue that from the research question development stage, there must be a clear and justified rationale for the method, sampling, and analyzing of data which best match answering the research questions (Morse, Barrett, Mayan, Olson, & Spiers, 2002).

Overcoming these issues has been made clear when publishing qualitative research in fields which are dominated by quantitative methods whereby bias can be confirmed through statistical methods. More recently, guidelines and frameworks have been developed for qualitative research which outlined measures taken to recruit participants, details of the analysis process and the verification of analyses. The main guidelines used for qualitative research are the Consolidated criteria for Reporting Qualitative research (COREQ), Standards for Reporting Qualitative Research (SRQR), and Enhancing Transparency in REporting the synthesis of Qualitative research (ENTREQ). The COREQ is a 32-item guideline suitable for interviews and focus groups with a focus on the research team and reflexivity, study design and analysis and findings (Dossett, Kaji, & Cochran, 2021; Tong, Sainsbury, & Craig, 2007). The SRQR is a 21-item suitable for a broad range of study types and focusses on research question formulation, methods, results and discussion (Dossett et al., 2021; O'Brien, Harris, Beckman, Reed, & Cook, 2014). The ENTREQ is suitable for studies which are a review of qualitative research and was developed by the same team that

developed COREQ (Tong, Flemming, McInnes, Oliver, & Craig, 2012). A meta-analysis reports that there has been an increase in reporting quality of qualitative studies since the development of such guidelines (de Jong et al., 2021). Chapter 7 of this thesis used the COREQ guidelines in the development, analysis and writing up of the study as this Chapter involved the use of interviews.

3.9 Qualitative analyses

Chapter 7 reports a framework analysis of experiences with alcohol use among individuals who have a SMI and either drink alcohol or no longer drink.

3.9.1 Framework analysis

Framework analysis originates from policy research and is similar to other qualitative methods such as thematic analysis (Gale, Heath, Cameron, Rashid, & Redwood, 2013). Developed by Ritchie and Spencer, framework analysis helps to address research questions which focus on i) identifying the nature of what exists, ii) the reasons for, or causes of, what exists, iii) evaluating the effectiveness of what exists, iv) identifying new theories, plans or actions (Ritchie & Spencer, 2002). Framework analysis has a clear step-by-step process with some steps similar to thematic analysis. The familiarization stage involves the researcher getting to know and understand the data in detail, such as listening to recordings, transcribing and re-reading transcripts. This is followed by identifying a framework which can be decided a priori (based upon the research questions) as well as emergent through the reading of data. Parkinson and colleagues emphasise the importance of a framework which best fit the data and research questions. The next stage is indexing which organizes the transcripts and data into the framework categories. Once data is fit into the framework, data is then charted which involves summarising the indexed data for each category. Once data has been summarised, the researcher then maps and interprets the data as a whole as well as between groups. This step involves exploring the range of phenomena and establishing relationships (Parkinson, Eatough, Holmes, Stapley, & Midgley, 2016; Ritchie & Spencer, 2002). Framework analysis is not aligned to a specific epistemological perspective or theoretical approach; therefore, it is possible to use both inductive and deductive analysis.

3.9.2 Alternative considerations

As Chapter 7 aims to understand experiences with alcohol use among individuals with a SMI who either drink alcohol or no longer drink, both interpretative phenomenological analysis (IPA) and thematic analysis were considered. IPA focusses on obtaining a detailed account of an individual's lived experience and the meaning of a phenomena. IPA focusses on the particular rather than the general, and processes which are important to the individual rather than to the researcher (Eatough & Smith, 2008; Larkin & Thompson, 2012). IPA was

considered for this chapter because the aim is to understand individuals' experiences with alcohol use, however, the chapter also aims to understand differences in the reasons why individuals either do drink alcohol or no longer drink and would therefore involve the recruitment of a more heterogenous sample which is not suited for IPA (Eatough & Smith, 2008).

Thematic analysis was also considered for Chapter 7, thematic analysis aims to explore patterns of shared meanings which are conceptualized either at the start or later in the analytic process (Braun, Clarke, Hayfield, & Terry, 2019). Thematic analysis can be used to answer a range of research questions, however, as the Chapter 7 had potential implications on differences between groups which may inform policy, it was felt that framework analysis is more appropriate and can be seen as an extension of thematic analysis.

3.10 Ethical considerations

While Chapters 5 and 6 involved the use of secondary data, and therefore did not require ethical approval, there are still ethical and data management considerations as the 2014 APMS is a secure dataset and can only be obtained through a successful application with NHS Digital. Particular considerations around the need for such research, the variables to be used in the analysis, how and where data would be stored, reporting of small cell sizes are addressed in the process of accessing the data. With recent changes to the Data Protection Act, the Information Commissioner's Office (ICO) outlines the process for requesting and managing data, particularly personal data, to ensure compliance with these changes (Information Commissioner's Office, 2019). For example, ICO require that data processing must be lawful and proportionate to achieving a specific purpose, therefore, the use of data must be justified. Taken together, this thesis involves applying for access to the 2014 APMS through NHS Digital.

Chapter 7 involves the recruitment of individuals with a SMI through community mental health organisations (non-NHS organisations) and ethical approval was obtained by the University of Liverpool ethics committee. In accordance with the British Psychological Society's code of conduct (British Psychological Society, 2021), participants are initially contacted by a gatekeeper of the community mental health organizations and then contacted the researcher for more information. Informed consent is obtained prior to arranging interviews and completing questionnaires, participants are made aware of the nature of the interview questions and a risk protocol is in place if participants became distressed. Specifically, a protocol is in place in the event that the participant disclosed thoughts of harm or self-harm where the community mental health organisation is alerted of this disclosure to check on the participants wellbeing. Participant names and contact details are stored in a

password protected Excel file during data collection and securely deleted once unanonymized interview transcripts were confirmed as accurate. The audio-recording is deleted once the unanonymized interview transcript is confirmed as accurate and any identifiable information (e.g. names) is removed from the interview transcript, thus creating a pseudoanonymized transcript.

**Chapter 4: Associations of common mental disorder with alcohol use in the adult
general population: a systematic review and meta-analysis**

Chapter 4 is published in *Addiction* as:

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4.1 Foreword

What is already known from the previous Chapter (Chapter 1)?

- Chapter 1 provides an overview of previous literature which has examined alcohol use, mental health problem, SES and other factors both individually and collectively
- Chapter 1 shows that the prevalence and associations of alcohol use are higher among individuals with a mental health problem but that there are discrepancies in the prevalence depending on the type of mental health problem and AUD
- Chapter 1 shows that SES is associated with both AUD and mental health, separately, but that there is limited research examining its role among individuals with co-occurring alcohol and mental health problems
- Chapter 1 also outlines the theoretical mechanisms through which alcohol, mental health problems and SES may co-occur

What does the current Chapter aim to do?

- This Chapter aims to extend the previous findings outlined in Chapter 1 through synthesising the current evidence from a range of databases, such as MEDLINE and Web of Science, which report the prevalence of alcohol use, including consumption, binge-drinking and AUD across groups with specific CMDs, compared to those without a CMD
- This Chapter also aims to conduct a meta-analysis to calculate the pooled prevalence and associations of alcohol use among individuals with and without specific CMDs, globally
- This Chapter aims to examine how the prevalence and associations and alcohol among individuals with and without specific CMDs differ across SES characteristics

What new findings does this Chapter add?

- This Chapter includes a review of 51 studies, of which 33 report the prevalence of AUD, five of binge-drinking, and 12 of alcohol consumption

- Of the 33 studies reporting the prevalence of AUD among individuals with and without CMD, 17 are included in a meta-analysis. The meta-analysis shows that the pooled prevalence of reporting an AUD among individuals with a CMD is 15% compared to 8% among those without a CMD
- The meta-analysis shows that associations of reporting an AUD among those with an anxiety/phobic or mood disorder are similar at approximately a two-fold increase in the odds compared to those without the respective disorder. But a sensitivity analysis suggests that there may be differences in associations when stratified by the specific type of CMD, e.g. MDD, PTSD
- Associations among individuals with a CMD compared to those without are strong for moderate/severe AUD compared to mild AUD (OR=2.19, 95% CI=1.82-2.63) indicating that alcohol is used at increasingly harmful levels among those with a CMD, compared to those without
- A narrative synthesis indicates mixed evidence on whether binge-drinking and alcohol consumption is more prevalent among individuals with and without a CMD, indicating that the patterning of other types of alcohol use among those with a CMD are not well-known
- Finally, there are gaps in the literature which examine i) associations between some CMDs (notably SAD) and AUD, and ii) associations between alcohol use and CMD stratified by SES

4.2 Introduction

It is estimated that 32.5% of the global population consume alcohol (Griswold et al., 2018). While there are differences between countries (World Health Organization, 2019), approximately 18.4% of adults report binge-drinking (Peacock et al., 2018) and 5.1% have an alcohol use disorder (AUD)(World Health Organization, 2019), including harmful and dependent drinking. Despite differences between countries, alcohol use was ranked the seventh leading risk factor for premature death and disability. Alcohol use has also led to 1.6% and 6% of disability adjusted life years for females and males, respectively (Griswold et al., 2018). Meanwhile depressive and anxiety disorders (known as common mental disorders; CMD) are also prevalent in the general population globally, with 4.4% and 3.6% reporting a depressive or anxiety disorder, respectively (World Health Organization, 2017).

Drinking alcohol can be harmful to an individual's mental health particularly if they meet criteria for an AUD (symptoms include an impaired ability to control alcohol use (American Psychiatric Association, 2013)), binge-drinking (generally consuming more than five units alcohol in a certain period (Wilsnack, Wilsnack, Gmel, & Kantor, 2018)), or drinking excessively (drinking excessive amounts of alcohol on most days or weeks (National Health Service, 2018)). Among the general population, research has found associations between CMD with binge-drinking (Lee, Wang, et al., 2020; Nazareth et al., 2011; Paljärvi et al., 2009) and AUD (Lai et al., 2015). Research has also shown that those with co-occurring panic disorder and AUD, or depression and AUD, are at an increased risk of mortality compared to those without such disorders (Hjorthøj et al., 2015; Kingsbury et al., 2020). Elsewhere, a narrative review found evidence to suggest that anxiety and depressive episodes are related to binge-drinking which can subsequently lead to injury (Kuntsche et al., 2017). Other research also found college students with co-occurring anxiety and depressive symptoms reported increased weekly alcohol use, more hazardous use and negative alcohol consequences, compared to those without symptoms (Austin & Villarosa-Hurlocker, 2021). Nineteen percent of all alcohol-related hospital admissions have been attributed to mental health problems resulted from alcohol use (Institute for Alcohol Studies, 2018) and those with co-occurring alcohol and mental health problems may have difficulties accessing treatment compared to those with only one of these problems (Alsuhaibani, Smith, Lowrie, Aljhani, & Paudyal, 2021). These findings indicate that having a CMD is associated with a range of alcohol outcomes, which have negative health implications on health, however, previous research has focussed specifically on associations with AUD.

There is evidence for an association between worsening mental health and increased alcohol use (Jane-Llopis & Matytsina, 2006). Motivational models argue that individuals may be motivated to use alcohol to cope with stress (Wills & Shiffman, 1985), where benefits

outweigh the cost (Cox & Klinger, 2011). Such models suggest alcohol may be used to cope with symptoms of poor mental health, and alcohol may be used specifically due to its rapid onset of action (Khantzian, 1997). This might be the case among those with a CMD as drinking alcohol may be perceived to alleviate symptoms of a disorder (Khantzian, 1997).

Genome-wide studies have shown a causal relationship between CMDs, such as major depression, and alcohol dependence while the reverse association has not been found (Polimanti et al., 2019). However, associations between alcohol use and mental health comorbidity may be more complex and vary based upon the specific type of CMD (Castillo-Carniglia, Keyes, Hasin, & Cerdá, 2019; Puddephatt, Jones, et al., 2021). Among the general population, research has shown that those with major depressive disorder (MDD) were more likely to report lifetime moderate/severe AUD compared to those without MDD (Grant et al., 2015). Whereas those with generalized anxiety disorder (GAD) were more likely to report mild or severe AUD, compared to those without GAD (Grant et al., 2015). Elsewhere, a significant association with alcohol dependence among those meeting criteria for alcohol abuse was reported among those with dysthymia but not MDD, compared to those without the respective disorder (Swendsen et al., 2010). While a review across observational studies showed differences in associations with AUD with specific types of anxiety disorders, such as panic disorder (Smith & Randall, 2012). Differences in associations have also been found for other patterns of alcohol use. For example, a positive association of binge-drinking with anxiety disorder was found among individuals attending primary care in Portugal while a negative association with binge-drinking was found for major depression, compared to those without the respective disorders (Nazareth et al., 2011).

Previous systematic reviews have explored alcohol misuse and CMD in both directions, for example, the prevalence of CMD among those misusing alcohol (Oliveira, Bermudez, de Amorim Macedo, & Passos, 2018) and the prevalence of alcohol misuse among those with a CMD (Lai et al., 2015). The latter was most recently reported by Lai and colleagues (2015) where those with an anxiety disorder or major depression were around one-and-a-half times more likely to report alcohol abuse, and two-and-a-half and three times more likely to report dependence, respectively (Lai et al., 2015). This indicates that those with a CMD are more likely to use alcohol at harmful levels, and that there may be differences based upon the type of CMD. However, this review included bipolar disorder in their definition of CMD, which United Kingdom health guidelines on CMD exclude along with other psychotic and related disorders (Hardoon et al., 2013; National Health Service England, 2019; Pilling, Whittington, Taylor, & Kendrick, 2011). This review also did not include post-traumatic stress disorder (PTSD) despite its inclusion as a CMD in United Kingdom health guidelines

(National Collaborating Centre for Mental Health, National Institute for Health, Clinical Excellence, British Psychological Society, & Royal College of Psychiatrists, 2011).

To date, there has not been a systematic review or meta-analysis reporting the prevalence of other types of alcohol use, such as binge-drinking, among those with and without a CMD in the adult general population, and by specific CMD diagnoses. The current systematic review and meta-analysis aimed to i) estimate the pooled prevalence of alcohol use (AUD, binge-drinking and alcohol consumption) in those with and without a CMD, ii) evaluate associations between CMD and patterns of alcohol use, iii) examine how prevalence and associations differed across specific types of CMDs and iv) examine how results may differ by study characteristics.

4.3 Method

This study is pre-registered on PROSPERO (ref. CRD42019126770) and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher, Liberati, Tetzlaff, Altman, & The, 2009)(see figure 3 and table 2), and in line with the Condition, Context, Population (CoCoPop) framework (Munn, Moola, Lisy, Riitano, & Tufanaru, 2015). The CoCoPop framework is a quality appraisal tool suitable for systematic reviews and meta-analyses which aim to examine the prevalence of a condition, and therefore, require specific information about groups that may not be required using other frameworks (Munn, Stern, Aromataris, Lockwood, & Jordan, 2018).

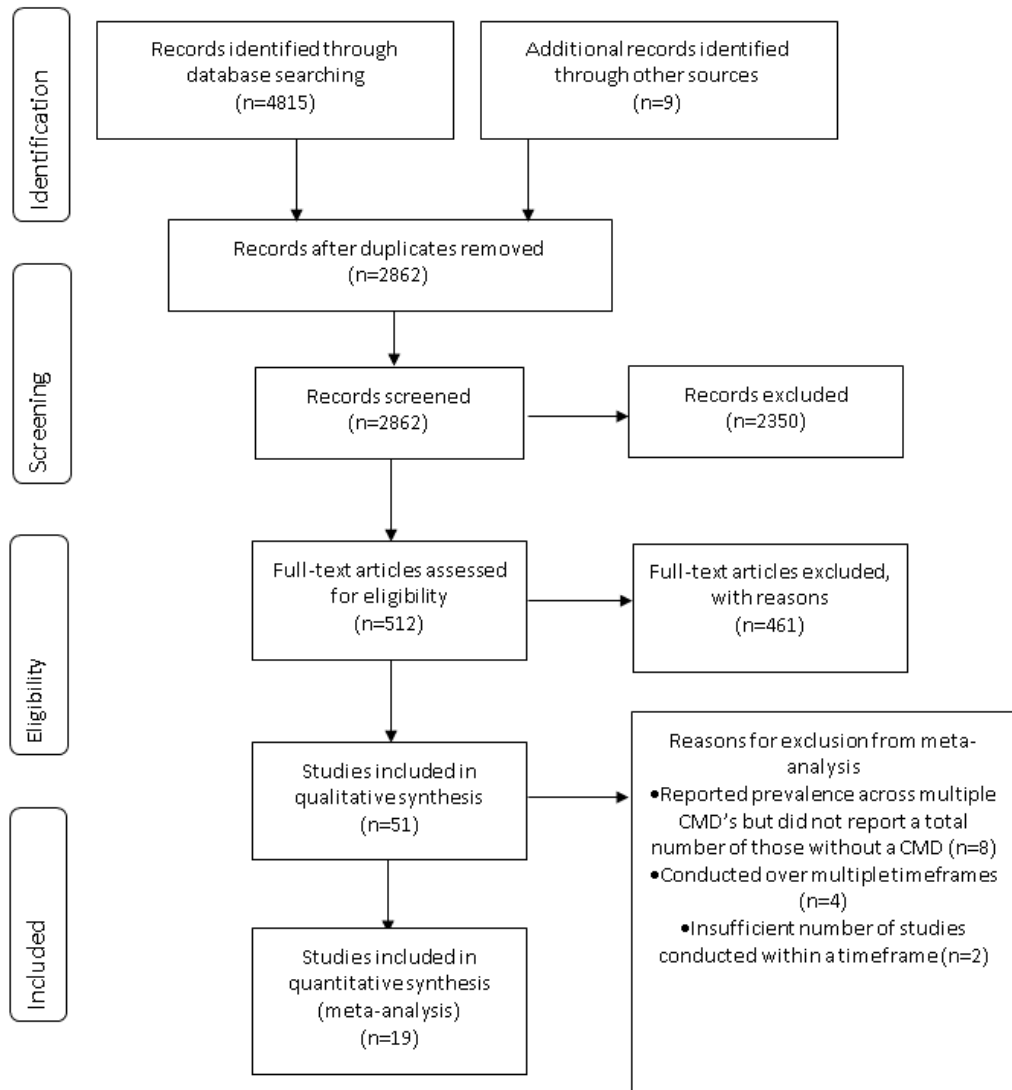


Figure 3: PRISMA flow diagram

Table 2: PRISMA Checklist

| Section/topic | # | Checklist item | Reported on page # |
|---------------------------|---|---|-----------------------------------|
| TITLE | | | |
| Title | 1 | Identify the report as a systematic review, meta-analysis, or both. | 1 |
| ABSTRACT | | | |
| Structured summary | 2 | Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number. | 2 |
| INTRODUCTION | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. | 3-5 |
| Objectives | 4 | Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS). | 5-9 |
| METHODS | | | |
| Protocol and registration | 5 | Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number. | 5 |
| Eligibility criteria | 6 | Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale. | 5-9 (and supplementary materials) |

| | | | |
|------------------------------------|----|--|-----------------------------------|
| Information sources | 7 | Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched. | 6-7 |
| Search | 8 | Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated. | 6 (and supplementary materials) |
| Study selection | 9 | State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis). | 5-9 |
| Data collection process | 10 | Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators. | 7-8 (and supplementary materials) |
| Data items | 11 | List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made. | 6-7 |
| Risk of bias in individual studies | 12 | Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis. | 7 |
| Summary measures | 13 | State the principal summary measures (e.g., risk ratio, difference in means). | 7-9 |
| Synthesis of results | 14 | Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis. | 7-9 |

| Section/topic | # | Checklist item | Reported on page # |
|-------------------------------|----------|--|--|
| Risk of bias across studies | 15 | Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies). | 7 |
| Additional analyses | 16 | Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified. | 8-10 |
| RESULTS | | | |
| Study selection | 17 | Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram. | 10 and 22 (and supplementary materials) |
| Study characteristics | 18 | For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations. | 10 (and table 1) |
| Risk of bias within studies | 19 | Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12). | Table 1 |
| Results of individual studies | 20 | For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot. | Tables 1-6 and figures 1-3 |
| Synthesis of results | 21 | Present results of each meta-analysis done, including confidence intervals and measures of consistency. | 11-13 (and tables 1-4 and |

| | | | |
|-----------------------------|----|--|---|
| | | | figures 1-3 |
| Risk of bias across studies | 22 | Present results of any assessment of risk of bias across studies (see Item 15). | 12 (and table 1 and figures 1-4 in supplementary materials) |
| Additional analysis | 23 | Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]). | 11-13 |
| DISCUSSION | | | |
| Summary of evidence | 24 | Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers). | 14-16 |
| Limitations | 25 | Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias). | 16-18 |
| Conclusions | 26 | Provide a general interpretation of the results in the context of other evidence, and implications for future research. | 14-16 |
| FUNDING | | | |
| Funding | 27 | Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review. | 18 |

4.3.1 Inclusion and exclusion criteria

We included peer-reviewed observational studies, comprising cross-sectional, national surveys, cohort, prospective, longitudinal and case control studies published in English. Where the same dataset was used by multiple studies and reported the same outcome, we used the study which reported information on more CMDs. If two or more studies reported the same information, the more recent study was chosen. Reviews and intervention studies were excluded.

Studies which measured the prevalence of lifetime or 12-month AUD, binge-drinking or alcohol use, comparing those with and without a CMD, and used a standardised measure of alcohol use, alcohol use disorder and CMD, for example the Diagnostic and Statistical Manual diagnostic instruments were included. The authors note that definitions of binge-drinking may vary across countries and details of standardised measures of alcohol use and CMD are reported in table 1. CMDs were defined in this review as MDD, dysthymia, GAD, panic disorder, phobias, PTSD, obsessive-compulsive disorder (OCD), or social anxiety disorder (SAD)(National Institute for Health and Care Excellence, 2018). Studies were excluded if they did not report the prevalence of alcohol use in those with and without a CMD.

As this review aimed to report the global prevalence of alcohol use among those with and without a CMD within the adult general population, studies that focused on treatment-seeking individuals were excluded. Studies which examined the prevalence of alcohol use in those with and without a CMD within a population who experienced a specific traumatic event (e.g. military) or with a specific health condition, such as epilepsy, were also excluded (see table 3).

Table 3: Study Inclusion and Exclusion Criteria

| Inclusion | Exclusion |
|--|---|
| <ul style="list-style-type: none"> • Measured the prevalence of alcohol misuse using a standardised measure of alcohol use, dependence or CMD (for example Alcohol Use Disorder Identification Test or Diagnostic and Statistical Manual diagnostic instruments • CMD defined as major depressive disorder, dysthymia, generalised anxiety disorder, panic disorder, | <ul style="list-style-type: none"> • Did not report the prevalence of alcohol misuse in those with and without a CMD • Included treatment-seeking populations • Included populations who experienced a specific traumatic event (e.g. military populations) • Included populations with a specific health condition (e.g. epilepsy) |

| | |
|---|---|
| <p>phobias, post-traumatic stress disorder, obsessive compulsive disorder, or social anxiety disorder</p> <ul style="list-style-type: none"> • Studies conducted in the adult general population • Reported the prevalence of alcohol misuse in those with and without a CMD • Observational, cross-sectional, cohort or case-control design | <ul style="list-style-type: none"> • Review or intervention design |
|---|---|

4.3.2 Search strategy

PsycINFO, MEDLINE, PsycARTICLES, PubMed, Scopus and Web of Science were searched using Boolean methods. Key terms were chosen using databases' own "MeSH" terms or subject headings and broad enough to cover possible synonyms for alcohol use (e.g. alcohol*), CMDs (e.g. depression), comorbidity (e.g. comorbid*) and prevalence (e.g. prevalence) (see table 4 for full search terms). Titles, abstracts and keywords were searched. A manual search of reference lists of studies which met the inclusion criteria was also conducted. The search was conducted from inception until March 2020.

Table 4: A table showing the full search terms

| Topic | Terms used |
|----------------|---|
| Alcohol misuse | alcohol* or drinking* |
| CMD | AND dysthymia or depression or depress* or generalized anxiety disorder or GAD or social anxiety* or panic disorder or social phobia or phobias or phobic disorder or obsessive-compulsive disorder or OCD or post-traumatic stress disorder or PTSD or stress disorder or psychiatric disorder |
| Comorbidity | AND comorbidity or comorbid* |
| Methods | AND prevalence or epidemiology or incidence |
| Population | AND population |
| Other topics | NOT gambling* |

A second researcher (PI) reviewed a random sample of 10% of titles, abstracts and full-texts and checked against the first author's screening to establish reliability for inclusion. A kappa score of 0.62 was confirmed between researchers, indicating moderate agreement in study inclusion (McHugh, 2012).

4.3.3 Assessment of methodological quality

The Joanna Briggs Critical Appraisal Checklist for Studies Reporting Prevalence Data was used to assess the methodological quality of each study (Munn et al., 2015). This checklist consists of nine items (scored 0 if no or unclear evidence or 1 if evidence was present) which covers different methodological aspects, such as the sampling frame, appropriateness of the analysis conducted, and response rate. The maximum possible score was nine.

4.3.4 Data extraction

In accordance with the Joanna Briggs Institute Data Extraction Form for Prevalence Studies, the following study characteristics were extracted: name and date of study, author, titles, journal, year survey was conducted, sample size, use of methods for establishing the diagnosis of CMD and AUD, use of methods to measure SES, study population, country, description of main results and reviewer comments. We contacted authors for additional information if any key information was missing. We extracted data which reported the overall number of participants who had a CMD and the overall number who did not have a CMD. We then extracted the raw number of participants who did or did not have a CMD and reported mild, moderate or severe AUD, respectively.

4.3.5 Synthesis of data

4.3.5.1 Statistical analyses

Our meta-analysis focuses on the prevalence and associations of AUD among those with and without a CMD, other alcohol outcomes were not included due to variance in the measures and cut-offs used. In light of changes to the diagnostic criteria of AUD, we categorised AUD as mild, moderate or severe (American Psychiatric Association, 2013). Studies that used earlier definitions of AUD, such as DSM-IV abuse and dependence, were re-categorised whereby abuse was considered mild and dependence as moderate or severe given previous research indicates that there may be differences in those meeting criteria for alcohol abuse and moderate AUD (Dawson, Goldstein, & Grant, 2013). Due to the small number of studies examining the prevalence among those with and without a specific CMD (e.g. GAD), we grouped CMDs into two broad categories: mood disorder (dysthymia and MDD), anxiety/phobic disorder (GAD, OCD, PTSD, panic disorder, social phobia, simple phobia, and specific phobia). The comparison group was not meeting criteria for any CMD.

A random effects meta-analysis was conducted to examine the global associations of AUD (e.g. mild, moderate or severe AUD) and any CMD. To consider both within and between study variability (Harris et al., 2008), we then conducted an a-priori random effects meta-analyses to examine the global prevalence and associations of any AUD stratified by type of CMD (e.g. mood disorder), then two post-hoc random effects meta-analyses by i) severity of AUD (e.g. mild AUD vs no AUD excluding moderate/severe AUD, and moderate/severe AUD vs no AUD excluding mild AUD)), and ii) severity of AUD by type of CMD.

For all analyses, studies which reported the total number of participants meeting criteria for a mood, anxiety/phobic disorder, or no disorder were included. Studies which tested multiple CMDs within the same sample, over multiple time-frames in the same sample (e.g. 12-month AUD and lifetime AUD), or did not state the cut-off used to determine AUD severity were excluded. Stratified analyses, such as severity of AUD by type of CMD, were not conducted where there were less than three sources of data within a group.

The *metaprop* command with Freeman-Tukey transformation was used to pool proportions of those with and without a CMD who reported AUD (Nyaga, Arbyn, & Aerts, 2014) using the numbers of those with a CMD who reported having an AUD and those with a CMD who did not report having an AUD, and this was repeated among those without a CMD for each study. The pooled proportions were then converted to an odds ratio using the *metan* command with the DerSimonian and Laird mode in STATA 16 (Harris et al., 2008). Forest plots and tables were generated to present the pooled prevalence, odds ratios and 95% confidence intervals. We conducted a sensitivity analysis by removing studies with the largest and smallest odds ratio to test the effect on the overall odds of having any AUD among those with a CMD and publication bias was assessed using the Egger's test (Egger, Smith, Schneider, & Minder, 1997) and funnel plot. A planned a priori sub-group analysis by decade of data collected and continent was conducted. It was not possible to conduct other sub-group analyses due to a lack of reporting of demographic characteristics stratified by those with and without a CMD. Heterogeneity was assessed using I^2 and funnel plots using the *metafunnel* command (Sterne & Harbord, 2004).

4.3.5.2. Narrative synthesis

Due to a small number of studies reporting the prevalence of binge-drinking of which one study had a much larger sample size than others, it was not appropriate to conduct a meta-analysis. Further, due to variances in the measures and cut-offs used to measure alcohol consumption, we were unable to conduct a meta-analysis of alcohol consumption. Instead, a narrative synthesis is provided for these alcohol outcomes.

The current systematic review and meta-analysis had planned to examine the prevalence of alcohol use among those with and without a CMD from different SES backgrounds, however, studies included in this review did not report adequate information. Instead, studies generally reported the overall SES characteristics of the total sample and did not provide the required data stratified by SES.

4.4 Results

4.4.1 Study selection

Our initial search yielded 2,862 results after removing duplications with 512 full-texts reviewed after screening titles and abstracts. 51 studies were included in our final review and 17 in our meta-analyses ($N=382,201$, see figure 3 PRISMA flow diagram). Of the 51 studies included, 33 reported the prevalence of mild, moderate or severe AUD (including earlier diagnostic classifications), five of binge-drinking, and 12 of alcohol consumption. Studies were conducted in 24 countries, with the majority in the United States of America ($N=10$) and used data from 33 surveys. Bias scores ranged from 3-9 with a median of 7 indicating medium to low bias (see table 5, study characteristics).

Table 5: Study characteristics

| Study | Year(s) conducted | Country | Dataset | Waves used | Sample size (response rate) | Gender and age | Type of CMD studied (and measure and criteria used to assess presence of CMD) | Type of alcohol use studied (and measure and criteria used) | Duration of AUD | Risk of bias score (max score of 9) |
|------------------------|---|--------------------------|--|------------|-----------------------------------|---|---|--|----------------------|-------------------------------------|
| 1. Archie et al 2012 | 2005 | Canada | Canadian Community Health Survey | Cycle 3.1 | 17,524 (response rate not stated) | Gender Female=8587 (49.0%) Male=8937 (51.0%) <u>Age range</u> 15-24 | Depressive symptoms (Derived Depression Scale, cut off score of 5 or more) | Binge-drinking (item on alcohol use, 5 or more drinks once a month or more) | 12-month | 7 |
| 2. Batelaan et al 2012 | Baseline = 1996, time 1 = 1997. Time 2 = 1999 | Netherlands | Netherlands Mental Health Survey and Incidence Study (NEMESIS) | Baseline | 5571 (no overall response rate) | Gender Female=2896 (51.9%) Male=2675 (48.1%) <u>Age range</u> Not clear | Panic disorder (Composite International Diagnostic Interview, DSM-III-R) | Alcohol dependence (Composite International Diagnostic Interview, DSM-III-R) | 12-month | 6 |
| 3. Blanco et al 2010 | 2001-2002 | United States of America | National Epidemiologic Survey on Alcohol and Related Conditions (NESARC) | Wave 1 | 43,093 (81%) | Gender Female=21,662 (51.43%) Male=19,598 (48.57%) <u>Age range</u> 18+ | Chronic MDD Dysthymic disorder (Alcohol Use Disorder and Associated Disabilities) | Alcohol abuse dependence (Alcohol Use Disorder and Associated Disabilities) | 12-month Lifetime | 9 |

| | | | | | | | | Interview Schedule, DSM-IV) | Interview Schedule, DSM-IV) | | |
|--------------------------------------|-----------|-----------|---|--------|-------------------|--|--|---|-----------------------------|---|--|
| 4. Burns & Teesson 2002 | 1997 | Australia | National Survey of Mental Health and Well Being (NSMH&WB) | Wave 1 | 10,641 (78%) | <u>Gender</u> Female=5452 (51.2%) Male=5189 (48.8%) <u>Age range</u> Age range=18+ | Depression Dysthymia Bipolar disorder Panic disorder Social phobia OCD PTSD GAD Agoraphobia (Composite International Diagnostic Interview, DSM-IV) | Alcohol abuse dependence Alcohol use disorder (Composite International Diagnostic Interview, DSM-IV) | 12-month | 7 | |
| 5. Caraveo-Anduaga et al 2004 | 1995 | Mexico | - | - | 1932 (60.4%) | <u>Gender</u> Female=Not stated Male=Not stated <u>Age range</u> 18+ | OCD (Composite International Diagnostic Interview, ICD-10) | Alcohol abuse dependence (Composite International Diagnostic Interview, ICD-10) | 12-month Lifetime | 5 | |
| 6. De Castro Longo et al 2020 | 2007-2008 | Brazil | - | - | 3744 (81 and 95%) | <u>Gender</u> Female=1584 Male=2160 <u>Age range</u> 15-75 | PTSD (Composite International Diagnostic Interview 2.1, ICD-10 and DSM-IV) | Hazardous alcohol use dependence (Composite | 12-month | 9 | |

| | | | | | | | | | | | |
|----|--------------------------|-------------------------------|------------------------------------|---|--|---|---|---|--|---|--|
| | | | | | | | | | International Diagnostic Interview 2.1, ICD-10 and DSM-IV) | | |
| 7. | Chong et al 2009 2012 | Singapore | Singapore | - | 6616 (76%) | <u>Gender</u> Female=3317 (50.1%) Male=3299 (49.9%) <u>Age range</u> 18+ | MDD Dysthymia GAD OCD (World Mental Health Composite International Diagnostic Interview, DSM-IV) | Alcohol abuse dependence (World Mental Health Composite International Diagnostic Interview, DSM-IV) | Lifetime | 8 | |
| 8. | Chou et al 2012 | NESARC-2001-2002 KECA-2000 | Korea and United States of America | NESARC and Korean Epidemiologic Catchment Area (KECA) | NESARC wave 1 (81%) KECA wave 1 (79.8%) | NESARC: <u>Gender</u> Female=23,227 (65.7%) Male=15,619 (44.2%) <u>Age range</u> 18-65 KECA: <u>Gender</u> Female=3510 (56.1%) Male=2743 (43.9%) | MDD Dysthymia Panic disorder Social phobia GAD (NESARC: Associated Disabilities Interview Schedule-DSM-IV Version, Korean version of Composite International Diagnostic | Alcohol abuse dependence (NESARC: Associated Disabilities Interview Schedule-DSM-IV Version, Korean version of Composite International Diagnostic | 12-month | 9 | |

| | | | | | | | | | | | | | | |
|---------------------------------|-----------|--------------------------|--|-----------|--------------------------------|--|--|---|---|------|--|------|--------------------|---|
| | | | | | | | | <u>Age range</u> 18-65 | Interview DSM-IV) | 2.1, | Interview DSM-IV) | 2.1, | | |
| 9. Cousins et al 2014 | 2009-2011 | Ireland | The Irish Longitudinal Study on Ageing (TILDA) | Wave 1 | 8175 (62%) | | | <u>Gender</u> Female=2041 (53.4%) Male=1774 (46.6%) <u>Age range</u> 60-99 | Depression (Center for Epidemiologic Studies Depression Scale, score of 16 or more) | | Problem drinker (CAGE, score of 2 or more) | | 6-month | 7 |
| 10. Crum et al 2005 | 1993-1996 | United States of America | Baltimore Epidemiologic Catchment Area (ECA) follow-up | Wave 2 | 2633 (73%) | | | <u>Gender</u> Female: 1644 (63.2%) Male: 989 (36.8%) <u>Age range</u> 31-99 | MDD (Diagnostic Interview Schedule, DSM-III-R) | | Alcohol dependence (Diagnostic Interview Schedule, DSM-III-R) | | Lifetime | 7 |
| 11. Currie et al 2005 | 2002 | Canada | Canadian Community Health Survey (CCHS) | Cycle 1.2 | 36,984 (77%) | | | <u>Gender</u> Female=Not stated Male=Not stated <u>Age range</u> 15+ | MDE (Canadian World Mental Health Composite Diagnostic Interview, DSM-IV) | | Harmful alcohol use (ICD-10) Alcohol dependence (DSM-IV) (Composite International Diagnostic Interview short form) | | 12-month | 7 |
| 12. Dahl & Dahl 2010 | 2000-2001 | Norway | Oslo Health Study (HUBRO) | - | 2676: 446=SPAS groups and 2230 | | | <u>Gender</u> Female=1558 (58%) | Social phobia and anxiety symptoms (MINI-Social | | Alcohol frequency (Self-report item, more | | 1 week and 5 years | 3 |

| | | | | | | | | | | | |
|--------------------------------|-----------|----------------|--------------------------|---|--------|-------------------------------------|---|--|---|-----------|---|
| | | | | | | controls (response rate not stated) | Male=1118 (42%) <u>Age range</u> 30-45 | Phobia Inventory, score of 8 or more) | than 1 time per week) Alcohol problems (Self-report item on impairment in job due to alcohol') | | |
| 13. Davis et al 2020 | 2017 | United Kingdom | UK Biobank | - | | 157,366 (46%) | <u>Gender</u> Female=89,101 (56%) Male=68,265 (44%) <u>Age range:</u> 45-82 | Depression (Composite International Diagnostic Interview short form) Anxiety disorder (Composite International Diagnostic Interview short form) PTSD (Post-traumatic Stress Disorder Checklist-6, score of 14 or more) | Harmful alcohol use (Alcohol Use Disorder Identification Test score of 16 or more) | 12-month | 4 |
| 14. De Sousa et al 2017 | 2013-2015 | Portugal | EpiDoC (CoReumaPt) study | 2 | Wave 2 | 1680 (response rate not stated) | <u>Gender</u> Female=908 (54%) Male=772 (46%) <u>Age range</u> | Depression and anxiety symptoms (Hospital Anxiety Disorder | Alcohol intake (self-report of frequency of alcohol intake and categorised as | Not known | 5 |

| | | | | | | | | | | |
|-------------------------------|-----------|--------------------------|----------------------------------|--------|----------------|--|---|--|----------|---|
| | | | | | | 65+ | Scale, score of 11 or more) | daily, occasionally, never, cut offs not stated) | | |
| 15. Emerson et al 2017 | 2012-2013 | United States of America | NESARC | Wave 3 | 36,309 (60.1%) | <u>Gender</u> Female=10,940 (55.5%) Male=8765 (44.5%) <u>Age range</u> 18+ | PTSD (Alcohol Use Disorder and Associated Disabilities Interview Schedule-5, DSM-5) | Alcohol use disorder (Alcohol Use Disorder and Associated Disabilities Interview Schedule-5, DSM-5) | 12-month | 5 |
| 16. Forlani et al 2014 | 2006 | Italy | The Faenza Community Aging Study | - | 366 (65.8%) | <u>Gender</u> Female=184 (50.3%) Male=182 (49.7%) <u>Age range</u> 70+ | Anxiety symptoms (Geriatric Anxiety Inventory short form, cut off of 3 or more) | Alcohol consumption (quantity of alcoholic drink converted to units per day, defined as alcoholic unit as a glass of wine (125 ml), a can of beer (330 ml) and a small glass of hard liquor (40 ml), cut off of more than 2 alcohol units per day) | Per day | 5 |

| | | | | | | | | | | |
|-------------------------------------|------|--------------------------|--|---|---|--|---|--|-------------------|---|
| 17. Furihata et al 2018 | 2008 | Japan | Nihon University Sleep and Mental Health Epidemiology Project (NUSMEP) | - | 2559 (54%) | <u>Gender</u> Female=1396 (52.53%) Male=1163 (47.47%) <u>Age range</u> 20+ | Depressive symptoms (Center Epidemiologic Studies Depression Scale , score of 16 or more) | Alcohol consumption (self-report item on drinking more than one glass of sake three times per week, defined as A glass of sake is equal to a 500-ml bottle of beer, 80 ml of distilled spirit, 60 ml of whiskey, or two glasses of wine (240 ml), cut off yes) | 1 week | 5 |
| 18. Grant & Harford 1995 | 1992 | United States of America | National Longitudinal Alcohol Epidemiologic Survey (NLAES) | - | 42,862 (household response rate=91.9%, sample person=97.4%) | <u>Gender</u> Not stated without depression <u>Age range</u> 18+ | MDD (Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV) | Alcohol abuse dependence (Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV) | 12-month Lifetime | 7 |

| | | | | | | | | | | |
|-----------------------------|-----------|--------------------------|--|-----------------------|-------------------|--|---|---|---|---|
| 19. Grant et al 2004 | 2001-2002 | United States of America | NESARC | Wave 1 | 43,093 (81%) | <u>Gender</u> Female=25,575 (57%) Male=18,518 (43%) <u>Age range</u> 18+ | MDD Dysthymia GAD Panic disorder Phobia (Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV) | Alcohol abuse dependence (Alcohol Use Disorder and Associated Disabilities Interview Schedule, DSM-IV) | 12-month | 8 |
| 20. Han et al 2017 | 2005-2014 | United States of America | National Survey on Drug Use and Health (NSDUH) | Ten waves (2005-2014) | 61,240 (71.2-76%) | <u>Gender</u> Female=32,825 (53.6%) Male=28,415 (46.4%) <u>Age range</u> 50+ | Depressive episode Anxiety (self-report item, cut-off not stated) | Binge-drinking (Self-report item, five more drinks on same occasion) Alcohol Use Disorder (measure not stated, DSM-IV) | Binge-drinking-30 days Alcohol abuse/dependence-12-month | 7 |
| 21. Ho et al 2016 | 2003-2004 | Singapore | Singapore Longitudinal Aging Study (SLAS) | Wave 1 | 1070 (72.4%) | <u>Gender</u> Female=585 (53.75%) Male=485 (46.25%) <u>Age range</u> 18+ | Depressive symptoms (Geriatric Mental State Examination, DSM-IV) | Alcohol consumption (measure not stated, more than one drink per week) | 1-week | 5 |
| 22. Husky et al 2018 | 2005 | France | - | - | 17,237 (62.7%) | <u>Gender</u> | MDD GAD | Alcohol abuse | 12-month | 7 |

| | | | | | | | | | | | | |
|--------------------------------|-----------|--------------------------|--------------------------------------|--------|--------|--------------|--|--|---|---------------------|---|--|
| | | | | | | | Female=10,262 (59.5%) Male=6975 (40.5%) <u>Age range</u> 18-99 | Panic disorder PTSD OCD Specific phobia Social phobia (Composite International Diagnostic Interview short form, DSM-IV) Diagnostic Interview short form, DSM-IV) | Alcohol dependence (Composite International Diagnostic Interview short form, DSM-IV) | | | |
| 23. Kawakami et al 2004 | 1997-1999 | Japan | - | - | Wave 1 | 1029 (56.9%) | <u>Gender</u> Female=578 (56.2%) Male=451 (43.8%) <u>Age range</u> 20+ | MDD Mania Dysthymia GAD Panic disorder (World Mental Health University of Michigan Composite International Diagnostic Interview, DSM- III-R) Diagnostic Interview, DSM-III- R) | Alcohol use disorder (World Mental Health University of Michigan Composite International Diagnostic Interview, DSM- III-R) | 6-month Lifetime | 6 | |
| 24. Kessler et al 1997 | 1990-1992 | United States of America | National of Comorbidity Survey (NCS) | Wave 1 | Wave 1 | 8098 (82.6%) | <u>Gender</u> Female=4263 (49.26%) Male=3835 (50.74%) <u>Age range</u> | MDD Dysthymia Panic disorder Social phobia Simple phobia | Alcohol abuse Alcohol dependence (World Mental Health Composite International | Lifetime | 6 | |

| | | | | | | | | | | | | |
|---------------------------------|-----------|---------|--|-----------|----------------|--|---|---|--|----------|---|--|
| | | | | | | 15-54 | GAD Mental Composite International Diagnostic Interview, DSM-III-R) | (World Health Composite International Diagnostic Interview, DSM-III-R) | Diagnostic Interview, DSM-III-R) | | | |
| 25. Kinley et al 2009 | 2002-2003 | Canada | Canadian Community Health Survey – Mental Health and Well-Being | Cycle 1.2 | 28,541 (77.0%) | <u>Gender</u> Female=15,074 (52.82%) Male=13,467 (47.18%) <u>Age range</u> 15+ | Panic disorder (World Health Composite International Diagnostic Interview, DSM-IV) | (World Mental Composite International Diagnostic Interview, DSM-IV) | Alcohol dependence (World Mental Health Composite International Diagnostic Interview short form, DSM-III-R) | 12-month | 8 | |
| 26. Kleinberg et al 2010 | 2006-2008 | Estonia | Estonian Health Interview Survey (EHIS) | - | 6105 (60.2%) | <u>Gender</u> Female=3177 (52.04%) Male=2928 (47.95%) <u>Age range</u> 18-85 | MDD International Neuropsychiatric Interview , DSM-IV) | (Mini- International Neuropsychiatric Interview , DSM-IV) | Binge-drinking (Self-report item partly based on the European Health Determinant Module, defined as five bottles of beer, five glasses of wine, or five glasses of vodka at a time, 5 or more) | 12-month | 7 | |

| | | | | | | | | | | |
|---|-----------|--------------|---|----------------|-----------------------------------|---|---|---|---------|---|
| 27. Klemenc-Ketis & Kersnik 2015 | 2011 | Slovenia | - | - | 1002 (response rate not reported) | <u>Gender</u> Female=512 (51.1%) Male=490 (48.9%) <u>Age range</u> Not clear | Anxiety/depression (Gothenburg Quality of Life Instrument, answering yes to mood and anxiety items) | “Risky” drinker (Slovenian version of the Alcohol Use Disorder Identification Test-Consumption, score of 6 or more for men or 5 or more for women) | - | 6 |
| 28. Koyanagi et al 2017 | 2002-2004 | 47 countries | World Health Survey (WHS) | - | 201,279 (98.5%, range=63%-99%) | <u>Gender</u> Female=102,279 (50.8%) Male=99,058 (49.2%) <u>Age range</u> 18+ | Depressive symptoms (Self-report items to four mandatory questions and two additional ones, DSM-IV) | Alcohol consumption (Self report, defined as how many alcoholic drinks they had on each day in the past seven days, cut off 4 or 5 drinks on at least three days) | 7 days | 7 |
| 29. Leray et al 2011 | 1999-2003 | France | Mental Health in General Population (MHGP) survey | French dataset | 36,105 (response rate not stated) | <u>Gender</u> Female=19,458 (53.9%) Male=16,647 (46.1%) <u>Age range</u> 18+ | GAD Panic disorder Social phobia PTSD (Mini International Neuropsychiatric Interview, ICD-10) Neuropsychiatric Interview, ICD-10) | Alcohol abuse (Mini International Neuropsychiatric Interview, ICD 10) | 6-month | 6 |

| | | | | | | | | | | |
|---------------------------------|---|-------------|--|---------------|---|---|---|--|------------------------|---|
| 30. Levola et al 2011 | 2007 | Finland | National FINRISK 2007 Study | - | 10,000 but used a random subsample (N=2086, 51.9%) | <u>Gender</u> Female=1140 (54.7%) Male=946 (45.3%) <u>Age range</u> 25-74 | Depressive symptoms (Modified Beck's Depression Inventory, score of 8 or more) | Heavy drinking occasion (Timeline-Followback reporting frequency and quantity of consumption of alcoholic drink, defined as 12 g of absolute alcohol, cut off of seven, or five or more for men and women, respectively) | 28-day | 6 |
| 31. Markkula et al 2016 | 2000-2001 and 2011 | Finland | Health Survey and Health Survey | 2000 and 2011 | Wave 1 and 2 Wave 1=6005 (75%) Wave 2=4620 (80.6%) | <u>Gender</u> Female=3257 (54.2%) Male=2748 (45.8%) <u>Age range</u> 30+ | Depressive symptoms (Munich Composite International Diagnostic Interview, DSM-IV) | Alcohol use disorder (Munich Composite International Diagnostic Interview, DSM-IV) | 12-month | 7 |
| 32. Marquenie et al 2007 | Baseline=1996, time 1=1997, time 2=1999 | Netherlands | Netherlands Mental Health Survey and Incidence Study (NEMESIS) | All waves | Baseline=7076 (69.7%), time 1=5618 (79.4%) Time 2=4796 (67.8%) | <u>Gender</u> Female=3777 (53.4%) Male=3299 (46.6%) <u>Age range</u> | GAD Panic disorder Social phobia Agoraphobia OCD (Composite International | Alcohol dependence (Composite International Diagnostic | Lifetime and one-month | 8 |

| | | | | | | | | | | | |
|---|-----------|-------------|---|--------|--------------|--|--|---|-----------------------|---|--|
| | | | | | | 18-64 | Diagnostic Interview version 1.1, DSM-III-R | Interview version 1.1, DSM-III-R) | | | |
| 33. Mendoza-Sassi & Beria 2003 | 2000 | Brazil | - | - | 1260 (7%) | <u>Gender</u> Female=679 (53.9%) Male=581 (46.1%) <u>Age range</u> 15+ | Minor psychiatric disorder (depression or anxiety; Self Report Questionnaire-20, cut off score of 6 for men and 7 for women) | Probable alcohol use disorder (Alcohol Use Disorder Identification Test, score of 8 or more) | 12-month | 7 | |
| 34. Meyer et al 2004 | 1996-1997 | Germany | Transitional in Alcohol Consumption and Smoking (TACOS) | - | 4048 (70.2%) | <u>Gender</u> Female=2019 (61.1%) Male=2029 (63.3%) <u>Age range</u> 18-64 | MDD Dysthymia Phobia PTSD OCD (Munich Composite International Diagnostic Interview, DSM-IV) | Alcohol abuse Alcohol dependence (Munich Composite International Diagnostic Interview, DSM-IV) | Lifetime and 12-month | 6 | |
| 35. Muller et al 2014 | 2004-2008 | Switzerland | PsyCoLaus | Wave 2 | 3694 (67.0%) | <u>Gender</u> Female=1958 (53.0%) Male=1736 (47.0%) <u>Age range</u> 35-75 | PTSD (French version of Diagnostic Interview for Genetic Studies, DSM-IV) | Alcohol use disorder (French version of Diagnostic Interview for Genetic Studies, DSM-IV) | 12-month | 7 | |
| 36. Olaya et al 2018 | 2011-2012 | Spain | COURAGE | - | 4569 (69.9%) | <u>Gender</u> | Panic disorder (adapted version of | Alcohol consumption | 30 days | 6 | |

| | | | | | | | | | | |
|----------------------------------|-----------|--------------------------------|--|--------|----------------|--|--|---|----------------------|---|
| | | | | | | Female=2498 (50.6%) Male=2071 (49.4%) <u>Age range</u> 18+ | the Composite International Diagnostic Interview, DSM-5) | (frequent drinkers – consumed alcohol in either last 30 days and 7 days or 1-2 days per week with 5/4 standard drinks in last 7 days or 3 or more days per week with 5/4 standard drinks in the last 7 days) | | |
| 37. Osland et al 2018 | 2012 | Canada | Canadian Community Health Survey - Mental Health (CCHS-Mental Health) | Wave 2 | 25,097 (68.9%) | <u>Gender</u> Female=Not stated Male=Not stated <u>Age range</u> 15+ | OCD (self-reported diagnosis) | Alcohol abuse Alcohol dependence (Composite International Diagnostic Interview short form, DSM-IV) | 12-month Lifetime | 3 |
| 38. Pacek et al 2013 | 2001-2002 | United States of America | NESARC | Wave 1 | 43,093 (81.0%) | <u>Gender</u> Female=25,575 (57%) Male=18,518 (43%) <u>Age range</u> 18+ | GAD Panic disorder Social phobia Specific phobia (Alcohol Use Disorders and Associated Disabilities | Alcohol dependence (Alcohol Use Disorders and Associated Disabilities Interview Schedule, DSM- IV) | Lifetime | 7 |

| | | | | | | | | Interview Schedule, DSM-IV) | | | | |
|-------------------------------------|-----------|-------------------|--|--------|----------------|--|--|--|----------------------|---|--|--|
| 39. Park et al 2001 2013 | 2001 | Korea | Korean Epidemiologic Catchment Area - Replication (KECA-R) | Wave 2 | 6510 (81.7%) | <u>Gender</u> Female=3229 (49.6%) Male=3281 (50.4%) <u>Age range</u> 18-64 | Specific phobia (Korean version of Composite International Diagnostic Interview, DSM-IV) | Alcohol abuse Alcohol dependence (Korean version of Composite International Diagnostic Interview, DSM- IV) | Lifetime | 9 | | |
| 40. Patel et al 2002 | 1994-1995 | United Kingdom | Surveys of Psychiatric Morbidity in Great Britain | Wave 1 | 8564 (67.2%) | <u>Gender</u> Female=Not reported Male=Not reported <u>Age range</u> 16-64 | Social phobia (Clinical Interview Schedule-Revised, ICD-10) | Alcohol dependence (Self- completion questionnaire, cut off score of four or more) | 12-month | 6 | | |
| 41. Patten et al 2015 | 2015 | Canada | Canadian Community Health Survey - Mental Health (CCHS-Mental Health) | Wave 2 | 25,113 (68.9%) | <u>Gender</u> Female=12,883 (50.7%) Male=12,230 (49.3%) <u>Age range</u> 15+ | MDE MDD (World Mental Health Composite International Diagnostic Interview, DSM-IV) | Alcohol abuse Alcohol dependence (World Mental Health Composite International Diagnostic Interview, DSM- IV) | 12-month Lifetime | 9 | | |
| 42. Pirkola et al 2005 | 2000-2001 | Finland | Health 2000 Survey | Wave 1 | 6005 (75.0%) | <u>Gender</u> | MDD Dysthymia | Alcohol use disorder (Finnish | 12-month | 9 | | |

| | | | | | | | | | | | |
|--------------------------------|-----------|----------------|---|----------------|-------------------------------------|--|---|---|----------|---|--|
| | | | | | | Female=3257 (54.2%) Male=2748 (45.8%) <u>Age range</u> 30+ | GAD Panic disorder Social phobia Agoraphobia (Finnish version of Munich Composite International Diagnostic Interview, DSM- IV) | version of Munich Composite International Diagnostic Interview, DSM- IV) | | | |
| 43. Piwonski et al 2010 | - | Poland | WOBASZ | - | 13,545 (response rate not reported) | <u>Gender</u> Female=7153 (52.8%) Male=6392 (47.2%) <u>Age range</u> 20-74 | Depressive symptoms (Becks Depression Inventory, cut off score of 10 or more) | Alcohol consumption (elf-reporting consumption of three times per week) | 7-day | 6 | |
| 44. Tebeka et al 2018 | 1999-2003 | France | Mental Health in General Population (MHGP) survey | French dataset | 38,600 (not stated) | <u>Gender</u> Female=20,342 (52.7%) Male=18,258 (47.3%) <u>Age range</u> Age range 18+ | MDD Panic disorder Social phobia GAD PTSD (Mini International Neuropsychiatric Interview version 5.0, ICD-10) | Alcohol use disorder (Mini International Neuropsychiatric Interview version 5.0, ICD-10) | Lifetime | 7 | |
| 45. Torres et al 2006 | 2000 | United Kingdom | British National Psychiatric | Wave 2 | 8580 (69.5%) | <u>Gender</u> Female=4300 (50.1%) | OCD (Clinical Interview Schedule-Revised, ICD-10) | Hazardous use Alcohol dependence | 12-month | 7 | |

| | | | | | | | | | | | |
|-------------------------------------|-----------|--------------------------|---|---|--------------|--|---|---|--|---|--|
| | | | | | | Morbidity Survey 2000 | Male=4280 (49.9%) <u>Age range</u> Age range=16+ | | Problem drinking (Alcohol Use Disorder Identification Test and Severity of Alcohol Dependence Questionnaire, cut offs not stated) | | |
| 46. Tracy 2002 | 1993-1994 | United States of America | Chinese American Psychiatric Epidemiology Study (CAPES) | - | 1735 (82%) | <u>Gender</u> Female=876 (50.5%) Male=859 (49.5%) <u>Age range</u> Range=18-65 | PTSD (Diagnostic Interview Schedule, DSM-III-R) | Heavy alcohol use (two items from Composite International Diagnostic Interview, frequency-1-3 times per month and quantity-5+ and 4+ per day) | 12-month | 7 | |
| 47. Van Ameringen et al 2008 | 2002 | Canada | - | - | 2991 (68.1%) | <u>Gender</u> Female=1811 (51.5%) Male=1180 (48.5%) <u>Age range</u> Age range 18+ | PTSD (Revised version of Composite International Diagnostic Interview (CIDI), DSM-IV) | Alcohol use disorder (Mini International Neuropsychiatric Interview) | 3-day Lifetime | 8 | |

| | | | | | | | | | | |
|------------------------------------|-------------------------|-------------|---|---------------|--|---|---|--|---------|---|
| 48. Van Balkom et al 2000 | Not stated | Netherlands | Longitudinal Aging Study Amsterdam (LASA) | - | 3056 (86.0%). Used a subsample (N=659) of this restricted to those aged between 55-84 | <u>Gender</u> Female=354 (54.0%) Male=305 (46.0%) <u>Age range</u> Age range=55+ | GAD OCD Phobia (Diagnostic Interview Schedule, DSM-III) | Heavy/excessive alcohol intake (Garretsen scale, cut off score of four) | 6-month | 9 |
| 49. Van den Berg et al 2009 | 2002-2005 | Netherlands | Rotterdam study | Wave 3 | 5019 (85.4%) | <u>Gender</u> Female=2848 (56.7%) Male=2171 (43.3%) <u>Age range</u> Range=58-100 | MDD Dysthymia GAD Panic disorder Specific phobia Social phobia (Depression=Schedules for Clinical Assessment in Neuropsychiatry, DSM-IV-TR; Anxiety=Munich version of the Composite International Diagnostic Interview) | Excessive alcohol use (Self-reported question, more than 21 alcoholic drinks per week) | 7-day | 5 |
| 50. Van Gool et al 2003 | 1992-1993 and 1998-1999 | Netherlands | Longitudinal Aging Study Amsterdam (LASA) | Waves 1 and 2 | 1280 (response rate not reported) | <u>Gender</u> Female=698 (54.5%) Male=582 (45.5%) | Depressive symptoms (Center of Epidemiologic Studies Depression, | Alcohol consumption (Health Interview Questionnaire, | Daily | 7 |

| | | | | | | | | | | | | |
|------------------------------------|-------|--|---------------|-------------------------------------|--|--|--|---|--|---|------------|---|
| | | | | | | | | <u>Age range</u> | cut off score of 16 or more) | three or more drinks per day) | | |
| | | | | | | | | 55-85 | | | | |
| 51. Yu et al 2012-2013 2018 | China | China National Health and Wellness Survey (NHWS) | Waves 3 and 4 | 36,806 (response rate not reported) | | | | <u>Gender</u> Female=16,698 (45.4%) Male=20,108 (54.6%) | GAD (Generalized Anxiety Disorder-7, cut off score 10 or more) | Alcohol use (measure not stated, excessive) | Not stated | 5 |
| | | | | | | | | <u>Age range</u> 18+ | | | | |

4.4.2 Study characteristics

Of the 51 studies identified in the systematic review, 34 examined the prevalence of alcohol use among those meeting criteria for an anxiety/phobic disorder and 31 for mood disorder. The type of CMD most commonly studied was MDD (39%). None of the included studies examined alcohol use among those with and without SAD. Of the 33 studies reporting the prevalence of AUD among those with and without a CMD, 16 were not included in the meta-analysis (see reasons in the PRISMA flow diagram).

4.4.3 Primary analysis

4.4.3.1 Prevalence and associations of any AUD among those with and without a CMD

The pooled prevalence of having any AUD among those with a CMD was higher than those without (K=17, 15% vs 8%, see table 6), with those with a CMD being twice as likely to report any AUD (OR=2.02, 95% CI=1.72-2.36, $I^2=90.70\%$, see table 6). When stratified by 12-month and lifetime AUD, the prevalence remained higher for lifetime AUD among those with a CMD (12-month: K=9, 10%, lifetime: K=8, 21%, see table 6) compared to those without (12-month: 5%, lifetime: 12%, see table 2). Our meta-analysis found associations for both 12-month and lifetime AUD were approximately two-fold among those with a CMD compared to those without (12-month: OR=2.14, 95% CI=1.75-2.62, $I^2=78.90\%$; lifetime: OR=1.91, 95% CI=1.45-2.52, $I^2=94.70\%$, see table 6 and figure 4).

The pooled prevalence and associations of any AUD by the type of CMD, regardless of duration, among those with an anxiety/phobic disorder was 17% (K=9, compared to 10% for those without, see table 7) and 11% for mood disorder (K=6, compared to 5% for those without). Associations of having any AUD were similar for those with a mood or anxiety/phobic disorder (mood: OR=2.00, 95% CI=1.62-2.47, $I^2=90.00\%$; anxiety/phobic: OR=1.94, 95% CI=1.35-2.78, $I^2=91.40\%$, see table 7 and figure 5).

A sensitivity analysis removing studies with the largest (Kinley, Cox, Clara, Goodwin, & Sareen, 2009) and smallest (Patel, Knapp, Henderson, & Baldwin, 2002) odds ratio resulted in only a small change in the total and lifetime effect size (see supplementary figures S1 and S2). In light of changes to the categorisation of mental disorders whereby PTSD and OCD are now two distinct diagnosis classifications (“trauma- and stressor-related disorders” and “obsessive-compulsive and related disorders” (American Psychiatric Association, 2013)), a sensitivity analysis examining differences in associations of any AUD among those with PTSD compared to other anxiety/phobic disorder (without OCD) was conducted and showed a two-fold increase in associations among those with PTSD while associations with other

anxiety/phobic disorders were non-significant (see table S2). We were unable to conduct a sensitivity analysis of OCD due to an insufficient number of studies.

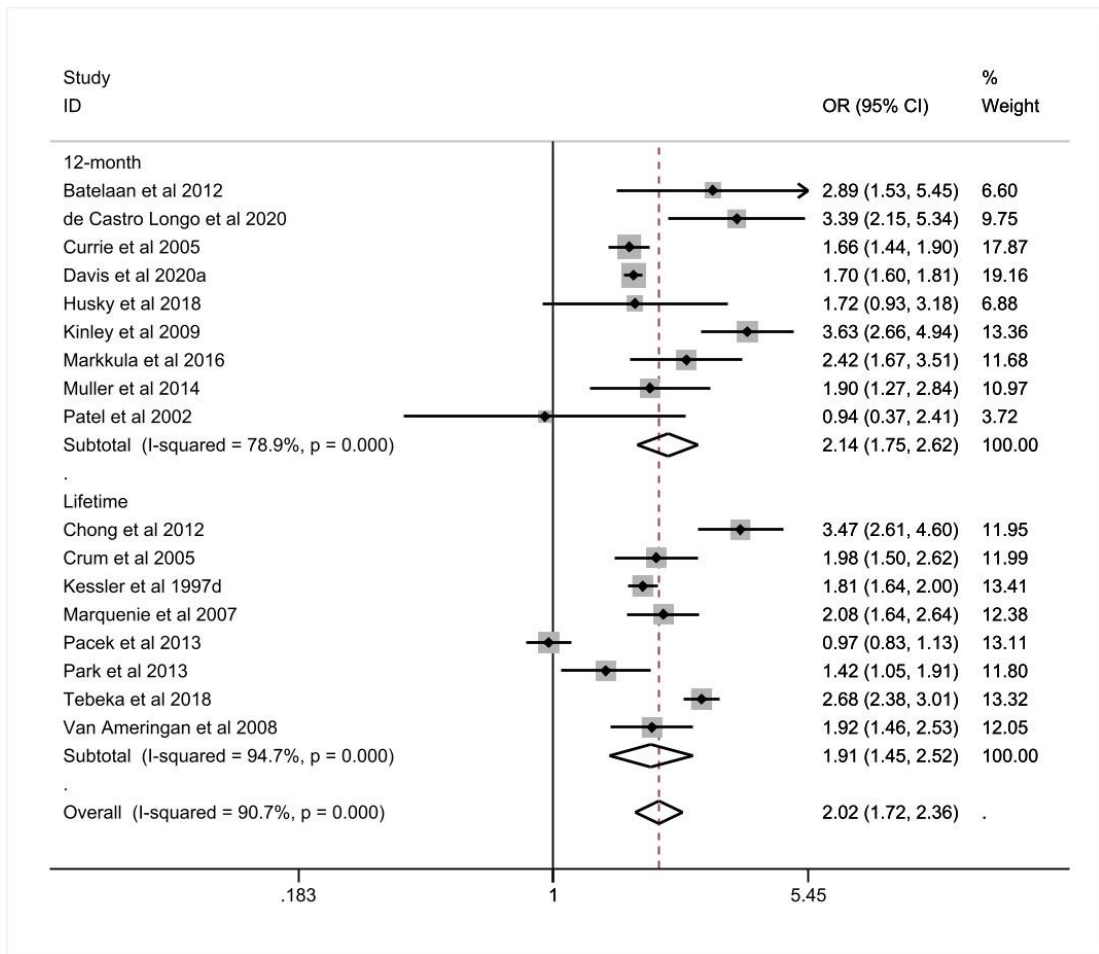


Figure 4: 12-month and lifetime associations of AUD among those with a CMD compared to those without a CMD (N=382,201)

Table 6: Prevalence and associations of any AUD among those with and without a CMD (N=382,201)

| Any AUD | Prevalence of those with a CMD (%) | 95% CI Lower (%) | 95% CI Upper (%) | Weight | Heterogeneity (I ²) | p | Prevalence of those without a CMD (%) | 95% CI Lower (%) | 95% CI Upper (%) | Weight | Heterogeneity (I ²) | p | OR | 95% CI Lower | 95% CI Upper | Weight | Heterogeneity (I ²) | p |
|----------------------------|------------------------------------|------------------|------------------|---------------|---------------------------------|-------------|---------------------------------------|------------------|------------------|---------------|---------------------------------|-------------|-------------|--------------|--------------|---------------|---------------------------------|-------------|
| 12-month | | | | | | | | | | | | | | | | | | |
| Batelaan et al 2012 | 8.00 | 5.00 | 14.00 | 10.79 | | | 3.00 | 2.00 | 3.00 | 11.09 | | | 2.89 | 1.53 | 5.45 | 6.60 | | |
| De Castro Longo et al 2020 | 8.00 | 6.00 | 12.00 | 11.52 | | | 2.00 | 2.00 | 3.00 | 11.06 | | | 3.39 | 2.15 | 5.34 | 9.75 | | |
| Currie et al 2005 | 17.00 | 15.00 | 19.00 | 12.00 | | | 10.00 | 10.00 | 11.00 | 11.15 | | | 1.66 | 1.44 | 1.90 | 17.87 | | |
| Davis et al 2020 | 4.00 | 4.00 | 4.00 | 12.14 | | | 2.00 | 2.00 | 2.00 | 11.15 | | | 1.70 | 1.60 | 1.81 | 19.16 | | |
| Husky et al 2018 | 7.00 | 4.00 | 12.00 | 10.93 | | | 4.00 | 4.00 | 4.00 | 11.14 | | | 1.72 | 0.93 | 3.18 | 6.88 | | |
| Kinley et al 2009 | 8.00 | 6.00 | 10.00 | 11.82 | | | 2.00 | 2.00 | 2.00 | 11.14 | | | 3.63 | 2.66 | 4.94 | 13.36 | | |
| Markkula et al 2016 | 9.00 | 6.00 | 12.00 | 11.64 | | | 4.00 | 3.00 | 4.00 | 11.10 | | | 2.42 | 1.67 | 3.51 | 11.68 | | |
| Muller et al 2014 | 21.00 | 15.00 | 28.00 | 10.88 | | | 11.00 | 10.00 | 12.00 | 11.06 | | | 1.90 | 1.27 | 2.84 | 10.97 | | |
| Patel et al 2002 | 14.00 | 6.00 | 29.00 | 8.28 | | | 15.00 | 14.00 | 15.00 | 11.12 | | | 0.94 | 0.37 | 2.41 | 3.72 | | |
| Subtotal | 10.00 | 5.00 | 16.00 | 100.00 | 97.87 | 0.01 | 5.00 | 3.00 | 8.00 | 100.00 | 99.84 | 0.01 | 2.14 | 1.75 | 2.62 | 100.00 | 78.90% | 0.01 |

| Lifetime | | | | | | | | | | | | | | | | | | |
|---------------------------------|-------|-------|-------|--------|-------|------|-------|-------|-------|--------|-------|------|------|------|------|--------|-------|------|
| Chong et al 2012 | 10.00 | 8.00 | 13.00 | 12.51 | | | 3.00 | 3.00 | 4.00 | 12.51 | | | 3.47 | 2.61 | 4.60 | 11.95 | | |
| Crum et al 2005 | 22.00 | 19.00 | 27.00 | 12.41 | | | 11.00 | 10.00 | 13.00 | 12.48 | | | 1.98 | 1.50 | 2.62 | 11.99 | | |
| Kessler et al 1997 | 35.00 | 33.00 | 37.00 | 12.62 | | | 19.00 | 18.00 | 20.00 | 12.51 | | | 1.81 | 1.64 | 2.00 | 13.41 | | |
| Marquene et al 2007 | 9.00 | 7.00 | 11.00 | 12.57 | | | 4.00 | 4.00 | 5.00 | 12.51 | | | 2.08 | 1.64 | 2.64 | 12.38 | | |
| Pacek et al 2013 | 40.00 | 37.00 | 44.00 | 12.50 | | | 42.00 | 41.00 | 43.00 | 12.52 | | | 0.97 | 0.83 | 1.13 | 13.11 | | |
| Park et al 2013 | 23.00 | 18.00 | 28.00 | 12.26 | | | 16.00 | 15.00 | 17.00 | 12.51 | | | 1.42 | 1.05 | 1.91 | 11.80 | | |
| Tebeka et al 2018 | 9.00 | 8.00 | 10.00 | 12.63 | | | 3.00 | 3.00 | 4.00 | 12.52 | | | 2.68 | 2.38 | 3.01 | 13.32 | | |
| Van Ameringen et al 2008 | 28.00 | 24.00 | 31.00 | 12.50 | | | 14.00 | 12.00 | 17.00 | 12.42 | | | 1.92 | 1.46 | 2.53 | 12.05 | | |
| Subtotal | 21.00 | 12.00 | 32.00 | 100.00 | 99.35 | 0.01 | 12.00 | 4.00 | 24.00 | 100.00 | 99.92 | 0.01 | 1.91 | 1.45 | 2.52 | 100.00 | 94.70 | 0.01 |
| Overall | 15.00 | 9.00 | 22.00 | 100.00 | 99.50 | 0.01 | 8.00 | 5.00 | 12.00 | 100.00 | 99.90 | 0.01 | 2.02 | 1.72 | 2.36 | 100.00 | 90.70 | 0.01 |

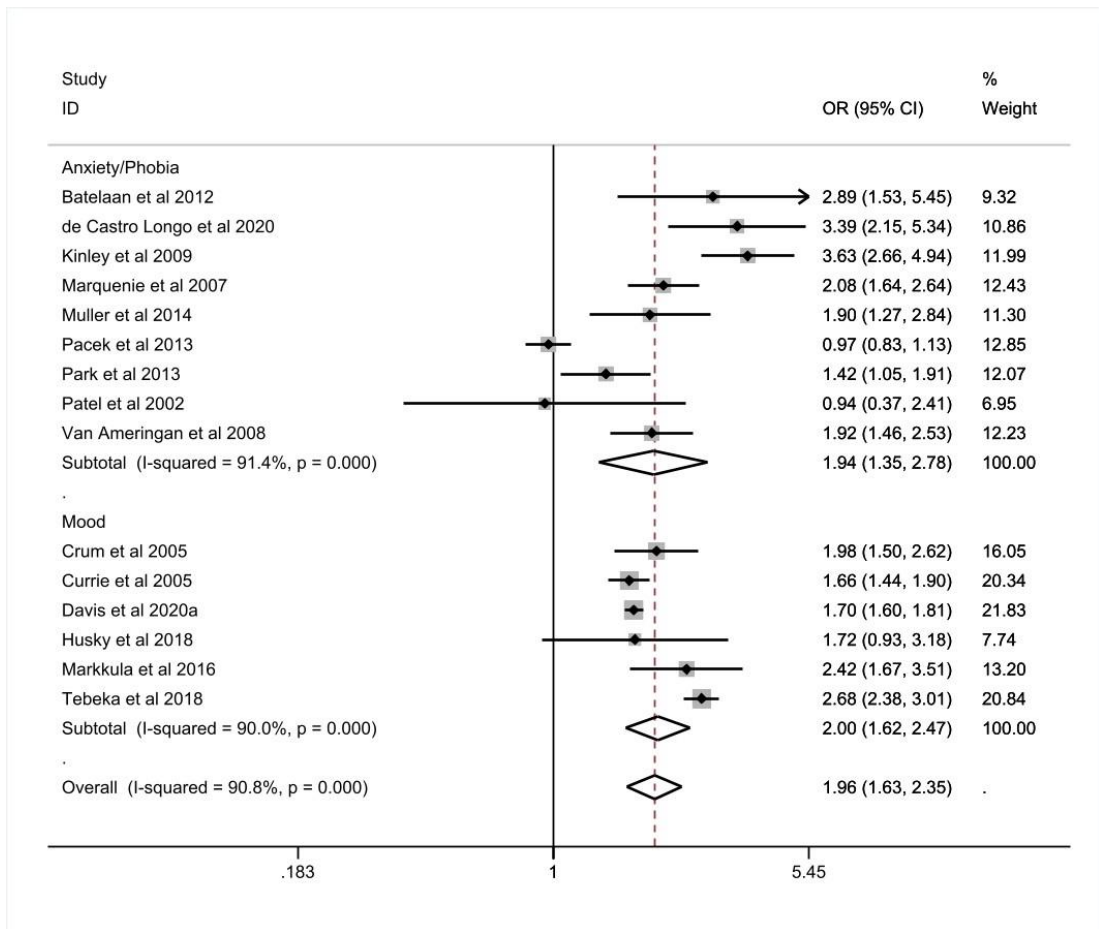


Figure 5: Associations of any AUD with CMD, stratified by anxiety/phobic and mood disorders (N=367,483)

Table 7: Associations of any AUD stratified by type of CMD (N=367,487)

| Type of CMD | Prevalence among those with the specific CMD (%) | 95% CI Lower (%) | 95% Upp er (%) | Weight | Heterogeneity (I ²) | <i>p</i> | Prevalence among those without the specific CMD (%) | 95% CI Lower (%) | 95% Upp er (%) | Weight | Heterogeneity (I ²) | <i>p</i> | OR | 95% CI Lower | 95% CI Upp er | Weight | Heterogeneity (I ²) | <i>p</i> |
|--------------------------------|--|------------------|----------------|--------|---------------------------------|----------|---|------------------|----------------|--------|---------------------------------|----------|------|--------------|---------------|--------|---------------------------------|----------|
| Anxiety/phobic disorder | | | | | | | | | | | | | | | | | | |
| Batelaan et al 2012 | 8.00 | 5.00 | 14.00 | 10.95 | | | 3.00 | 2.00 | 3.00 | 11.12 | | | 2.89 | 1.53 | 5.45 | 9.32 | | |
| De Castro Longo et al 2020 | 8.00 | 6.00 | 12.00 | 11.34 | | | 2.00 | 2.00 | 3.00 | 11.11 | | | 3.39 | 2.15 | 5.34 | 10.86 | | |
| Kinley et al 2009 | 8.00 | 6.00 | 10.00 | 11.49 | | | 2.00 | 2.00 | 2.00 | 11.13 | | | 3.63 | 2.66 | 4.94 | 11.99 | | |
| Marquenie et al 2007 | 9.00 | 7.00 | 11.00 | 11.57 | | | 4.00 | 4.00 | 5.00 | 11.12 | | | 2.08 | 1.64 | 2.64 | 12.43 | | |
| Muller et al 2014 | 21.00 | 15.00 | 28.00 | 11.00 | | | 11.00 | 10.00 | 12.00 | 11.11 | | | 1.90 | 1.27 | 2.84 | 11.30 | | |
| Pacek et al 2013 | 40.00 | 37.00 | 44.00 | 11.49 | | | 42.00 | 41.00 | 43.00 | 11.12 | | | 0.97 | 0.83 | 1.13 | 12.85 | | |
| Park et al 2013 | 23.00 | 18.00 | 28.00 | 11.26 | | | 16.00 | 15.00 | 17.00 | 11.12 | | | 1.42 | 1.05 | 1.91 | 12.07 | | |
| Patel et al 2002 | 14.00 | 6.00 | 29.00 | 9.39 | | | 15.00 | 14.00 | 15.00 | 11.12 | | | 0.94 | 0.37 | 2.41 | 6.95 | | |
| Van Ameringan et al 2008 | 28.00 | 24.00 | 31.00 | 11.50 | | | 14.00 | 12.00 | 17.00 | 11.04 | | | 1.92 | 1.46 | 2.53 | 12.23 | | |

| | | | | | | | | | | | | | | | | | | | |
|----------------------------|-------|------|------|--------|-------|------|-------|------|------|-------|-------|------|------|------|------|-------|-------|------|--|
| Subtotal | 17.00 | 9.00 | 26.0 | 100.00 | 97.86 | 0.01 | 10.00 | 3.00 | 20.0 | 100.0 | 99.92 | 0.01 | 1.94 | 1.35 | 2.78 | 100.0 | 91.40 | 0.01 | |
| | | | 0 | | | | | | 0 | 0 | | | | | | 0 | | | |
| Mood disorder | | | | | | | | | | | | | | | | | | | |
| Crum et al 2005 | 22.00 | 19.0 | 27.0 | 16.47 | | | 11.00 | 10.0 | 13.0 | 16.37 | | | 1.98 | 1.50 | 2.62 | 16.05 | | | |
| | | 0 | 0 | | | | | 0 | 0 | | | | | | | | | | |
| Currie et al 2005 | 17.00 | 15.0 | 19.0 | 17.15 | | | 10.00 | 10.0 | 11.0 | 16.75 | | | 1.66 | 1.44 | 1.90 | 20.34 | | | |
| | | 0 | 0 | | | | | 0 | 0 | | | | | | | | | | |
| Davis et al 2020 | 4.00 | 4.00 | 4.00 | 17.41 | | | 2.00 | 2.00 | 2.00 | 16.76 | | | 1.70 | 1.60 | 1.81 | 21.83 | | | |
| | | | | | | | | | | | | | | | | | | | |
| Husky et al 2018 | 7.00 | 4.00 | 12.0 | 15.18 | | | 4.00 | 4.00 | 4.00 | 16.73 | | | 1.72 | 0.93 | 3.18 | 7.74 | | | |
| | | | 0 | | | | | | | | | | | | | | | | |
| Markkula et al 2016 | 9.00 | 6.00 | 12.0 | 16.47 | | | 4.00 | 3.00 | 4.00 | 16.65 | | | 2.42 | 1.67 | 3.51 | 13.20 | | | |
| | | | 0 | | | | | | | | | | | | | | | | |
| Tebeka et al 2018 | 9.00 | 8.00 | 10.0 | 17.34 | | | 3.00 | 3.00 | 4.00 | 16.74 | | | 2.68 | 2.38 | 3.01 | 20.84 | | | |
| | | | 0 | | | | | | | | | | | | | | | | |
| Subtotal | 11.00 | 6.00 | 17.0 | 100.00 | 99.15 | 0.01 | 5.00 | 3.00 | 9.00 | 100.0 | 99.85 | 0.01 | 2.00 | 1.62 | 2.47 | 100.0 | 90.00 | 0.01 | |
| | | | 0 | | | | | | | 0 | | | | | | 0 | | | |

4.4.3.2 Exploratory analysis

When stratified by the decade (e.g. 1990's) and continent (e.g. Europe) in which the study was conducted respectively, we found similar strengths of associations (see tables S3 and S4).

4.4.3.3 Heterogeneity

There was substantial heterogeneity between studies when conducting each meta-analysis as illustrated in the forest plots (see figures S3-6), where I^2 percentages were over 80% which was further confirmed by our overall funnel plot (see figure S3). An Egger's test was non-significant ($p=0.86$) and a funnel plot showed studies remained close to the overall effect size, indicating limited evidence of bias (see figure S7). We also explored sources of heterogeneity by conducting a sub-group analysis according to the decade during which data was collected, continent in which the studies were conducted in, and bias score (see figures S3-S6) but these did not substantially reduce heterogeneity estimates. We were unable to explore heterogeneity according to group characteristics due to a lack of reporting among those with and without a CMD, however, there were differences in the diagnostic criteria used to assess both AUD and CMD which may explain some of the heterogeneity.

4.4.4 Secondary analyses

4.4.4.1 Prevalence and associations of mild and moderate/severe AUD among those with and without a CMD

The pooled prevalence of mild AUD was higher among those with a CMD compared to those without ($K=6$, 7% vs 5%, see table 8). Those with a CMD were more likely to report mild AUD compared to those without a CMD ($OR=1.71$, 95% $CI=1.31-2.23$, $I^2=75.20\%$, see table 8 and figure 6). We found 12% of those with a CMD reported moderate/severe AUD compared to 6% of those without a CMD ($K=17$, see table 8), and those with a CMD were twice as likely to report moderate/severe AUD ($OR=2.19$, 95% $CI=1.82-2.63$, $I^2=91.30\%$, see table 8 and figure 6).

Due to the small number of studies examining the prevalence of mild AUD ($N=6$), it was not possible to conduct a sub-group analysis of mild AUD by the type of CMD, though this was possible for moderate/severe AUD. We found those with a mood or anxiety/phobic disorder were approximately twice as likely to report moderate/severe AUD (mood: $K=6$, $OR=2.02$, 95% $CI=1.60-2.57$, $I^2=89.60\%$; anxiety/phobic: $K=9$, $OR=2.12$, 95% $CI=1.43-3.14$, $I^2=92.20\%$, see table S5).

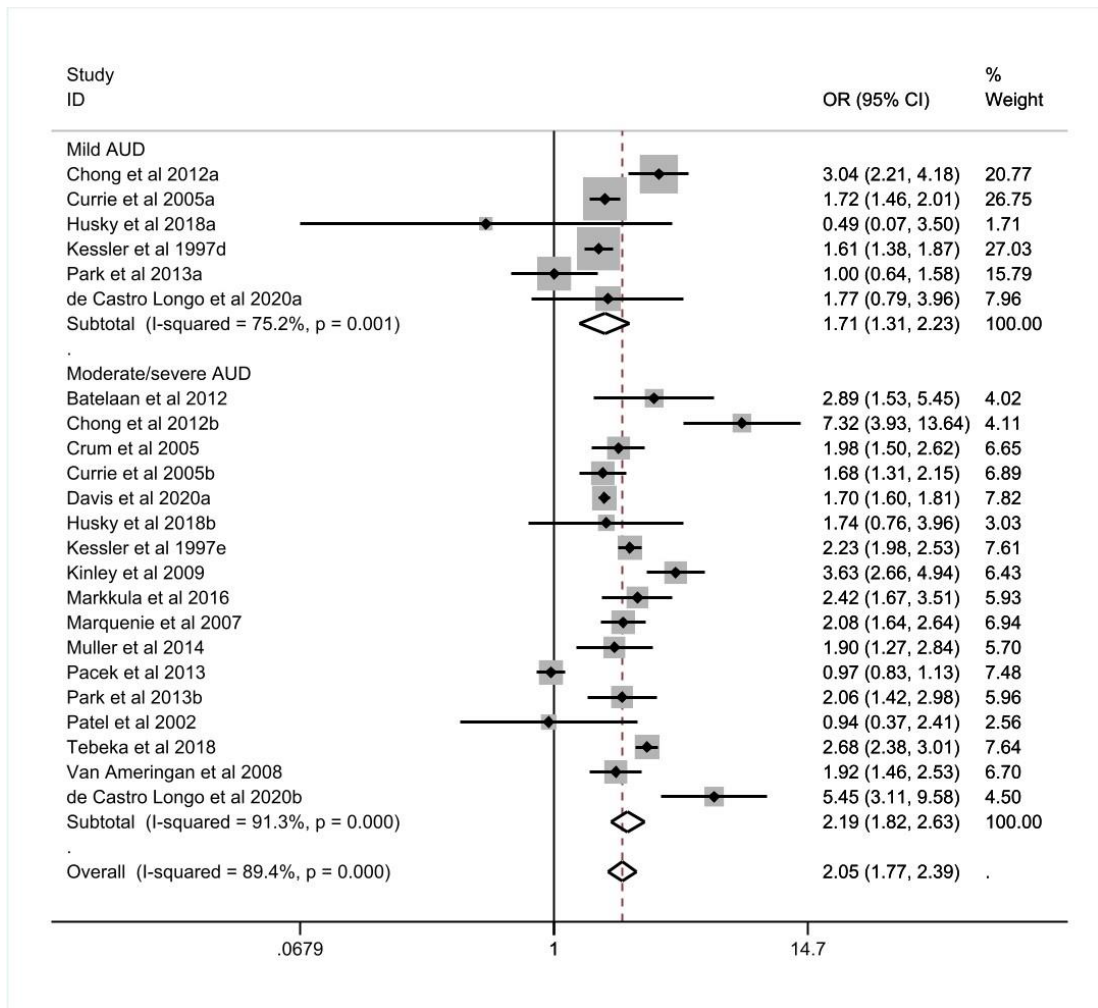


Figure 6: Associations of AUD among those with a CMD, stratified by AUD severity (N=382,201)

Table 8: Prevalence and associations of mild and moderate/severe AUD among those with and without a CMD (N=382.201)

| AUD severity | Prevalence among those with a CMD (%) | 95% CI Lower | 95% CI Upper | Weight | Heterogeneity (I ²) | p | Prevalence among those without a CMD (%) | 95% CI Lower | 95% CI Upper | Weight | Heterogeneity (I ²) | p | OR | 95% CI Lower | 95% CI Upper | Weight | Heterogeneity (I ²) | p |
|----------------------------|---------------------------------------|--------------|--------------|--------|---------------------------------|-----|--|--------------|--------------|--------|---------------------------------|-----|------|--------------|--------------|--------|---------------------------------|-----|
| Mild AUD | | | | | | | | | | | | | | | | | | |
| Chong et al 2012 | 8.00 | 6.00 | 10.00 | 17.31 | | | 3.00 | 2.00 | 3.00 | 16.66 | | | 3.04 | 2.21 | 4.18 | 20.77 | | |
| Currie et al 2005 | 13.00 | 11.00 | 15.00 | 17.72 | | | 8.00 | 7.00 | 8.00 | 16.73 | | | 1.72 | 1.46 | 2.01 | 26.75 | | |
| Husky et al 2018 | 1.00 | 0.00 | 4.00 | 14.90 | | | 1.00 | 1.00 | 2.00 | 16.71 | | | 0.49 | 0.07 | 3.50 | 1.71 | | |
| Kessler et al 1997 | 15.00 | 14.00 | 17.00 | 17.86 | | | 10.00 | 9.00 | 10.00 | 16.64 | | | 1.61 | 1.38 | 1.87 | 27.03 | | |
| Park et al 2013 | 10.00 | 7.00 | 15.00 | 15.80 | | | 10.00 | 9.00 | 11.00 | 16.66 | | | 1.00 | 0.64 | 1.58 | 15.79 | | |
| De Castro Longo et al 2020 | 2.00 | 1.00 | 5.00 | 16.41 | | | 1.00 | 1.00 | 2.00 | 16.60 | | | 1.77 | 0.79 | 3.96 | 7.96 | | |
| Subtotal | 7.00 | 4.00 | 12.00 | 100.00 | 95.66 | 0.0 | 5.00 | 2.00 | 8.00 | 100.00 | 99.71 | 0.0 | 1.71 | 1.31 | 2.23 | 100.00 | 75.20 | 0.0 |
| | | | | | | 1 | | | | | | 1 | | | | | | 1 |
| Moderate/severe AUD | | | | | | | | | | | | | | | | | | |
| Batelaan et al 2012 | 8.00 | 5.00 | 14.00 | 5.66 | | | 3.00 | 2.00 | 3.00 | 5.89 | | | 2.89 | 1.53 | 5.45 | 4.02 | | |

| | | | | | | | | | | | | | | |
|---------------------------------|-------|-------|-------|------|--|-------|-------|-------|------|--|------|------|-------|------|
| Chong et al 2012 | 3.00 | 2.00 | 4.00 | 6.02 | | 0.00 | 0.00 | 1.00 | 5.89 | | 7.32 | 3.93 | 13.64 | 4.11 |
| Crum et al 2005 | 22.00 | 19.00 | 27.00 | 5.96 | | 11.00 | 10.00 | 13.00 | 5.84 | | 1.98 | 1.50 | 2.62 | 6.65 |
| Currie et al 2005 | 5.00 | 4.00 | 7.00 | 6.08 | | 3.00 | 3.00 | 3.00 | 5.90 | | 1.68 | 1.31 | 2.15 | 6.89 |
| Davis et al 2020 | 4.00 | 4.00 | 4.00 | 6.13 | | 2.00 | 2.00 | 2.00 | 5.91 | | 1.70 | 1.60 | 1.81 | 7.82 |
| Husky et al 2018 | 4.00 | 2.00 | 9.00 | 5.70 | | 2.00 | 2.00 | 3.00 | 5.90 | | 1.74 | 0.76 | 3.96 | 3.03 |
| Kessler et al 1997 | 26.00 | 24.00 | 28.00 | 6.10 | | 12.00 | 11.00 | 13.00 | 5.89 | | 2.23 | 1.98 | 2.53 | 7.61 |
| Kinley et al 2009 | 8.00 | 6.00 | 10.00 | 6.02 | | 2.00 | 2.00 | 2.00 | 5.90 | | 3.63 | 2.66 | 4.94 | 6.43 |
| Markkula et al 2016 | 9.00 | 6.00 | 12.00 | 5.96 | | 4.00 | 3.00 | 4.00 | 5.88 | | 2.42 | 1.67 | 3.51 | 5.93 |
| Marquenie et al 2007 | 9.00 | 7.00 | 11.00 | 6.07 | | 4.00 | 4.00 | 5.00 | 5.89 | | 2.08 | 1.64 | 2.64 | 6.94 |
| Muller et al 2014 | 21.00 | 15.00 | 28.00 | 5.69 | | 11.00 | 10.00 | 12.00 | 5.88 | | 1.90 | 1.27 | 2.84 | 5.70 |
| Pacek et al 2013 | 40.00 | 37.00 | 44.00 | 6.02 | | 42.00 | 41.00 | 43.00 | 5.90 | | 0.97 | 0.83 | 1.13 | 7.48 |
| Park et al 2013 | 15.00 | 11.00 | 21.00 | 5.84 | | 8.00 | 7.00 | 8.00 | 5.89 | | 2.06 | 1.42 | 2.98 | 5.96 |
| Patel et al 2002 | 14.00 | 6.00 | 29.00 | 4.68 | | 15.00 | 14.00 | 15.00 | 5.89 | | 0.94 | 0.37 | 2.41 | 2.56 |
| Tebeka et al 2018 | 9.00 | 8.00 | 10.00 | 6.12 | | 3.00 | 3.00 | 4.00 | 5.90 | | 2.68 | 2.38 | 3.01 | 7.64 |

| | | | | | | | | | | | | | | | | | | |
|---------------------------------|-------|-------|-------|--------|-------|-----|-------|-------|-------|--------|-------|------|-------|------|------|--------|-------|-----|
| Van | 28.00 | 24.00 | 31.00 | 6.03 | | | 14.00 | 12.00 | 17.00 | 5.76 | | 1.92 | 1.46 | 2.53 | 6.70 | | | |
| Ameringan et al 2008 | | | | | | | | | | | | | | | | | | |
| De Castro | 6.00 | 4.00 | 9.00 | 5.92 | | | 1.00 | 1.00 | 2.00 | 5.88 | | 5.45 | 3.111 | 9.58 | 4.52 | | | |
| Longo et al 2020 | | | | | | | | | | | | | | | | | | |
| Subtotal | 12.00 | 8.00 | 17.00 | 100.00 | 99.26 | 0.0 | 6.00 | 4.00 | 10.00 | 100.00 | 99.88 | 0.0 | 2.19 | 1.82 | 2.63 | 100.00 | 91.30 | 0.0 |
| | | | | | | 1 | | | | | | 1 | | | | | | 1 |

4.4.5 Narrative synthesis

4.4.5.1 Binge-drinking among those with and without a CMD

Five studies reported the prevalence of binge-drinking among those with and without a CMD, though there was variation in the cut-offs used to assess this and the duration of binge-drinking (see table 9). Of the five studies, four examined the prevalence of binge-drinking among those with and without depression, one with anxiety and one with PTSD. Four of the five studies reported a higher prevalence of binge-drinking among those with a CMD (3.70%-35.03%, see table 9) compared to those without (1.01%-31.62%). One reported a lower prevalence (12.60% vs 15.10%, see table 9), this may have been due to the study measuring depressive episode or having any anxiety whereas other studies examined specific types of CMDs or depressive symptoms.

Table 9: Overview of findings of studies examining the prevalence of binge-drinking among those with and without a CMD

| Study | Type of CMD assessed | Outcome | Duration | Summary of findings | Demographic characteristics |
|-------------------------|---|---|----------|---|--|
| 1. Archie et al 2012 | Depression (cut off score >5 or more, derived depression scale) | Binge-drinking (5 or more drinks on one occasion once a month or more) | 12-month | Binge-drinker and depressed: 420/1199 (35.03%) Binge-drinker and not depressed: 5161/16324 (31.62%) | Gender: Binge-drinker/depressed: Male: 188/375 (50.00%) Female: 232/824 (28.13%) Binge-drinker/not depressed: Male: 3351/8561 (39.14%) Female: 1310/7763 (23.31%) |
| 2. Han et al 2017 | Major depressive episode (yes/no) Anxiety (yes/no) | Binge-drinking (5 or more drinks in last 30 days) | 30 days | With depressive episode: 2013-2014=169/1339 (12.60%) Without depressive episode: 2013-2014=2,142/13,963 (15.10%) With anxiety: 2013/2014=123/931 (13.20%) Without anxiety: 2206/14371 (15.00%) | |
| 3. Kleinberg et al 2010 | MDD (ICD-10) | Binge-drinking (5 or more drinks, never, some times per year, 1-3 times per month, at least once a week*) | 12-month | With MDD: 26/342 (7.50%) Without MDD: 265/5763 (4.60%) | |
| 4. Levola et al 2011 | Depressive symptoms (BDI cut off score >8) | Heavy drinking occasion (7 or more drinks for men or 5 or more for women) | 28-days | With depression: 25/321 (7.79%) Without depression: 86/1765 (4.87%) | Gender and depression Female=4/198 (2.02%) Male=21/123 (17.07%) Gender and no depression Female=36/942 (3.82%) Male=50/823 (6.08%) |
| 5. Tracy 2002 | PTSD (DSM-III-R) | Heavy alcohol use (frequency 1-3 times per month and quantity) | 12-month | With PTSD: 1/27 (3.70%) | |

5+ drinks per day for men and 4+
drinks per day for women,
respectively)

Without PTSD:
17/1691 (1.01%)

4.4.5.2 Alcohol consumption among those with and without a CMD

Twelve studies reported the prevalence of alcohol consumption among those with and without a CMD, although there was variation in the type of alcohol consumption and CMD assessed and cut-off scores used (see table 10). Three studies reported a higher prevalence of alcohol consumption among those with a CMD (1.66%-24.29%), compared to those without (0.92%-7.94%), six reported a lower prevalence among those with a CMD (0.00%-42.00%) and three reported both higher and lower prevalence depending on the type of CMD and alcohol consumption outcome (0.00%-14.81%, see table 10).

Table 10: Overview of findings of studies examining the prevalence of alcohol consumption among those with and without a CMD

| Study | Type of CMD assessed | Outcome | Duration | Summary of findings |
|------------------------|--|--|--|--|
| 1. Dahl & Dahl 2010 | Social phobia and anxiety (MINI-SPIN cut off score 8>) | Frequency of alcohol use (>1 times per week) Alcohol problems (one or more periods in the last 5 years affected job) | Alcohol frequency=1 week Alcohol problems=5 years | With SPAS: Weekly drinker=182/446 (40.80%) Alcohol problems=54/446 (11.21%) Without SPAS: Weekly drinker=1124/2230 (50.40%) Alcohol problems=121/2230 (5.43%) |
| 2. de Sousa et al 2017 | Depression (HADS-D cut off score 11>) Anxiety (HAD-A cut off score 11>) | Alcohol frequency (daily*, occasionally, never; cut offs not stated) | Not stated | With depression: Daily drinker=58/241 (24.07%) Without depression: Daily drinker=553/1439 (38.43%) With anxiety: Daily drinker=40/176 (22.73%) Without anxiety: Daily drinker=571/1504 (37.97%) |
| 3. Forlani et al 2014 | Anxiety symptoms (GAI-SF cut off score of 3>) | Alcohol consumption (<1, 1, 2, 2>* units per day) | Not stated | With anxiety: 7/77 (9.09%) Without anxiety: 14/289 (4.84%) |
| 4. Furihata et al 2018 | Depressive symptoms (CES-D cut off score 16>) | Alcohol frequency (three times per week) | 1-week | With depression: 32/159 (20.13%) Without depression: 533/2175 (24.51%) |
| 5. Ho et al 2016 | Depression (GSM, answering yes to questions 1 and 2) | Alcohol frequency (>1 drink per week) | 1-week | With depression: 0/54 (0.00%) Without depression: 14/915 (1.53%) |
| 6. Koyanagi et al 2017 | Depressive symptoms | Alcohol consumption | 7 days | With depression: |

| | | | | |
|------------------------------------|---|--|-------------------|---|
| | (yes to four mandatory questions and 2 additional) | (lifetime abstainers, non-heavy drinkers, infrequent heavy drinkers, frequent heavy drinkers* - 4 or 5 drinks for women and men on at least 3 days) | | Frequent heavy drinker=64/12,886 (0.50%) Without depression: Frequent heavy drinker=1558/155,835 (1.00%) |
| 7. Olaya et al 2018 | Panic disorder (DSM-5) | Alcohol consumption (frequent drinkers – consumed alcohol in either last 30 days and 7 days or 1-2 days per week with 5/4 standard drinks in last 7 days or 3 or more days per week with 5/4 standard drinks in the last 7 days) | 12-month | With panic disorder: 25/96 (31.30%) Without panic disorder: 1680/4176 (42.00%) |
| 8. Piwonski et al 2010 | Depressive symptoms (BDI cut off score >10) | Alcohol consumption (>=3 times per week) | Not stated | With depression: 63/3800 (1.66%) Without depression: 85/9279 (0.92%) |
| 9. Van Balkom et al 2000 | GAD OCD Phobia (DSM-III) | Heavy/excessive alcohol intake (cut off score of 4 on Garretsen scale) | 6-month | With phobic disorder: 1/21 (4.76%) With panic disorder: 0/6 (0.00%) With GAD: 3/47 (6.38%) Without an anxiety disorder: 1/27 (3.70%) |
| 10. Van den Berg et al 2009 | MDD Dysthymia GAD Panic disorder Specific phobia Social phobia | Excessive alcohol use (more than 21 drinks per week) | Alcohol use=7-day | With MDD: 9/96 (9.38%) With Dysthymia: 0/19 (0.00%) With GAD: 7/103 (6.80%) |

| | | | | |
|--------------------------------|--|--|------------|--|
| | (DSM-IV-TR) | | | With panic disorder: 4/27 (14.81%) With specific phobia: 6/77 (7.79%) With social phobia: 5/56 (8.93%) Without a CMD: 488/4499 (10.85%) |
| 11. Van Gool et al 2003 | Depressive symptoms (CES-D cut off score 16>) | Alcohol consumption (no alcohol intake, moderate, excessive* – 3 or more drinks per day) | Not stated | With depression: 7/176 (4.00%) Without depression: 45/1104 (4.10%) |
| 12. Yu et al 2018 | GAD (GAD-7 cut off score 10>) | Alcohol consumption (do not drink, moderate, excessive*) | Not stated | With GAD: 43/177 (24.29%) Without GAD: 2769/34,854 (7.94%) |

4.5 Discussion

4.5.1 Key findings

Our systematic review and meta-analysis aimed to examine the prevalence and associations of AUD, binge-drinking and alcohol consumption among those with and without a CMD, respectively. We found that those with a CMD were twice as likely to report an AUD compared to those without and these associations were similar across types of CMD across decades and continents. Based on the odds ratio, associations between CMD and AUD were stronger for moderate/severe AUD compared to mild AUD. In addition, our narrative review identified both positive and negative associations for CMD with binge-drinking and alcohol consumption indicating that more research using similar methods is required.

Our findings identified that those with a CMD were more likely to report severe levels of AUD and that most studies focussed on associations with a specific type of CMD, such as MDD. We were unable to identify any studies examining associations with SAD. In addition, much of the research has focussed on AUD as opposed to other problematic drinking patterns, such as binge-drinking, despite the high prevalence in the general population (Peacock et al., 2018) and the known negative health impacts (Kuntsche et al., 2017; Wilsnack et al., 2018).

4.5.2 Models of comorbidity and comparisons to previous research

Models of comorbidity have debated whether alcohol worsens mental health or vice versa (Jane-Llopis & Matytsina, 2006) and previous longitudinal research assessing both pathways indicate stronger support for the notion that poor mental health increases alcohol use (Bell & Britton, 2014), however, there is likely to be a bi-directional association. Psychological models, such as the stress-coping model and incentive-motivation model, hypothesise that individuals may be motivated to use alcohol to cope with stress and enhance positive affect (Wills & Shiffman, 1985) and that benefits of drinking outweigh the consequences of not (Cox & Klinger, 2011). Considering that symptoms of a CMD include low mood and irritability (National Collaborating Centre for Mental Health et al., 2011), alcohol may be used to cope with symptoms initially, increasing alcohol use (Cooper, Frone, Russell, & Mudar, 1995). The self-medication model argues further that alcohol may be used specifically because of its rapid onset of action and differ according to the individuals' symptoms (Khantzian, 1997). Our findings are based on cross-sectional research, therefore we cannot infer causality. We found associations between AUD and CMD regardless of the type of CMD and severity of AUD. It may be that individuals with a CMD may use alcohol to enhance positive affect and cope with symptoms of poor mental health. Further qualitative and longitudinal research is required to understand the reasons why those with a CMD use alcohol.

Our narrative review of associations between binge-drinking and CMDs and consumption respectively, showed mixed evidence. Studies included in this review suggest that alcohol use and CMD comorbidity may be more complex as some studies reported increases in binge-drinking or consumption while others did not. This may have been due to the range of CMDs measured or the measures used to assess alcohol use and CMDs. However, previous research suggests that this may also be explained by additional factors, such as gender (Austin & Villarosa-Hurlocker, 2021; Nazareth et al., 2011), age (Keyes, Hamilton, Patrick, & Schulenberg, 2020; Kuntzsch et al., 2017), and specific CMD diagnoses (Lee, Wang, et al., 2020). Future research should consider such characteristics when examining associations between alcohol use and CMD. In addition, further research is required on associations of CMDs with other alcohol outcomes given that they are more prevalent in the general population compared to AUD (Peacock et al., 2018) and are known to have implications on health (Wilsnack et al., 2018).

A previous systematic review reported a two-fold increase in the odds of reporting any AUD among those with an anxiety disorder and two-and-a-half-fold increase for those with major depression, in addition to a two-and-a-half-fold and three-fold increase in the odds of reporting alcohol dependence for any anxiety disorder and major depression, respectively. We found slightly weaker associations, with a two-fold increase in the odds of any AUD (and the same for moderate/severe AUD) for any anxiety or mood disorder, respectively. This difference could be explained by the types of CMDs included in our review in which we included MDD, dysthymia, GAD, panic disorder, phobias, PTSD, OCD, or SAD. Whereas Lai and colleagues (Lai et al., 2015) included agoraphobia, GAD, panic disorder, social phobia, bipolar disorder, dysthymia and MDD. Our sensitivity analysis also showed a two-fold increase in the odds of having any AUD among those with PTSD while a non-significant association was found among those with any other anxiety disorder, excluding OCD.

Other psychological models suggest that comorbid alcohol and mental health problems are due to shared vulnerabilities, such as SES factors (Castillo-Carniglia et al., 2019; McHugh & Weiss, 2019; Mueser, Drake, & Wallach, 1998; Neale & Kendler, 1995). We attempted to explore this by reviewing evidence examining the prevalence of alcohol use among those with and without a CMD based on SES characteristics, however, studies included in this review did not report this and thus cannot support or reject these suggestions.

4.5.3 Strengths and Limitations

With regards to the studies included in this review, the majority of studies used large sample sizes representative of the general population and standardised criteria to assess alcohol use and CMD, particularly those reporting the prevalence of AUD. There are some limitations to

note. Firstly, the majority of studies focussed on the prevalence of alcohol use among those with and without types of CMDs, namely MDD, rather than other disorders such as SAD. Therefore, we were unable to explore associations beyond broad mood and anxiety/phobic disorders, including more specific disorders. Secondly, we were unable to conduct a meta-analysis on the prevalence and association of binge-drinking or alcohol consumption due to variations in the measures and cut-offs used, therefore, we cannot conclude whether those with a CMD are more likely to report different patterns of alcohol use compared to those without beyond AUD.

With regards to our review, we conducted an extensive search of the literature across multiple databases and included a range of CMDs and types of alcohol use, with large sample sizes. There are also some limitations to note. Firstly, there was substantial heterogeneity between studies. While the majority of studies used diagnostic criteria to establish the presence of CMD and AUD, different versions of criteria were used between studies. There were also limited reporting of group characteristics among those with and without a CMD which may explain some of the heterogeneity. We overcame this by exploring differences in associations between the severity of AUD, type of CMD, as well as the continent and decade in which the study was conducted in. Secondly, we included published research, therefore, we may have missed some grey literature. However, given multiple databases and references were searched, we believe our review was inclusive. Thirdly, some of the associations may have been driven by specific types of CMD, as found in previous research (Grant et al., 2015), we conducted a sensitivity analysis with PTSD but were unable to do further analyses due to insufficient numbers. Fourthly, the stratified prevalence by AUD severity would equal the overall any AUD prevalence for studies that provided this stratified data, however, some studies reported moderate/severe AUD only. For those studies which reported the stratified prevalence by AUD severity, then the sum of the mild and moderate/severe prevalence would equal the overall prevalence. But some studies only reported the prevalence for moderate/severe AUD and, in these cases, this was the same as the numbers included in the overall meta-analysis. Relatedly, we calculated odds ratios from the raw numbers of each study included in the meta-analysis as these were not available in the included studies. Finally, while studies included in this review generally included individuals aged 18 and over, in some cases studies had a minimum age in adolescence (e.g. 15 years and over). Due to the way in which data was presented in these studies, it was not possible to exclude these participants and restrict the prevalence estimates to those aged 18 and over. However, in large population studies the numbers aged under 18 would be in the minority and this should not impact on the prevalence reported.

4.6 Conclusions

Our review and meta-analysis show that having a CMD is associated with increased odds of having an AUD, particularly moderate/severe AUD. There was little difference in associations based on the type of CMD. There is a need to ensure alcohol and mental health problems are treated in parallel while more research is required to investigate group characteristics and differences beyond broad CMD classifications. Additional research examining associations between having a CMD with other alcohol outcomes is required to provide a more holistic understanding of drinking patterns among individuals with a CMD.

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**Chapter 5: Associations of alcohol use, mental health and socioeconomic status in
England: findings from a representative population survey**

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5.1 Foreword

What is already known from the previous Chapter (Chapters 1 and 4)?

- Chapter 1 provides an overview of the prevalence of alcohol use and mental health problems, respectively, and how these problems may co-occur together but it highlights gaps in the literature on the patterns of different co-occurring alcohol and mental health problems
- Chapter 1 also provides an overview of how SES may be associated with alcohol use and mental health problems, respectively
- Chapter 4 extends on previous literature described in Chapter 1 to show that individuals with a CMD are twice as likely to report an AUD, compared to those without a CMD, globally
- Chapter 4 also extends on previous literature to show that associations of CMD and AUD are stronger for moderate/severe AUD, compared to those without, which provides some support for the self-medication hypothesis
- Findings from Chapter 4 indicate that there may be differences in the associations with AUD depending on the specific type of CMD, e.g. GAD, major depression, but there are not enough studies to examine this
- There is a lack of evidence which has examined the role of SES on co-occurring AUD and CMD

What does the current Chapter aim to do?

- This Chapter aims to extend on findings from Chapter 4 and examine associations of alcohol use, including non-drinking, across a range of mental health problems, beyond CMDs, in England
- This Chapter also aims to examine whether associations between alcohol use and mental health problems are accounted for by SES

What new findings does this Chapter add?

- This Chapter extends on Chapters 1 and 4 through establishing associations of alcohol use (including non-drinking) across a range of mental health problems, beyond having a CMD
- This Chapter extends on Chapter 4 to show that the level of associations of alcohol use vary depending on the specific type of mental health problem where the strength of associations ranges from one-and-a-half fold to nine-fold
- Associations with alcohol use, including non-drinking, are stronger among individuals meeting criteria for a more severe mental health problems which indicates that individuals are not only more likely to use alcohol in a harmful way but are also more likely to be non-drinkers
- Adjusting for SES characteristics partially attenuate some of the associations between alcohol use and mental health problems where some associations with non-drinking became non-significant, indicating the importance of SES on co-occurring alcohol and mental health problems
- Overall, this Chapter shows that the co-occurrence between alcohol use and mental health problems are more complex in the general population, and that individuals with a mental health problem are also more likely to be non-drinkers. Further, there are indications that SES plays a role in this co-occurrence but requires further investigation

5.2 Introduction

Almost a fifth of adults in England drink alcohol at hazardous or harmful levels (Drummond, 2016), and around one in six report symptoms of a common mental disorder (CMD) in the past week. The proportion of people reporting severe CMD symptoms has increased in recent years (Stansfeld et al., 2016). Individuals with a mental health problem, such as depression, are more likely to misuse alcohol (Bell & Britton, 2014; Lai et al., 2015). Longitudinal and prospective cohort research has found that individuals with depressed mood, psychosis or anxiety at baseline were at increased risk of reporting alcohol problems, dependence or alcohol use disorder at follow up (Crum et al., 2008; Degenhardt et al., 2018; Torvik et al., 2019) indicating that as mental health worsens alcohol use increases. While those with severe mental illnesses (SMI), such as bipolar disorder, are more likely to have a comorbid alcohol use disorder compared to those with a CMD (Grant et al., 2015; Hartz et al., 2014). Those with a mental health problem may also be more likely to not drink with evidence showing individuals with personality disorder being more likely to abstain than consume alcohol (Skogen et al., 2011) suggesting that alcohol and mental health may be more complex. Both heavy and non-drinkers have been found to have poorer physical health than low risk drinkers, known as the J-shaped curve (Gmel, Gutjahr, & Rehm, 2003; White, Altmann, & Nanchahal, 2002). However, this has been contested as providing evidence of the protective effects of moderate drinking because non-drinkers may include previous drinkers who have given up due to pre-existing health conditions (Day & Rudd, 2019; Stockwell et al., 2016).

Alcohol may be used to cope with negative affect and reduce symptoms of poor mental health (Collins, Thompson, Sherry, Glowacka, & Stewart, 2018; Cooper et al., 1995; Holahan, Moos, Holahan, Cronkite, & Randall, 2003). Longitudinal research exploring associations of mental health and alcohol use found strongest evidence for a model in which declining mental health was most predictive of increasing alcohol use (Bell & Britton, 2014) indicating that alcohol was used to self-medicate (Khantzian, 1997). There may be variations in how people with different mental health conditions use alcohol, for example someone with bipolar disorder may use alcohol differently from someone with post-traumatic stress disorder (Goodwin et al., 2017). A recent study found only social anxiety disorder was longitudinally associated with alcohol use disorder while other anxiety disorders were not indicating differences between specific types of mental health problems (Torvik et al., 2019). However, much of the research has examined associations of types of alcohol misuse or non-drinking, and restricted to specific types of mental health problems, separately (Crum et al., 2008; Degenhardt et al., 2018; Grant et al., 2015; Skogen et al., 2011; Torvik et al., 2019), therefore it is less well understood whether the pattern of alcohol misuse and non-drinking is similar across different types of mental health problems.

Socioeconomic status (SES) is independently associated with both alcohol use and mental health problems, with those of lower SES more likely to experience alcohol harms and poor mental health than those of higher SES (Beard et al., 2019; Goodwin et al., 2018). Patterns of associations between SES and alcohol use depend on the assessment used; research has shown associations with binge-drinking and those on lower income and with A-Level education, whereas lower social grade and housing tenure was associated with decreased alcohol frequency and increased unit intake (Beard et al., 2019). The social causation hypothesis suggests that those experiencing more disadvantage, such as lower education, might disproportionately experience alcohol harms and poor mental health (Goldman, 1994). However, much of the research is limited to associations of SES with alcohol use or mental health separately (Beard et al., 2019; Goodwin et al., 2018), despite the availability of such data providing an opportunity to consider the role of SES with comorbid alcohol use and mental health problems.

Using an English dataset, the current study aimed to i) examine the prevalence and associations of non-drinking, hazardous and harmful/probable dependence in individuals who do and do not meet criteria for different mental health problems, ii) compare associations across different mental health problems, and iii) determine whether associations remained after adjustment for SES. We hypothesised that those meeting criteria for a mental health problem will be more likely to report non-drinking or harmful/probable dependence than those not meeting criteria and that these associations will be partially explained by demographic (e.g. age) and SES (e.g. education) characteristics. Finally, we hypothesised that non-drinking or harmful/probable dependence will be more strongly associated with more severe mental health problems.

5.3 Method

5.3.1. Study design

A secondary analysis of the 2014 Adult Psychiatric Morbidity Survey (APMS) was conducted with study plans pre-registered on Open Science Framework (<https://osf.io/32xka/>). The APMS uses a stratified, multi-stage random probability sample. It is a cross-sectional survey conducted among those living in private households in England every seven years since 1993. 2014 APMS data was accessed with special permission from NHS Digital (ref. DARS-NIC-220105-B3Z3S-v0.3).

5.3.2. Participants and setting

Further details of the methodology of APMS are described elsewhere (McManus, Bebbington, et al., 2019). An advance letter introducing the survey was sent to each sampled address, one adult aged 16 or older was selected in each eligible household to take part in a face-to-face interview and reimbursed with a £15 high street voucher. Interviews were conducted in

participants' homes, with some information collected by self-completion using computer assisted interviewing. 6% of participants did not complete the self-completion section of the interview. Interviews were conducted from May 2014 to September 2015 (McManus, Bebbington, et al., 2019).

5.3.3. Measures

Alcohol use: Past year alcohol use was measured using two screening questions and the Alcohol Use Disorder Identification Test (AUDIT); “Do you ever drink alcohol nowadays?”, those who responded “no” were asked an additional question “Could I just check, does that mean you never have an alcoholic drink nowadays, or do you have an alcoholic drink very occasionally, perhaps for medicinal purposes or on special occasions like Christmas or New Year?”. Those who responded “no” did not complete the AUDIT. The AUDIT is a 10-item questionnaire used to assess alcohol frequency, harmful use and consequences of drinking alcohol (Babor, Higgins-Biddle, Saunders, Monteiro, & World Health Organization, 2001) with good internal reliability within this sample (Cronbach’s $\alpha=0.96$). The following categories were used according to recommendations (Babor et al., 2001). Those with an AUDIT score of 0 or responding ‘No’ to screening questions were categorised as “non-drinkers”. Those with an AUDIT score of 1-7 were categorised as “low risk” (reference category), 8-15 categorised as “hazardous use”, 16 or more categorised as “harmful/probable dependence”. Harmful use and probable dependence were combined due to small numbers.

Any CMD, depression, anxiety disorders, and phobia: The Clinical Interview Schedule-Revised (CIS-R) was used to screen for meeting criteria for a CMD. This was based on a participant’s overall CIS-R score where a score of 12 to 17 categorised participants as having “moderate symptoms of CMD” and a score of 18 or more as having “severe symptoms of CMD”. This was also used to screen for those meeting criteria for 10th International Classification of Disease depression, anxiety and phobia diagnosis categories (Stansfeld et al., 2016). Due to small cell sizes, screening for mild, moderate and severe depression were grouped as “depression”. Generalised anxiety disorder, obsessive compulsive disorder and panic disorder grouped as “anxiety”. Social phobia, specific phobia and agoraphobia grouped as “phobia”. Participants were also grouped as meeting criteria for any one (depression alone, anxiety alone or phobia alone), any two (two of depression, anxiety and/or phobia) or all three CMDs.

Probable PTSD: The PTSD Checklist (PCL-C) questionnaire is a self-report scale comprising 17-items which correspond to symptoms of DSM-IV PTSD in the past month. Participants were categorised as meeting criteria for probable PTSD if they had a score of 50 on the PCL-

C and positive responses to at least one item on re-experiencing, three on avoidance and numbing, and two on hyperarousal (Fear et al., 2016).

Bipolar disorder: The Mood Disorder Questionnaire is a 13-item questionnaire assessing lifetime experience of manic or hypomanic symptoms and, if these have been experienced at the same time, caused moderate to serious problems and has been shown to be reliable (Cronbach's $\alpha=0.97$). Those who scored seven or more were also asked; "Have several of these ever happened during the same period of time?" and "How much of a problem did any of these cause you – like being unable to work; having family, money or legal troubles; getting into arguments or fights?". Participants screened for bipolar disorder if they answered "yes" to the first additional question, "moderate" or "severe problem" to the second additional question, and had a score of seven or more (Marwaha, Sal, & Bebbington, 2016).

Anti-Social Personality Disorder (ASPD) and Borderline Personality Disorder (BPD): The Structured Clinical Interview for DSM-IV Personality Disorders was used to screen for lifetime ASPD and BPD (Moran, 2016). Meeting criteria for ASPD was defined as having a score of three or more on questions around failure to conform to social norms and aggressiveness, as well as meeting diagnostic criteria for conduct disorder before age 15. Meeting criteria for BPD was defined as having a score of five or more to questions related to instability of interpersonal relationships, mood, with impulsivity in childhood (Moran, 2016).

Probable psychotic disorder: The Psychosis Screening Questionnaire (PSQ) is a five-item questionnaire assessing symptoms of psychosis. Screening for probable psychotic disorder included participants who positively endorsed any two of the following and did not complete a follow-up interview: 1) currently taking antipsychotic medication; 2) reporting an inpatient stay for a mental or emotional problem in the past three months; or 3) having been admitted to a hospital specialising in mental health problems at any time, 5) a positive response to question 5a on the PSQ assessing auditory hallucinations, 6) reporting symptoms suggestive of psychotic disorder or 7) discussing such symptoms with a GP in the past year, self-reported identification with psychotic disorder (Bebbington, 2016).

Attention Deficit Hyperactivity Disorder (ADHD): The Adult ADHD Self-Report Scale-v1.1 is a six-item shortened version of the 18-item Symptom Checklist scale which measures the frequency of recent symptoms of adult ADHD and is shown to be reliable (Cronbach's $\alpha=0.73$). A score of four or more was used to screen positive for ADHD (Brugha T., 2016).

Demographic and SES characteristics: A range of demographic and SES characteristics were measured. Gender ("male" as the reference category), age (categorised as "16-34", "35-54" (reference category), "55-74", "75+"), marital status (categorised as "married or civil partnership" (reference category), "single", "separated/divorced/widowed"), ethnicity

(categorised as “white” (reference category) and “non-white”, this variable was not pre-registered), whether participants had children aged under 16 years living in the household (categorised as “yes” or “no” (reference category), education (categorised as “degree level or above”, “GCSE or A-Level” (reference category), “foreign qualifications”, “no qualifications”), occupational grade (categorised as “professional/managerial”, “intermediate, lower supervisory/small employers and own account workers”, “lower supervisory technical/semi-routine/routine” (reference category), “never worked/not worked in past year” and “not classified for other reason”, housing tenure (categorised as “owner-occupied” (reference category), “private renter”, and “social or other renter”) (McManus et al., 2016).

5.3.4 Sample size

Of the 13,122 addresses identified in the sampling frame the final 2014 APMS sample was 7,546, with a response rate of 57%. This included 18 partial interviews where the participant completed some sections of the full interview. Most variables had a small amount of missing data (~0.01%) though alcohol use, probable PTSD and bipolar disorder had 3.7%, 5.3% and 5.5% missing data, respectively. Given the small amount of missing data, a complete case analysis was conducted with participants who completed the alcohol use measures ($N=7,218$) as this was our main outcome variable. Potential non-response bias could be due to items being in the self-completion section of the questionnaire (McManus, Gunnell, et al., 2019).

5.3.5 Statistical methods

Cross-tabulations were used to examine the prevalence of the different alcohol use categories in individuals who did and did not meet criteria for each mental health problem. The unweighted frequency and weighted percentage were reported, with weights accounting for selection probabilities and non-response. Alcohol use categories (non-drinking, hazardous use, harmful/probable dependence) were our outcome variables and meeting criteria for CMD symptoms and specific mental health problems predictor variables.

Unadjusted multinomial logistic regression was conducted to examine the strength of the association between non-drinking, hazardous use, and harmful/probable dependence and meeting criteria for symptoms of CMD and specific mental health problems compared to those who did not meet criteria for symptoms of CMD and the respective mental health problem, respectively. We then adjusted our analyses for demographic (gender, age, marital status, ethnicity and having children in the household) and SES characteristics (occupational grade, education and housing tenure). Multinomial odds ratios and 95% confidence intervals were used to assess and compare the size of associations between alcohol use and specific mental health problems. Confidence intervals overlapping with 1 and with a p-value of over 0.05 were deemed non-significant. Forest plots were produced to illustrate the strength of the association

between alcohol use categories and mental health problems. All analyses were conducted in STATA 14.0 using the 'svy' command.

A pre-registered sensitivity analysis was conducted to examine the interaction between gender and CMD symptoms on alcohol use outcomes (non-drinking, hazardous use, and harmful/probable dependence). We conducted an exploratory analysis to examine the prevalence and associations between meeting criteria for one, two or all CMD, or any SMI with alcohol use categories.

5.4 Results

5.4.1 Descriptive data

Table 11 shows participant demographic and SES characteristics, and associations with alcohol use. Non-drinkers were more likely to be female, aged under 35 or over 74, non-white, previously partnered, had children aged under 16 living in the household, no qualifications, not worked in the last year and living in rented accommodation. Hazardous or harmful/probable dependent drinkers were more likely to be male and single. Being of higher occupational grade or not working in the last year decreased the likelihood of harmful/probable dependent drinking.

Table 11: Participant characteristics and distribution by alcohol use categories (N=7,218)

| | | Non-drinking | | | Low risk ^a | Hazardous use | | Harmful/probable dependence | |
|------------------------------------|---|-----------------------|-------------------------|-------------|-----------------------|-------------------------|-------------|-----------------------------|-------------|
| | | <i>N</i> (weighted %) | MOR (95% CI) | <i>P</i> | | MOR (95% CI) | <i>P</i> | MOR (95% CI) | <i>P</i> |
| Demographic characteristics | | | | | | | | | |
| Gender | Male ^b | 2,924 (48.83) | 1 | - | 1 | 1 | - | 1 | - |
| | Female | 4,294 (51.17) | 1.30 (1.13-1.50) | 0.01 | 1 | 0.48 (0.41-0.57) | 0.01 | 0.38 (0.27-0.54) | 0.01 |
| Age | 16-34 | 1,555 (31.38) | 1.29 (1.05-1.58) | 0.02 | 1 | 1.53 (1.27-1.85) | 0.01 | 1.42 (1.00-2.00) | 0.05 |
| | 35-54 ^c | 2,405 (33.85) | 1 | - | 1 | 1 | - | 1 | - |
| | 55-74 | 2,315 (25.48) | 0.99 (0.84-1.17) | 0.90 | 1 | 0.89 (0.75-1.06) | 0.19 | 0.56 (0.38-0.83) | 0.01 |
| | 75+ | 943 (9.28) | 1.79 (1.49-2.16) | 0.01 | 1 | 0.28 (0.19-0.40) | 0.01 | 0.08 (0.02-0.31) | 0.01 |
| Ethnicity | White | 6,515 (87.34) | 1 | - | 1 | 1 | - | 1 | - |
| | Non-white | 678 (12.66) | 5.11 (4.13-6.33) | 0.01 | 1 | 0.54 (0.36-0.81) | 0.01 | 0.86 (0.45-1.65) | 0.66 |
| Marital status | Single | 2,069 (34.22) | 1.15 (0.97-1.38) | 0.11 | 1 | 2.00 (1.68-2.37) | 0.01 | 2.70 (1.91-3.82) | 0.01 |
| | Married or civil partnership ^d | 3,264 (49.41) | 1 | - | 1 | 1 | - | 1 | - |
| | Separated/Divorced/Widowed | 1,884 (16.37) | 1.57 (1.36-1.82) | 0.02 | 1 | 1.03 (0.86-1.23) | 0.74 | 1.05 (0.66-1.65) | 0.84 |
| | Has children aged under 16 | No ^e | 5,658 (77.62) | 1 | - | 1 | 1 | - | 1 |
| | Yes | 1,560 (22.38) | 1.21 (1.04-1.41) | 0.02 | 1 | 0.87 (0.72-1.04) | 0.13 | 0.81 (0.54-1.22) | 0.31 |

| years living in household | | | | | | | | | |
|----------------------------|---|---------------|-------------------------|-------------|---|-------------------------|-------------|-------------------------|-------------|
| SES characteristics | | | | | | | | | |
| Education | Degree or above | 2,335 (33.51) | 0.76 (0.63-0.91) | 0.01 | 1 | 0.92 (0.77-1.11) | 0.39 | 0.77 (0.53-1.13) | 0.18 |
| | A-Level/GCSE ^f | 2,855 (43.75) | 1 | - | 1 | 1 | - | 1 | - |
| | Foreign qualifications | 252 (3.04) | 1.29 (0.91-1.83) | 0.16 | 1 | 0.55 (0.32-0.96) | 0.03 | 0.79 (0.29-2.19) | 0.65 |
| | No qualifications | 1,704 (19.69) | 1.80 (1.53-2.12) | 0.01 | 1 | 0.66 (0.53-0.83) | 0.01 | 0.71 (0.45-1.12) | 0.14 |
| Occupational grade | Managerial/professional | 1,760 (26.42) | 0.68 (0.54-0.87) | 0.01 | 1 | 1.01 (0.80-1.29) | 0.91 | 0.59 (0.39-0.90) | 0.02 |
| | Intermediate/Small employers and own account workers | 1,064 (15.45) | 0.75 (0.59-0.95) | 0.02 | 1 | 0.72 (0.56-0.94) | 0.01 | 0.62 (0.38-1.01) | 0.06 |
| | Lower supervisory and technical/semi-routine/routine ^g | 1,305 (21.91) | 1 | - | 1 | 1 | - | 1 | - |

| | | | | | | | | | |
|----------------|--------------------------------------|---------------|-------------------------|-------------|---|-------------------------|-------------|-------------------------|-------------|
| | Never worked/not worked in last year | 2,752 (30.11) | 1.49 (1.23-1.81) | 0.01 | 1 | 0.44 (0.35-0.57) | 0.01 | 0.44 (0.29-0.66) | 0.01 |
| | Not classified for other reason | 295 (6.10) | 3.63 (2.55-5.17) | 0.01 | 1 | 1.08 (0.67-1.73) | 0.76 | 0.71 (0.30-1.70) | 0.44 |
| Housing tenure | Owner-occupier ^h | 4,722 (64.17) | 1 | - | 1 | 1 | - | 1 | - |
| | Social renter | 1,184 (15.63) | 2.54 (2.13-3.03) | 0.01 | 1 | 0.87 (0.67-1.12) | 0.28 | 2.13 (1.39-3.26) | 0.01 |
| | Private or other renter | 1,265 (20.20) | 1.29 (1.07-1.57) | 0.01 | 1 | 1.45 (1.19-1.76) | 0.01 | 2.31 (1.54-3.46) | 0.01 |

****Note: MOR=multinomial odds ratio, CI=confidence interval. Bold font indicates significance**

Reference categories: ^aLow risk, ^bMale gender, ^cAged 35-54, ^dMarried or in civil partnership, ^eDoes not have children living in household, ^fEducated to A-Level/GCSE level, ^gLower supervisory and technical/semi-routine/routine occupational grade, ^hOwner-occupier

5.4.2 Primary analyses

5.4.2.1. Non-drinking and meeting criteria for mental health problems

The prevalence of non-drinking was higher among those with moderate (22.72%) and severe (33.21%) symptoms of CMD compared to those without symptoms (21.81%, see table 12). The prevalence of non-drinking among those meeting criteria for a specific mental health problem was highest for probable psychotic disorder (52.30%, see table 12). With the exception of ASPD, the prevalence of non-drinking was higher among those meeting criteria for any specific mental health problem compared to those not meeting criteria for the respective problem (see table 12).

Those meeting criteria for severe symptoms of CMD were twice as likely to report non-drinking and associations remained, though slightly attenuated, after adjustment for demographic and SES characteristics (see table 13). Adjusted associations with non-drinking increased for most mental health problems with odds highest for more severe problems, such as probable psychotic disorder, whereby odds were three-fold indicating a moderate effect. Unadjusted associations between meeting criteria for specific mental health problems and non-drinking (excluding ASPD) were partially attenuated after adjustment for demographic and SES characteristics, excluding anxiety disorder and ADHD where associations were no longer significant (see table 13). This suggests that non-drinking is associated with most mental health problems after accounting for participant SES characteristics and strongest for those meeting criteria for more severe problems (see figures 7 and 8 for further illustration).

5.4.2.2. Hazardous use and meeting criteria for mental health problems

There was no association between hazardous use and having symptoms of CMD (see table 12). For specific mental health problems, the prevalence of hazardous use was highest for those meeting criteria for ASPD (30.29%, see table 12) with a two and a half fold increase in the odds of reporting hazardous use after adjustment for demographic and SES characteristics, compared to low risk, indicating a moderate effect (see table 13). There were some associations between meeting criteria for mental health problems and hazardous use, excluding depression, phobia and probable psychotic disorder, which were partially attenuated after adjustment for demographic and SES characteristics (see table 13). Associations were strongest for personality disorder and bipolar disorder whereby odds were over seven-fold indicating a large effect, suggesting that those meeting criteria for more severe problems were more likely to report hazardous drinking, compared with low risk and this is reflected in the forest plots (see figures 7 and 8).

5.4.2.3 Harmful/probable dependence and meeting criteria for mental health problems

The prevalence of harmful/probable dependence among those with moderate (6.47%) or severe symptoms (8.54%) of CMD was higher compared to those without symptoms (2.27%, see table 12). The prevalence of harmful/probable dependence was higher among those meeting criteria for all mental health problems (see table 12).

Moderate to large effects were found with three- and five-fold increases in the odds of harmful/probable dependence for those with moderate or severe CMD symptoms, compared to low risk, respectively after adjustment for demographic and SES characteristics (see table 13). For more specific mental health problems, associations were strongest for those meeting criteria for more severe problems; individuals with BPD had an almost 10-fold increase in the odds, compared to low risk, indicating a large effect (see table 13). Associations with specific mental health problems, excluding probable psychotic disorder, remained after adjustment for demographic and SES characteristics (see table 13) and this is reflected in the forest plots (see figures 7 and 8). The attenuated effect for meeting criteria for probable psychotic disorder may be due to insufficient power (see table 13).

Table 12: Prevalence of alcohol use among those meeting criteria for a mental health problem compared to those who did not meet criteria for the respective mental health problem (N=7,218)

| | | Non-drinking | Low risk | Hazardous use | Harmful/probable dependence | |
|--------------------------------------|-------------|----------------------------|----------------------------|----------------------------|------------------------------------|-------|
| Symptoms of CMD | | N (weighted%, 95% CI) | N (weighted %, 95% CI) | N (weighted %, 95% CI) | N (weighted %, 95% CI) | Total |
| No symptoms | | 1,356 (21.81, 20.52-23.16) | 3,694 (59.15, 57.62-60.67) | 876 (16.76, 15.61-17.97) | 117 (2.27, 1.84-2.81) | 6,043 |
| Moderate symptoms of CMD | | 132 (22.72, 18.55-27.52) | 301 (53.85, 48.42-59.19) | 89 (16.95, 13.35-21.28) | 32 (6.47, 4.13-10.01) | 554 |
| Severe symptoms of CMD | | 213 (33.21, 28.58-38.18) | 269 (43.29, 38.03-48.71) | 86 (14.96, 11.68-18.97) | 53 (8.54, 5.65-12.71) | 621 |
| Total | | 1,701 | 4,264 | 1,051 | 202 | 7,218 |
| Type of mental health problem | | | | | | |
| Depression | Not present | 1,602 (22.33, 21.11-23.60) | 4,155 (58.00, 56.59-59.41) | 1,019 (16.78, 15.75-17.88) | 177 (2.88, 2.41-3.43) | 6,953 |
| | Present | 99 (36.62, 28.46-45.63) | 109 (41.80, 32.98-51.18) | 32 (11.99, 9.50-15.03) | 25 (9.59, 4.97-17.98) | 265 |
| Anxiety | Not present | 1,545 (22.42, 21.14-23.75) | 4,033 (58.46, 57.03-59.88) | 964 (16.48, 15.44-17.57) | 154 (2.64, 2.21-3.14) | 6,696 |
| | Present | 156 (27.75, 22.69-33.45) | 231 (44.38, 38.17-50.77) | 87 (18.65, 14.07-24.30) | 48 (9.22, 6.45-13.02) | 522 |
| Phobia | Not present | 1,626 (22.42, 21.21-23.67) | 4,198 (58.00, 56.59-59.41) | 1,023 (16.63, 15.59-17.73) | 181 (2.95, 2.49-3.49) | 7,028 |
| | Present | 75 (38.41, 29.22-48.51) | 66 (35.88, 26.37-46.63) | 28 (16.54, 12.88-20.99) | 21 (9.17, 4.81-16.80) | 190 |
| Probable PTSD | Not present | 1,428 (20.70, 19.49-21.97) | 4,141 (59.50, 58.07-60.91) | 992 (16.85, 15.78-17.97) | 176 (2.95, 2.49-3.50) | 6,737 |
| | Present | 114 (34.32, 27.11-42.34) | 116 (39.47, 32.29-47.12) | 56 (18.47, 12.77-25.96) | 26 (7.74, 4.65-12.61) | 312 |
| Bipolar disorder | Not present | 1,513 (21.21, 19.99-22.48) | 4,215 (59.11, 57.70-60.50) | 1,024 (16.81, 15.75-17.91) | 182 (2.88, 2.44-3.39) | 6,934 |
| | Present | 39 (29.53, 20.92-39.90) | 46 (31.53, 21.45-43.70) | 25 (21.95, 18.15-26.29) | 20 (16.99, 8.14-32.10) | 130 |
| ASPD | Not present | 971 (20.30, 18.87-21.81) | 2,941 (57.78, 56.12-59.42) | 842 (18.74, 17.47-20.07) | 155 (3.18, 2.65-3.82) | 4,909 |
| | Present | 31 (18.18, 11.64-27.25) | 57 (31.07, 22.93-40.57) | 45 (30.29, 20.22-42.70) | 31 (20.46, 9.39-38.97) | 164 |
| BPD | Not present | 965 (19.96, 18.57-21.42) | 2,956 (57.56, 55.91-59.20) | 867 (19.07, 17.79-20.41) | 164 (3.42, 2.87-4.07) | 4,952 |

| | | | | | | |
|--|-------------|----------------------------|----------------------------|----------------------------|------------------------|-------|
| | Present | 37 (31.47, 17.59-49.69) | 42 (29.39, 20.06-40.85) | 20 (21.41, 15.10-29.44) | 22 (17.73, 8.69-32.81) | 121 |
| Probable psychotic disorder | Not present | 1,658 (22.53, 21.30-23.80) | 4,241 (57.73, 56.32-59.13) | 1,043 (16.68, 15.65-17.77) | 196 (3.05, 2.60-3.59) | 7,138 |
| | Present | 43 (52.30, 38.21-65.94) | 23 (29.40, 16.19-47.31) | 8 (10.58, 3.09-30.52) | 6 (7.72, 1.31-34.57) | 80 |
| ADHD | Not present | 1,491 (22.56, 21.26-23.92) | 3,891 (59.03, 57.53-60.51) | 901 (15.94, 14.86-17.09) | 135 (2.47, 2.03-3.00) | 6,418 |
| | Present | 210 (24.50, 20.84-28.57) | 373 (45.93, 41.20-50.73) | 150 (21.81, 18.27-25.82) | 67 (7.76, 5.65-10.57) | 800 |

**CI=Confidence interval*

Table 13: Unadjusted and adjusted associations between alcohol use and meeting criteria for a mental health problem (N=7,218)

| Unadjusted ^{ab} | | | | | | | Adjusted for demographic and SES characteristics ^{ab} | | | | | | |
|--------------------------------------|-------------------------|-------------|-------------------------|-------------|-----------------------------|-------------|--|-------------|-------------------------|-------------|-----------------------------|-------------|--|
| | Non-drinking | | Hazardous use | | Harmful/probable dependence | | Non-drinking | | Hazardous use | | Harmful/probable dependence | | |
| Symptoms of CMD | MOR (95% CI) | P | MOR (95% CI) | P | MOR (95% CI) | P | MOR (95% CI) | P | MOR (95% CI) | P | MOR (95% CI) | P | |
| Moderate symptoms of CMD | 1.14 (0.89-1.47) | 0.29 | 1.11 (0.83-1.49) | 0.48 | 3.13 (1.92-5.10) | 0.01 | 1.03 (0.80-1.34) | 0.83 | 1.22 (0.89-1.68) | 0.21 | 3.36 (2.03-5.57) | 0.01 | |
| Severe symptoms of CMD | 2.08 (1.67-2.59) | 0.01 | 1.22 (0.90-1.65) | 0.20 | 5.13 (3.42-7.71) | 0.01 | 1.55 (1.20-1.99) | 0.01 | 1.36 (1.00-1.86) | 0.05 | 5.06 (3.34-7.66) | 0.01 | |
| Type of mental health problem | | | | | | | | | | | | | |
| Depression Present | 2.28 (1.64-3.15) | 0.01 | 0.99 (0.60-1.63) | 0.97 | 4.62 (2.67-8.00) | 0.01 | 1.83 (1.28-2.61) | 0.01 | 1.06 (0.65-1.72) | 0.81 | 3.92 (2.23-6.89) | 0.01 | |
| Anxiety Present | 1.63 (1.27-2.09) | 0.01 | 1.49 (1.09-2.03) | 0.01 | 4.61 (3.13-6.79) | 0.01 | 1.35 (1.00-1.81) | 0.05 | 1.54 (1.12-2.12) | 0.01 | 4.32 (2.92-6.38) | 0.01 | |
| Phobia Present | 2.77 (1.86-4.13) | 0.01 | 1.61 (0.92-2.82) | 0.10 | 5.03 (2.77-9.13) | 0.01 | 1.99 (1.30-3.03) | 0.01 | 1.79 (0.99-3.25) | 0.06 | 3.83 (1.99-7.36) | 0.01 | |
| Probable PTSD Present | 2.50 (1.85-3.37) | 0.01 | 1.65 (1.14-2.40) | 0.01 | 3.96 (2.41-6.50) | 0.01 | 1.64 (1.16-2.33) | 0.01 | 1.59 (1.07-2.35) | 0.01 | 3.10 (1.73-5.58) | 0.01 | |

| | | | | | | | | | | | | |
|--|-------------------------|-------------|-------------------------|-------------|---------------------------|-------------|-------------------------|------------|-------------------------|------------|--------------------------|-------------|
| Bipolar disorder Present | 2.61 (1.66-4.12) | 0.01 | 2.45 (1.34-4.49) | 0.01 | 11.07 (6.03-20.31) | 0.01 | 2.45 (1.49-4.04) | 0.0 | 2.04 (1.11-3.73) | 0.0 | 7.52 (3.97-14.28) | 0.01 |
| | | | | | | | 1 | | | 2 | | |
| ASPD Present | 1.67 (0.98-2.82) | 0.06 | 3.01 (1.93-4.68) | 0.01 | 11.95 (7.11-20.11) | 0.01 | 1.40 (0.76-2.56) | 0.2 | 2.66 (1.69-4.20) | 0.0 | 8.73 (5.07-15.04) | 0.01 |
| | | | | | | | 8 | | | 1 | | |
| BPD Present | 3.09 (1.86-5.14) | 0.01 | 2.20 (1.18-4.11) | 0.01 | 10.16 (5.38-19.20) | 0.01 | 2.14 (1.13-4.05) | 0.0 | 2.40 (1.29-4.44) | 0.0 | 9.77 (4.81-19.84) | 0.01 |
| | | | | | | | 2 | | | 1 | | |
| Probable psychotic disorder Present | 4.56 (2.53-8.23) | 0.01 | 1.25 (0.48-3.25) | 0.65 | 4.97 (1.73-14.27) | 0.01 | 3.42 (1.74-6.70) | 0.0 | 1.31 (0.51-3.38) | 0.5 | 2.87 (0.95-8.67) | 0.06 |
| | | | | | | | 1 | | | 8 | | |
| ADHD Present | 1.40 (1.13-1.73) | 0.01 | 1.76 (1.37-2.25) | 0.01 | 4.04 (2.81-5.80) | 0.01 | 1.22 (0.96-1.54) | 0.1 | 1.56 (1.21-2.01) | 0.0 | 3.25 (2.18-4.84) | 0.01 |
| | | | | | | | 0 | | | 1 | | |

*Note: MOR = multinomial odds ratio, CI = confidence interval, bold indicates significant results

^aThe reference group for all alcohol use analyses are the remainder of the sample reporting low risk alcohol use

^bThe references group for all mental health analyses are not meeting criteria for the respective mental health problem

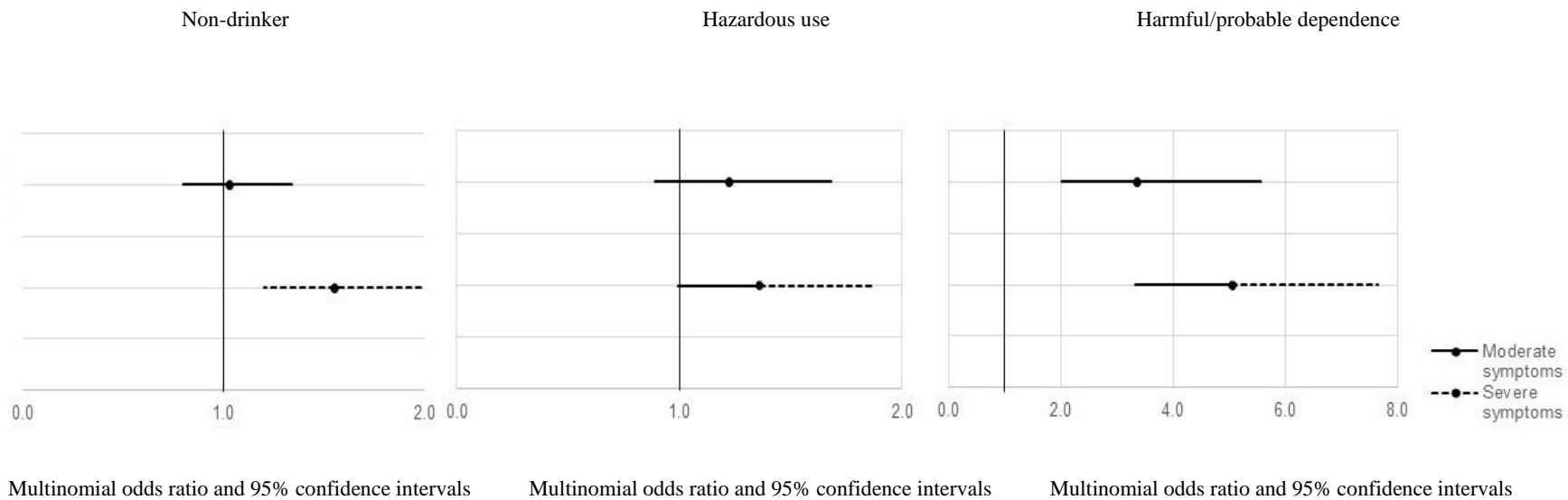
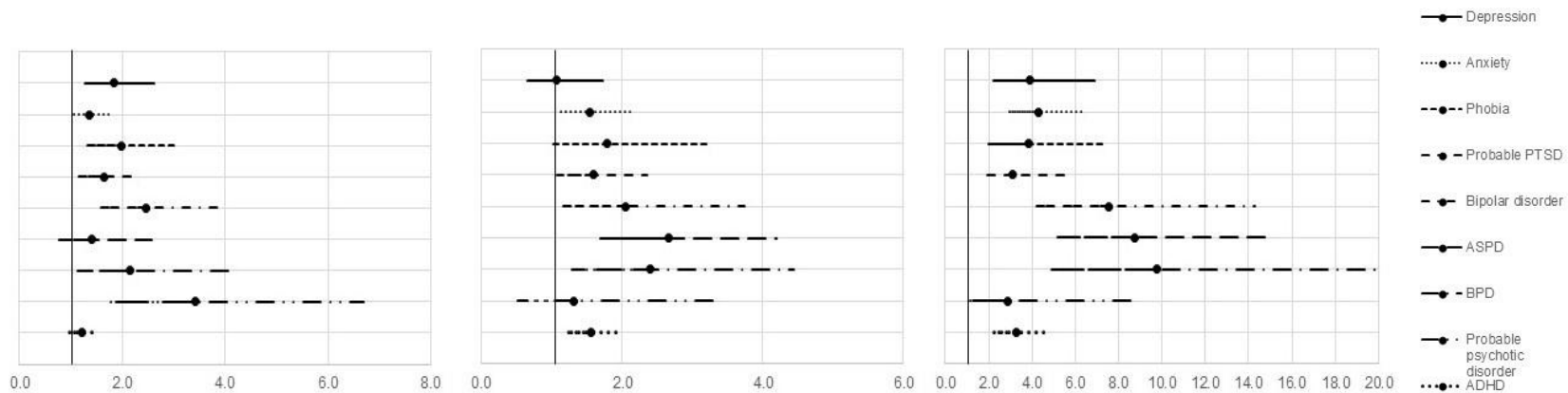


Figure 7: A forest plot illustrating the odds of reporting non-drinking, hazardous use or harmful/probable dependence among those with moderate or severe symptoms of CMD, compared to those reporting low risk

Non-drinker

Hazardous use

Harmful/probable dependence



Multinomial odds ratio and 95% confidence intervals

Multinomial odds ratio and 95% confidence intervals

Multinomial odds ratio and 95% confidence intervals

Figure 8: A forest plot illustrating the odds of reporting non-drinking, hazardous use or harmful/probable dependence among those meeting criteria for specific mental health problems, compared to those reporting low risk

5.4.3 Exploratory analyses

The prevalence and associations of non-drinking or harmful/probable dependence was higher among those meeting criteria for one or more CMDs or SMIs compared to those not meeting criteria, with moderate effect sizes (see supplementary table S7).

5.4.3.1 Sensitivity analyses

A sensitivity analysis found no significant interaction between gender and CMD symptoms for any of the alcohol use outcomes ($p > 0.05$, see supplementary table S8).

5.5 Discussion

5.5.1. Key findings

Supporting our hypotheses, we found those meeting criteria for a mental health problem were more likely to report non-drinking, hazardous and harmful/probable dependence, compared to low risk. Associations were strongest for those meeting criteria for probable psychotic disorder, ASPD and BPD, respectively, even after adjustment for demographic and SES characteristics. Our study shows that whilst alcohol misuse is associated with mental health problems, which is consistent with previous research, we also found non-drinking is strongly associated with such problems, even after accounting for demographic and SES characteristics. This is one of the first studies to examine associations between alcohol use and non-drinking across a range of mental health problems while also examining the role of SES in explaining comorbidity.

Our findings indicate the need to explore additional mechanisms of alcohol use and non-drinking among those with a mental health problem, specifically those meeting criteria for more severe problems. Further, our findings strengthen the notion that alcohol use and mental health problems should be treated in parallel, with improved communication across mental health and substance use services.

5.5.2. Comparisons to previous research

Our findings are partially consistent with previous research which found that alcohol use was higher among those with a mental health problem (Bell & Britton, 2014; Swendsen et al., 2010), specifically depressive, anxiety and more severe mental health problems (Grant et al., 2015). A recent study found the prevalence of hazardous/harmful alcohol use was highest for those with depression compared to other disorders whereas we found this was highest for those with more severe problems, but this may be due to differences between the cut-offs used (Davis et al., 2020). However, much of the research has focussed on alcohol misuse and non-drinking separately, and with regards to a restricted number of mental health problems (Crum et al., 2008; Degenhardt et al., 2018; Skogen et al., 2011). We have shown, in a sample representative of the general population, moderate to strong associations between alcohol

misuse and non-drinking across different mental health problems, particularly those meeting criteria for a SMI, such as probable psychotic disorder.

Strong associations were found between non-drinking and mental health problems, particularly more severe problems, indicating that alcohol use and mental health comorbidity may extend beyond alcohol misuse. Specifically, only BPD, and not ASPD, was associated with non-drinking, which is in contrast to a previous study (Skogen et al., 2011), indicating that non-drinking may be uniquely associated with specific types of personality disorder. Reasons for non-drinking may include participants' beliefs, severity of the illness, being on medication, or being a previous harmful drinker (Healey et al., 2009; Skogen et al., 2011). Indeed, longitudinal research has shown that drinkers at baseline who stopped drinking at follow-up were more likely to report an onset of depression or anxiety, therefore, worsened mental health may influence the decision to not drink (Sarich et al., 2019). Our findings of non-drinking indicate having a mental health problem may not necessarily increase the likelihood of drinking at harmful levels and other factors may influence drinking or abstinence among those with a mental health problem. Currently, there is limited research exploring the relationship between non-drinking and mental health, and our findings suggest a need to examine this further.

We found those meeting criteria for anxiety, BPD or ADHD were more likely to drink alcohol at hazardous or harmful/probable dependent levels with stronger associations for harmful/probable dependence which is consistent with previous research (Grant et al., 2015; Lai et al., 2015). It may be that alcohol is used to control different phases of an illness, for example, used to control the feelings of elation in the lead up to the manic phase and used less in the depression phase (Healey et al., 2009; Lai et al., 2015). Longitudinal research has shown that those reporting poor mental health, psychotic experiences or depressive mood at baseline were at an increased risk of reporting alcohol problems (Bell & Britton, 2014; Degenhardt et al., 2018; Torvik et al., 2019) indicating that alcohol may be used to cope worsened mental health and our findings support this.

Stronger associations with alcohol use were found among those meeting criteria for more severe problems which could be explained by theories, such as the self-medication theory (Khantzian, 1997). Indeed, it may be that experiencing specific symptoms associated with more severe mental health problems increases the likelihood of drinking (Healey et al., 2009; Tragesser, Sher, Trull, & Park, 2007), this could be prevented by the treatment of symptoms (Swendsen, 2010). It was not possible to explore whether alcohol use was motivated by mental health symptoms in this study, however, some theories suggest that alcohol can be used to cope with poor mental health (Cooper et al., 1995), and research has shown this for some mental health problems, such as depression and anxiety (Collins et al., 2018; Holahan et al.,

2003). Our findings suggest a need to explore this across a range of more severe problems which might inform how to tailor interventions more appropriately.

Finally, we found that demographic and SES characteristics only partially accounted for the association between alcohol use and mental health problems suggesting that, although such characteristics should be considered, alcohol use remains strongly associated with mental health problems irrespective of an individual's SES characteristics. More specifically, those with a mental health problem were more likely to drink harmfully and this was not restricted to those of lower SES which is contrary to previous research (Beard et al., 2019) and theories such as the social causation hypothesis (Goldman, 1994). Our findings, instead, suggest that alcohol may be used as a coping technique for mental health across SES groups. Associations may differ depending on which SES measure is used, and that methods such as latent class analysis can be used to define more descriptive categories beyond just high or low SES (Skogen et al., 2019).

5.5.3 Strengths and limitations

This study examined the prevalence and association between a large range of mental health problems and alcohol use in England. Much of the previous research has focused on alcohol misuse or non-drinking separately (Grant et al., 2015; Skogen et al., 2011; Swendsen et al., 2010) and research that has focussed on investigating the associations with mental health problems, has restricted this to a small number of problems (Goodwin et al., 2018; Skogen et al., 2011; Thandi et al., 2015). Our study provides a novel insight into the associations between alcohol and mental health while considering other characteristics.

Our study has limitations. First, the APMS is a cross-sectional survey, and therefore, we cannot determine the timeline of associations between mental health and alcohol use. Second, while measures used in our study have been validated, these are screening tools and those meeting criteria for a specific mental health problem would require further investigation to determine diagnostic caseness. Third, where possible we have used stringent criteria to screen for mental health problems though some use diagnostic criteria (i.e. PCL-C) and others do not (i.e. mood disorder questionnaire), and comparing different problems is not always directly comparable. And fourth, while we included a range of demographic and SES characteristics in our analyses, other characteristics such as income may explain some of these associations, however, it was not possible to do this in the current study due to a large amount of missing data.

5.6 Conclusions

Our study found meeting criteria for mental health problems, in particular SMIs, was strongly associated with drinking above hazardous levels and non-drinking which remained after adjustment for demographic and SES characteristics using a large representative dataset of

England. Our findings suggest that treatment for alcohol use and mental health should be addressed in parallel and comorbidity is not restricted to individuals of lower SES. Further, mechanisms underlying misusing alcohol and non-drinking among those with more severe mental health problems should be explored.

Chapter 6: Socioeconomic status, alcohol use and the role of social support and neighbourhood disadvantage among individuals meeting criteria for a mental health problem: a cross-sectional study

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This is due to be submitted to Psychological Medicine.

6.1 Foreword

What is already known from the previous Chapter (Chapter 4 and 5)?

- The previous Chapters show that the co-occurrence of alcohol use is higher among individuals who meet criteria for a mental health problem, compared to those not meeting criteria for the specific mental health problem
- Findings from the previous Chapters suggest that those meeting criteria for a range of mental health problems are also more likely to be non-drinkers which has not yet been shown in the published literature reporting associations of AUD and types of mental health problems
- The previous Chapters indicate that SES partially attenuates some of the associations between alcohol use and mental health problems, but this may differ across different SES indicators
- The partial attenuations of SES on associations between alcohol use and mental health problems indicate that there may be other additional factors which contribute towards this co-occurrence

What does the current Chapter aim to do?

- Based on findings from Chapters 4 and 5, this Chapter focuses on individuals who meet criteria for a mental health problem to understand how their alcohol use may differ based upon their SES
- This Chapter aims to explore the complexities of SES among this sample using latent class analysis which provides detailed information about the social patterning of groups who meet criteria for a mental health problem
- This Chapter aims to examine alcohol use with SES among individuals who meet criteria for a mental health problem
- This Chapter aims to explore the indirect effect of other contextual factors on these associations

What new findings does this Chapter add?

- This Chapter shows the social profiles of individuals who meet criteria for a mental health problem which are broadly defined by their occupation and housing tenure: “economically inactive, social renters”, “intermediate/routine occupation, mixed owner/renters”, “retired homeowners”, and “professional occupation, homeowners”
- This Chapter shows that, compared to “professional occupation, homeowners”, all other SES groups have increased odds of non-drinking which indicates that those with a mental health problem who are of lower SES are not necessarily more likely to drink at harmful/probable dependent levels
- This Chapter shows that, compared to “professional occupation, homeowners”, no associations with harmful/probable dependence were found which contradicts theories, such as the alcohol harms paradox
- This Chapter shows that decreases in social support facilitate both non-drinking and harmful/probable dependence while increases in neighbourhood disadvantage facilitate harmful/probable dependence among the most deprived SES group, “economically inactive, social renters”

6.2 Introduction

6.2.1 Background

The global prevalence of past year alcohol use is 52.3%, while the prevalence of alcohol use disorder (AUD) is around 2.2% (Glantz et al., 2020). Alcohol has been found to be the most harmful drug when considering its impact on the individual and others (Nutt et al., 2010). Recent evidence has shown that the prevalence of AUD was higher among individuals meeting criteria for a mental health problem (Grant et al., 2015; Lai et al., 2015; Puddephatt, Irizar, Jones, Gage, & Goodwin, 2021), while mental health problems and AUDs contribute significantly towards disability-adjusted life years (Rehm & Shield, 2019; Whiteford et al., 2013; World Health Organization, 2019) and mortality (Plana-Ripoll et al., 2019; Walker et al., 2015).

The alcohol harms paradox (Bellis et al., 2016) and social causation hypothesis (Goldman, 1994; Mossakowski, 2014) suggest that individuals may be at greater risk of experiencing alcohol harms and reporting poorer mental health because of their socioeconomic status (SES). Previous research has shown that those of lower SES were more likely to experience alcohol harms, despite lower self-reported alcohol use (Beard et al., 2016; Beard et al., 2019; Katikireddi et al., 2017). Those from lower SES groups were also more likely to experience worsened mental health which may be explained by patterns of alcohol use (Beard et al., 2016; Bellis et al., 2016; Goodwin et al., 2018), other unhealthy behaviours (e.g. smoking (Bellis et al., 2016)), other co-occurring problems (Bellis et al., 2016), and barriers to accessing services (Bellis et al., 2016; Smith & Foster, 2014). A recent study also found that SES partially accounted for associations between alcohol use (including non-drinking), and mental health (Puddephatt, Jones, et al., 2021), suggesting that SES plays a role in this co-occurrence. However, much of the previous research has explored associations of SES using either individual measures, such as education (Beard et al., 2016), or a composite (total) score based on multiple measures of SES (Beard et al., 2019) but these findings may differ depending on the measure of SES (Beard et al., 2019). Using individual measures of SES or a composite score can be problematic given that SES can be defined in terms of an individual's economic, employment, education and housing status (Collins, 2016).

An alternative approach for assessing SES is using latent class analysis (LCA) which groups individuals based on responding to different measures in a similar way, allowing the researcher to examine the effect of having multiple advantages or disadvantages. This has been used previously in the general population where economically inactive groups were more likely to report harmful drinking; and having a common mental disorder (CMD) partially explained these increased associations (Boniface et al., 2020). Research among adolescents,

found the proportion of ever using alcohol and frequency of drunkenness was highest among individuals with non-working parents compared with other higher SES classes. This study also reported that the second highest proportion of ever using alcohol was among those from more affluent families (Lowthian et al., 2021).

As previously mentioned, research indicate that there may be additional mechanisms in the associations between mental health problems and alcohol use (Puddephatt, Jones, et al., 2021). The “stress-buffering model” argues that social support protects against stress and negative events (Cohen & Wills, 1985). A review found that social support reduced psychological distress and helped adjust to stressful conditions (Taylor, 2011), while other research has found that emotional support reduced the risk of a CMD (Smyth, Siriwardhana, et al., 2015). However, research on associations between social support and AUD is mixed but this may be due to the population studied or the type of social support. This suggests that there may be differences in the role of social support depending upon the population. Neighbourhood disadvantage is defined as the sense of belonging in the community, the presentation of surroundings (e.g. litter and graffiti) and the extent to which a person feels safe in their neighbourhood (Businelle et al., 2010; McElroy et al., 2019). Neighbourhood disadvantage has been found to mediate relationships between SES with alcohol use (Fone, Farewell, White, Lyons, & Dunstan, 2013; Karriker-Jaffe, 2011; Karriker-Jaffe, HuiGuo., & M., 2016) and mental health (McElroy et al., 2019). But little is known about how neighbourhood disadvantage plays a role in the relationship between SES and alcohol use among individuals with a mental health problem.

6.2.2 Aims

This study aimed to address the following objectives in people meeting criteria for a mental health problem: i) understand how individuals are clustered based upon multiple indicators of SES to define latent classes, ii) determine associations between SES classes and alcohol use, and iii) examine whether there is an indirect effect of SES and alcohol use via social support and neighbourhood disadvantage. We hypothesise that more advantaged SES classes will have increased odds of non-drinking or hazardous use and more disadvantaged classes will have increased odds of being a harmful/probable dependence. We also hypothesise that there will be indirect associations between SES and alcohol use via social support and neighbourhood disadvantage.

6.3 Methods

6.3.1 Study design

This study used data from the 2014 Adult Psychiatric Morbidity Survey (APMS) which uses a stratified multi-stage random probability sample. It is a cross-sectional survey of private

households in England which has been on-going since 1993. 2014 APMS data was accessed through NHS Digital (ref. DARS-NIC-220105-B3Z3S-v0.3). We pre-registered our hypotheses and analysis strategy in advance of analysing the data (<https://osf.io/h3ntf/>).

6.3.2 Participants and setting

A detailed description of the APMS methodology is described elsewhere (McManus et al., 2020). One adult aged 16 or older was selected from each eligible household to take part in a face-to-face interview and reimbursed with a £15 high street voucher. Interviews were conducted in individuals' homes and some information was collected by self-completion using computer-assisted interviewing. Interviews were conducted from May 2014 to September 2015 (McManus et al., 2020). This study focused on those meeting criteria for a mental health problem, further detail around the specific types of mental health problems included, measures and cut-offs used can be found in table S10 and elsewhere (Puddephatt, Jones, et al., 2021).

6.3.3. Measures

The following indices were used to measure SES within this study:

Social occupational grade: This variable was derived by combining responses from the following items; ever having a job (“*Have you ever had a paid job, apart from casual or holiday work?*”) and reasons for not being in work (“*What was the main reason you did not seek any work in the last 4 weeks/would not be able to start in the next 2 weeks?*”). This variable was categorised as; i) managerial/professional, ii) intermediate, small employers and own account workers, iii) lower supervisory/technical/semi-routine/routine, iv) student, v) retired, and vi) never worked/not worked in the past year/not classified for other reason.

In debt: This variable was derived from item “*Have there been times during the past year when you or your household were seriously behind in paying within the time allowed for any of these items?*” and dichotomised as “yes” or “no”.

In receipt of any out of work benefits: This variable was derived from item “*Are you currently receiving any of these benefits as the named recipient?*” and dichotomised as “yes” or “no”.

Highest education qualification: This variable was derived from item (“*Please look at this card and tell me whether you have passed any of the qualifications listed. Look down the list and tell me the first one you come to that you have passed.*”) and categorised as; i) University degree or higher, ii) A-Level/GCSE level, iii) other qualifications (including foreign qualifications), and iv) no qualifications.

Housing tenure: This variable was derived from two questions; “*In which of these ways do you (or your household) occupy this accommodation?*” and “*Who is your landlord?*”. Participants were categorised as; i) homeowner, ii) social renter, and iii) private renter.

Household type: Participants were asked to indicate their current household living situation and categorised as; i) lives alone, without children (reference category), ii) lives with another adult without children, iii) lives in a family, and iv) lives in an adult household.

Alcohol use: Alcohol use was measured using two screening questions and participants’ scores on the Alcohol Use Disorder Identification Test (AUDIT); “*Do you ever drink alcohol nowadays?*”, those who responded “no” were then asked, “*Could I just check, does that mean you never have an alcohol drink nowadays, or do you have an alcoholic drink very occasionally?*”. Those who responded “no” did not complete the AUDIT. The AUDIT is a 10-item screen for alcohol use and related problems (World Health Organization, 2001), which has a maximum score of 40 and good internal reliability within this sample (Cronbach’s $\alpha=0.96$). Participants were categorised in accordance to established cut offs (World Health Organization, 2001); “non-drinker” (answering “no” to screening questions or having an AUDIT score of 0), “low-risk” (AUDIT score: 1-7, reference group), “hazardous use” (AUDIT score: 8-15), and “harmful/probable dependence” (AUDIT score: 16 or above).

Social support: Perceived social support was measured using a seven-item questionnaire from the 1987 Health and Lifestyle Survey (Cox et al., 1987). The questionnaire includes statements, such as “*There are people I know amongst my family and friends - who do things to make me happy*” and “*There are people I know amongst my family and friends - who would see that I am taken care of if I needed to be*”, that individuals responded to as “not true”, “partly true”, or “certainly true” of their family and friends and has a maximum score of 21. This measure has good internal reliability (Cronbach’s $\alpha = 0.94$). This measure was treated as a continuous variable, with a high score indicating strong social support. The mean score for social support in this sample was 19.25 (SD=3.02), indicating moderate levels of social support.

Neighbourhood disadvantage: Neighbourhood disadvantage was measured using a 10-item questionnaire which asks participants questions around social cohesion (Kawachi & Berkman, 2000) and neighbourhood quality (Mouratidis, 2020). All items except one (“*The area is kept nice by its residents*”) had good item-test correlation with the proposed constructs (Cronbach’s inter-item test correlation= 0.73-0.89). The item with lower item-test correlation compared to other items in the questionnaire (Cronbach’s inter-item test correlation=0.42) was removed from analysis, thus, a nine-item questionnaire was used to generate a total score (Cronbach’s

$\alpha = 0.84$) with a maximum score of 45. This measure was treated as a continuous variable, with a high score indicating greater neighbourhood disadvantage. The mean score for neighbourhood disadvantage in this sample was 20.62 (SD=7.42).

6.3.4. Sample size

The full sample size of the 2014 APMS was 7,546, but after restricting to those individuals who met criteria for a mental health problem, the final sample was 1,463.

6.3.5 Statistical analysis

Data was processed in STATA version 16 and analysed in MPlus version 8. A previous study using this dataset reported that most variables assessing specific types of mental health problems had a small amount of missing data (~0.01%) though alcohol use had 3.7% of missing data (Puddephatt, Jones, et al., 2021). There was also a small amount of missing data for SES measures, social support and neighbourhood disadvantage (1.03%-1.64%). 1,463 participants met criteria for a mental health problem, of which 36 (2.51%) did not complete the alcohol measures, therefore, a complete case analysis was conducted. Potential non-response could be due to items being in the self-completion section of the questionnaire (McManus et al., 2020).

The analysis took part in three stages. All SES and alcohol variables except household type were treated as nominal and social support and neighbourhood disadvantage were treated as continuous.

- 1) *LCA*: Models were run with SES measures (social occupational grade, in debt, in receipt of benefits, highest education qualifications, housing tenure, household type) as variables ($n=1,463$). Models ran with 100 starts, starting with a one-class up to a six-class model until it could no longer be replicated, to determine the best-fitting model. The maximum likelihood model using the Lo-Mendell-Rubin loglikelihood ratio test (LMR-LRT) was used to estimate models as this accommodates complex survey design (Li, 2014). Due to the large sample size, the lowest BIC and SSABIC values across the classes were used to determine the best fitting model as these are sample size adjusted (Nylund et al., 2007). The highest entropy value was used to determine the best fitting model (Ramaswamy et al., 1993). We also inspected bivariate residual values to check for correlations between variables (Vermunt & Magidson, 2005).
- 2) *Multinomial logistic regression*: Weighted regression models were conducted to examine associations between the classes of SES and the alcohol use outcomes. SES was treated as a categorical variable in this analysis and the reference category was

the class indicative of highest SES. Multinomial odds ratios and 95% confidence intervals were used to assess the associations between each SES with the alcohol use outcomes (being a non-, hazardous or harmful/probable dependence). Confidence intervals not overlapping with 1 and p-value of less than 0.05 were deemed significant.

- 3) *Structural equation model (SEM)*: Two models using maximum likelihood robust estimation were conducted to examine the indirect effect of social support and neighbourhood disadvantage on associations between SES and alcohol use, respectively ($n=1,436$). This estimation method was used as this is suitable when using weighted data and when outcome are categorical or continuous (Li, 2014).

Indirect effects of social support and neighbourhood disadvantage were calculated using the “MODEL CONSTRAINT” command where the path from SES classes (class one, class two and class three) to social support or neighbourhood disadvantage were multiplied with the paths from social support or neighbourhood disadvantage to alcohol use (non-drinker, hazardous use, and harmful/probable dependence, (Muthén, 2007)). The regression coefficients for indirect paths with continuous outcomes (social support and neighbourhood disadvantage) were unstandardized and calculated using the Delta method (Feingold, 2019). Due to the dependent variable being nominal, it was not possible to use additional model fit indices to assess the indirect associations of SES and alcohol use via social support or neighbourhood disadvantage.

Multinomial logistic regression was used to calculate the paths from SES (class one, class two and class three) to alcohol use (non-drinker, hazardous use, harmful/probable dependence) and paths from social support and neighbourhood disadvantage to alcohol use, respectively. For the multinomial logistic regressions in these models, the multinomial odds ratio, confidence intervals not overlapping with 1 and a p-value of less than 0.05 was deemed significant. All analyses were conducted in MPlus version 8 and weighted to account for selection probabilities and non-response.

6.3.5.1 Sensitivity analysis

A sensitivity analysis of the prevalence of SES classes among individuals who met criteria for a CMD (defined as depressive and anxiety disorders (World Health Organization, 2017)) or severe mental illness (SMI; defined as bipolar disorder, probable psychotic disorder and any other psychotic disorder (Hardoon et al., 2013)) was conducted.

6.4 Results

6.4.1 Demographic characteristics of individuals with and without a mental health problem

Participant characteristics between those with and without a mental health problem were similar with regards to gender, age, ethnicity and household type (see table S11). A greater proportion of those with a mental health problem had never worked/not worked in the past year, in receipt of any out of work benefits, and in debt compared to those without a mental health problem (see table S11). Nearly half of those with a mental health problem had A-Level/GCSE level qualifications. Half of those with a mental health problem were homeowners though there was an even split of those who were social or private renters compared to two thirds of those without being a homeowner.

6.4.2 Latent class solutions

Table 14 shows the model fit indices of a one- to six-class model of SES among those who met criteria for a mental health problem. A four-class model was selected as this had the greatest reduction in AIC, BIC and SSABIC values, while also having a high entropy value.

Table 14: Model fit from one- to six-class model

| Fit indices | One-class | Two-class | Three-class | Four-class | Five-class | Six-class |
|-------------------------|------------------|------------------|--------------------|-------------------|-------------------|------------------|
| Model replicated | NA | Yes | Yes | Yes | Yes | No |
| Loglikelihood | -8940.511 | - | -8241.634 | - | - | - |
| d | | 8433.465 | | 8103.776 | 8035.702 | 8004.882 |
| No of parameters | 15 | 31 | 47 | 63 | 79 | 95 |
| LMR-LRT p | NA | 1004.250 | 380.401 | 273.371 | 134.99 | 61.117 |
| AIC | 17911.022 | 16928.93 | 16577.267 | 16333.55 | 16229.40 | 16199.76 |
| BIC | 17990.346 | 17092.86 | 16825.815 | 16666.71 | 16647.17 | 16702.14 |
| SSABIC | 17942.695 | 16994.38 | 16676.511 | 16466.58 | 16396.21 | 16400.36 |
| Entropy | NA | 0.772 | 0.888 | 0.813 | 0.772 | 0.764 |

6.4.3 Descriptions of four-class model

Table S12 shows the probability of being assigned to each of the four classes based on individual SES indicators, however, an overview of each class is provided below.

Class one – “Economically inactive, social renters” (N=361, 21.31%), probability of correct identification=89.20%)

There were approximately an equal number of males and females in this class, with nearly half aged 35-54, of white ethnicity, and half single (table 2). The majority of this group (79.10%) were not working/have not worked in the past year, 40.90% in debt and 84.60% in receipt of any out of work benefits. While 45.90% were educated to A-Level or GCSE level and 43.40% had no educational qualifications. Regarding housing tenure, 63.70% of this group were social renters and more likely to live in a household with another adult, without children, compared to living alone, without children (table S3).

Class two – “Routine/intermediate occupation, mixed owner/renters” (N=537, 47.83%), probability of correct identification=91.60%)

There were an equal number of males and females in this class, over half were aged 16-34, the majority of white ethnicity, and over half single (table 15). The majority of this group were in routine or intermediate occupations (66.70%) with 85.20% not in debt and 96.60% not in receipt of any out of work benefits. While 68.90% were educated to A-Level or GCSE level, 50.50% were homeowners and also more likely to live in a household on their own, without children (table S12).

Class three – “Retired, homeowners” (N=250, 11.91%), probability of correct identification=90.70%)

Two-thirds of this group were female, the majority aged over 55, of white ethnicity, and half married or in a civil partnership (table 15). Most were retired (89.50%) and homeowners (70.90%). The majority were not in debt (95.60%) and 98.20% were not in receipt of any out of work benefits. Within this group, 46.40% had no qualifications and more likely to live with another adult, without children or in a family household, compared to living on their own, without children (table S12).

Class four – “Professional occupation, homeowners” (N=315, 18.95%), probability of correct identification=87.90%)

There were an equal proportion of males and females in this class, just under half aged 35-54, the majority of white ethnicity and under half married or in a civil partnership (table 15). Most were in managerial or professional occupations (83.20%), 94.80% were not in debt and

98.60% were not in receipt of any out of work benefits. Seventy-one percent were educated to degree level while 67.80% were homeowners. This group were more likely to live in a family household, compared to living alone, without children (table S12).

Prevalence of latent SES classes based on the type of mental health problem

When stratified by the type of mental health problem (e.g. CMD or SMI) an individual has, 42.83% of those with a CMD were “routine/intermediate occupation, mixed owner/renters” whereas 13.76% were “retired, homeowners”. Of those with a SMI, 40.55% were “economically inactive, social renters” whereas 5.38% were “retired, homeowners” (table S13). This indicates that there were high levels of disadvantage among those with more severe mental health problems.

Table 15: Demographic characteristics of latent classes of SES

| Demographic characteristic | Class one: <i>“Economically inactive, social renters”</i> (n=361, 21.31%) | Class two: <i>“Routine/intermediate occupation, owner/renters”</i> (n=537, 47.83%) | Class three: <i>“Retired, homeowners”</i> (n=250, 11.91%) | Class four: <i>“Professional occupation, homeowners”</i> (n=315, 18.95%) |
|---------------------------------|--|---|--|---|
| | n (weighted %) | n (weighted %) | n (weighted %) | n (weighted %) |
| Gender | | | | |
| Male | 154 (51.43) | 204 (50.51) | 88 (38.31) | 130 (50.88) |
| Female | 207 (48.37) | 333 (49.49) | 162 (61.69) | 185 (49.12) |
| Age | | | | |
| 16-34 | 100 (33.34) | 225 (55.54) | - | 95 (38.36) |
| 35-54 | 166 (45.72) | 242 (35.08) | - | 162 (47.00) |
| 55-74 | 95 (21.94) | 69 (9.26) | 162 (65.64) | 58 (14.64) |
| 75+ | - | - | 84 (32.03) | - |
| Ethnicity | | | | |
| White | 321 (88.47) | 463 (83.09) | 239 (94.80) | 271 (87.08) |
| Non-white | 35 (11.53) | 69 (16.91) | 11 (5.20) | 43 (12.92) |
| Marital status | | | | |
| Single | 199 (54.20) | 258 (57.00) | 24 (8.00) | 121 (41.10) |
| Married or in civil partnership | 50 (20.17) | 185 (33.04) | 106 (55.45) | 141 (48.24) |
| Separated/divorced/widowed | 112 (5.63) | 94 (9.96) | 120 (6.55) | 53 (10.67) |

6.4.4 Associations of SES with alcohol use

Table 16 shows the frequency and associations of SES class with a non-drinking, hazardous use and harmful/probable dependence. Approximately 37% of “economically inactive, social renters” and “retired, homeowners” reported non-drinking compared to 10% of “professional occupation, homeowners”. Nearly 25% of “routine/intermediate occupation, mixed owner/renters” and “professional occupation, homeowners” reported hazardous use compared to 13% of “economically inactive, social renters” and “retired, homeowners”. Whereas 10% of “economically inactive, social renters” reported harmful/probable dependence compared to 3% of “retired, homeowners” but proportions were similar between “routine/intermediate occupation, mixed owner/renters” and “professional occupation, homeowners”.

Compared to “professional occupation homeowners”, all other SES classes had increased odds of non-drinking with associations strongest among “economically inactive, social renters” (OR=4.98, 95% CI=3.03-8.21, see table 16). Compared to “professional occupation, homeowners”, only “retired, homeowners” had decreased odds of hazardous use (OR=0.48, 95% CI=0.27-0.85, see table 16). Compared to “professional occupation, homeowners”, no associations between other SES classes with harmful/probable dependence were found (see table 16). This suggests that among individuals with a mental health problem, those from lower SES were more likely to be non-drinkers while associations with drinking at more harmful levels were not found.

Table 16: Weighted associations of classes of SES and alcohol use

| | | Non-drinker | | | | Low-risk use | | | | Hazardous use | | | | Harmful/probable dependence | | | |
|---|---|----------------|--------------|---------------|-------------|----------------|------|----------|----------|---------------|--------------|---------------|-------------|-----------------------------|-------|----------|----------|
| | | <i>n</i> | MOR | (95% CI) | <i>p</i> | <i>n</i> | MOR | (95% CI) | <i>p</i> | <i>n</i> | MOR | (95% CI) | <i>p</i> | <i>n</i> | MOR | (95% CI) | <i>p</i> |
| | | (weighted %) | | | | (weighted %) | | | | (weighted %) | | | | (weighted %) | | | |
| Class 1 | – | 130 (37.33) | 4.98 | (3.03- | 0.01 | 124 (37.86) | Ref. | | Ref. | 51 (13.93) | 0.67 | (0.42- | 0.10 | 34 (10.88) | 1.77 | (0.93- | 0.08 |
| <i>Economically inactive, social renters</i> | | | 8.21) | | | | | | | | 1.08) | | | | 3.38) | | |
| Class 2 | - | 114 (22.04) | 2.39 | (1.48- | 0.01 | 264 (46.54) | Ref. | | Ref. | 104 (23.34) | 0.91 | (0.61- | 0.65 | 41 (8.09) | 1.07 | (0.58- | 0.83 |
| <i>Routine/intermediate occupation, mixed owner/renters</i> | | | 3.87) | | | | | | | | 1.36) | | | | 1.97) | | |
| Class 3 | – | 85 (37.11) | 3.98 | (2.39- | 0.01 | 108 (47.14) | Ref. | | Ref. | 27 (12.49) | 0.48 | (0.27- | 0.01 | 9 (3.28) | 0.43 | (0.18- | 0.05 |
| <i>homeowner</i> | | | 6.63) | | | | | | | | 0.85) | | | | 1.00) | | |
| Class 4 | - | 35 (10.36) | Ref. | | Ref. | 170 (52.34) | Ref. | | Ref. | 79 (28.81) | Ref. | | Ref. | 25 (8.49) | Ref. | | Ref. |
| <i>Professional occupation, homeowners</i> | | | | | | | | | | | | | | | | | |

*Bold indicates statistical significance ($p < .05$), MOR=multinomial odds ratio, CI=confidence interval

6.4.5 Indirect effect of associations between SES and alcohol use via social support and neighbourhood disadvantage

Social support

The mean social support score was 19.25 (SD=3.02), indicating moderate levels of social support. The mean social support score was highest among “professional occupation, homeowners” and lowest among “economically inactive, social renters” (see table S14). When stratified by alcohol use, the mean social support score was highest among those who reported low-risk use and lowest among those who reported harmful/probable dependence (see table S5).

Compared to “professional occupation, homeowners”, all other SES classes reported significantly lower social support scores (see figure 9). A higher social support score (compared to lower) was associated with a decreased odds of non-drinking and harmful/probable dependence, respectively (see figures 9 and 11). Associations between SES and non-drinking via social support was significant among “economically inactive, social renters” and “retired homeowners” (see table 17). This suggests that lower social support facilitated non-drinking among these groups. Whereas associations between “economically inactive, social renters” and harmful/probable dependence via social support was significant which suggests that lower social support also facilitated lower odds of harmful drinking among this group.

Neighbourhood disadvantage

The mean neighbourhood disadvantage score was 20.63 (SD=7.42), indicating moderate levels of disadvantage. The mean highest neighbourhood disadvantage score was highest among “economically inactive, social renters” and lowest among “retired, homeowners” (see table S3). When stratified by alcohol use, the mean highest neighbourhood disadvantage score was highest among those who reported harmful/probable dependence and lowest among those who reported low-risk use (see table S14).

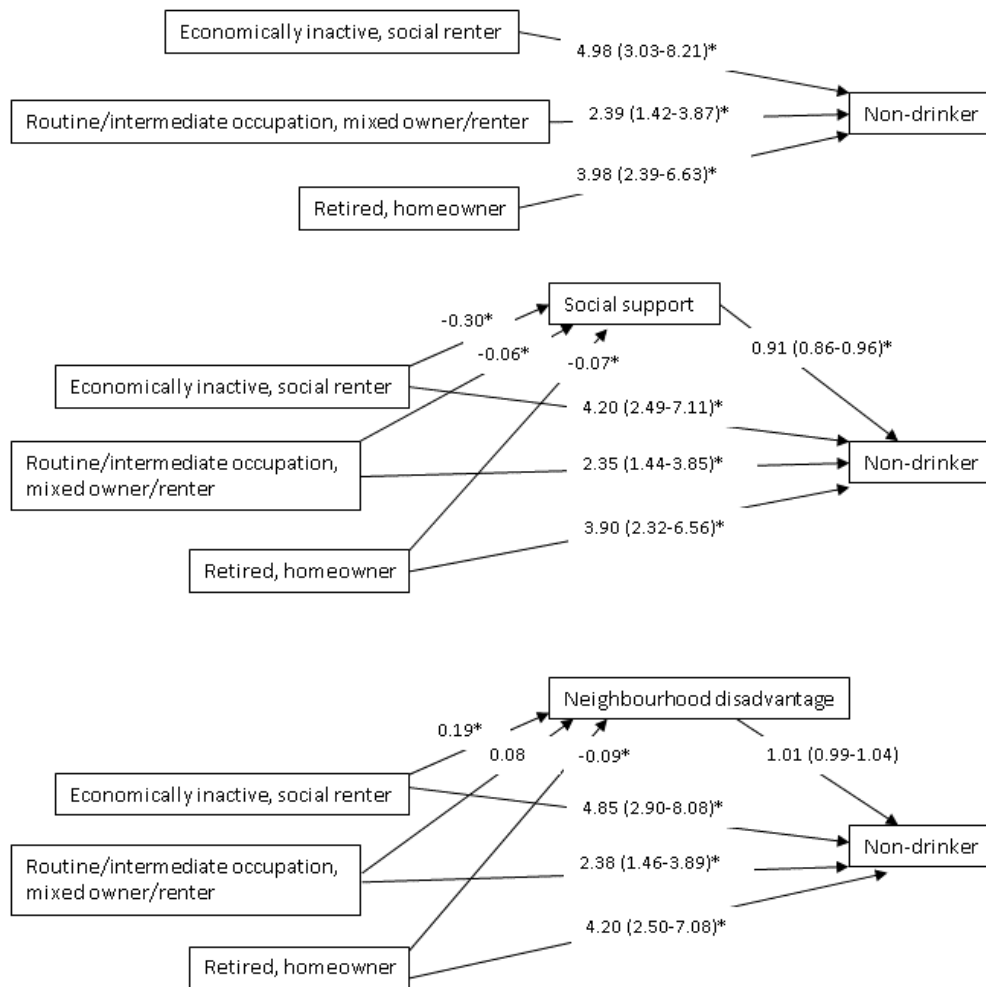
Compared to “professional occupations, homeowners”, “economically inactive, social renters” reported higher neighbourhood disadvantage scores whereas “retired, homeowners” reported lower scores (see figure 9). An increase in neighbourhood disadvantage was associated with an increased odds of harmful/probable dependence, compared to low-risk use (see figure 11). Associations between “economically inactive, social renters” and harmful/probable dependence via neighbourhood disadvantage was significant (see table 17), indicating that among lower SES groups with a mental health problem, area-level deprivation played a role in the likelihood of harmful drinking.

Table 17: The indirect effect of associations between SES and alcohol use via social support and neighbourhood disadvantage

| | | Social support (n=1,436) | | | Neighbourhood disadvantage (n=1,436) | | |
|---|------------------------------------|---------------------------------|------------------|-------------|--------------------------------------|------------------|-------------|
| | | Unstandardised coefficient (SE) | 95% CI | p | Unstandardised coefficient (SE) | 95% CI | p |
| Class 1 – Economically inactive, social renters | Non-drinker | 0.20 (0.06) | 0.09-0.30 | 0.01 | 0.04 (0.04) | -0.03-0.11 | 0.30 |
| | Low-risk drinker | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| | Hazardous drinker | 0.02 (0.07) | -0.09-0.14 | 0.73 | 0.02 (0.05) | -0.06-0.09 | 0.68 |
| | Harmful/probable dependent drinker | 0.25 (0.09) | 0.09-0.40 | 0.01 | 0.13 (0.06) | 0.04-0.22 | 0.02 |
| | | | | | | | |
| Class 2 - Routine/intermediate occupation, mixed owner/renters | Non-drinker | 0.03 (0.02) | 0.00-0.06 | 0.08 | 0.01 (0.02) | -0.01-0.04 | 0.37 |
| | Low-risk use | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| | Hazardous use | 0.00 (0.01) | -0.01-0.02 | 0.72 | 0.01 (0.01) | -0.02-0.03 | 0.68 |
| | Harmful/probable dependence | 0.04 (0.02) | 0.00-0.08 | 0.09 | 0.04 (0.03) | | 0.18 |
| | | | | | | | |
| Class 3 – Retired, homeowners | Non-drinker | 0.05 (0.02) | 0.02-0.09 | 0.02 | -0.03 (0.03) | -0.07-0.02 | 0.32 |
| | Low-risk use | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |
| | Hazardous use | 0.01 (0.02) | -0.02-0.04 | 0.72 | -0.01 (0.03) | -0.06-0.03 | 0.68 |

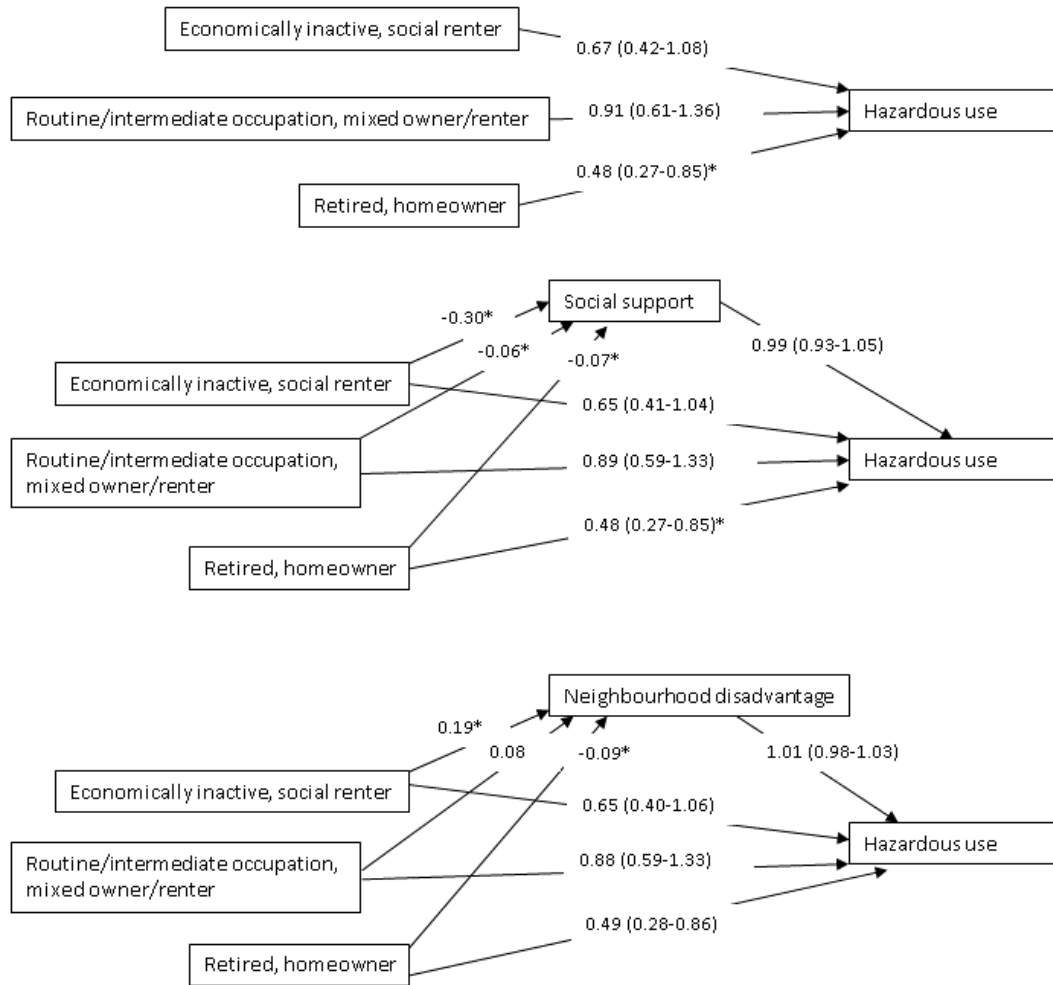
| | | | | | | | |
|--|-----------------------------|-------------|-----------|------|--------------|--------------|------|
| | Harmful/probable dependence | 0.07 (0.03) | 0.01-0.13 | 0.05 | -0.07 (0.04) | -0.13- -0.01 | 0.05 |
| Class 4 – Professional occupation, homeowners | | Ref. | Ref. | Ref. | Ref. | Ref. | Ref. |

*Bold indicates significance, SE=standard error, CI=confidence intervals



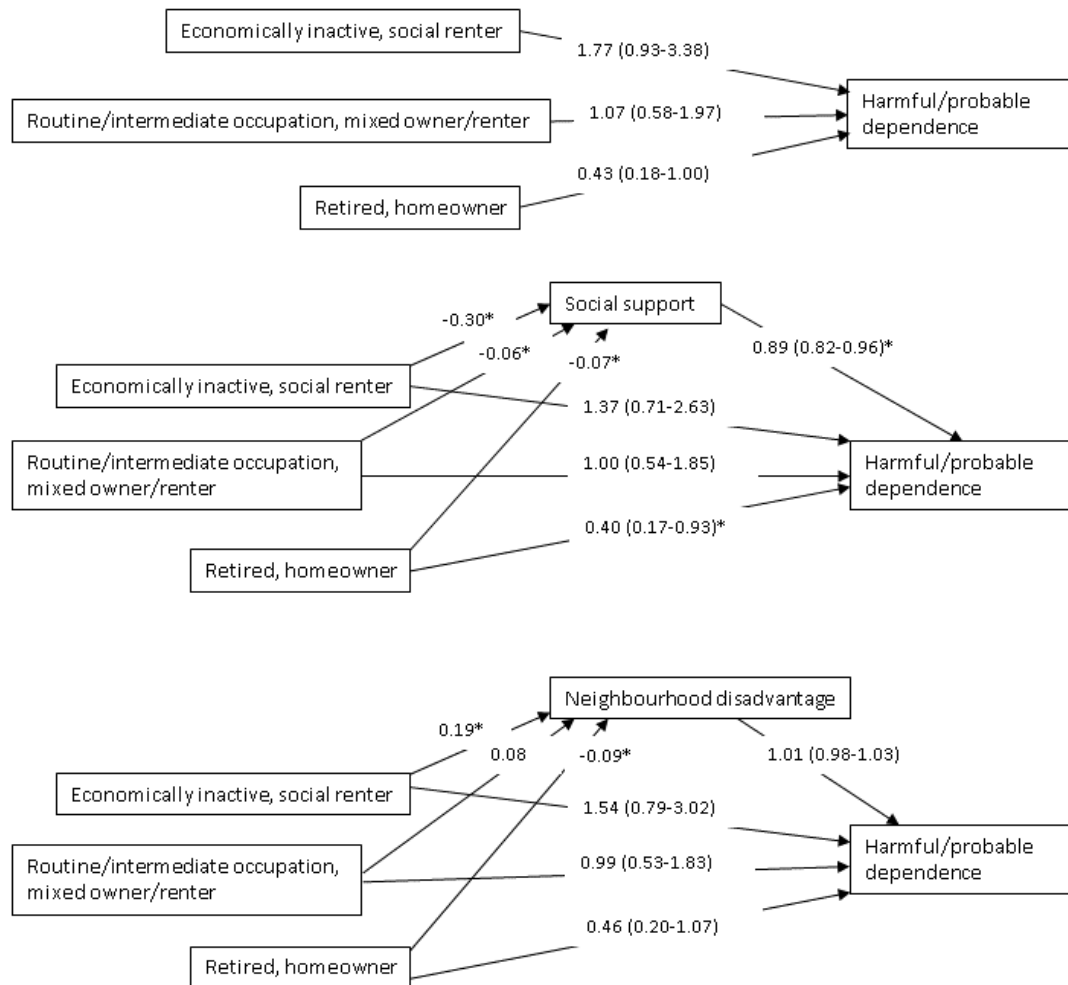
Paths from SES classes to social support and neighbourhood disadvantage represent beta coefficients. Paths from social support and neighbourhood disadvantage to non-drinking represent multinomial odds ratios. Paths from SES classes to non-drinking represent multinomial odds ratios.

Figure 9: Associations of SES and non-drinking via social support and neighbourhood disadvantage



Paths from SES classes to social support and neighbourhood disadvantage represent beta coefficients. Paths from social support and neighbourhood disadvantage to hazardous use represent multinomial odds ratios. Paths from SES classes to hazardous use represent multinomial odds ratios.

Figure 10: Associations of SES and hazardous use and the indirect effect of social support and neighbourhood disadvantage



Paths from SES classes to social support and neighbourhood disadvantage represent beta coefficients. Paths from social support and neighbourhood disadvantage to harmful/probable dependence represent multinomial odds ratios. Paths from SES classes to harmful/probable dependence represent multinomial odds ratios.

Figure 11: Associations of SES and harmful/probable dependence via social support and neighbourhood disadvantage

6.5 Discussion

6.5.1 Key findings

This study aimed to examine the SES classes of individuals who met criteria for a mental health problem, how SES was associated with alcohol use within this sample and examine the indirect effects via social support and neighbourhood disadvantage. Four classes of SES were identified; “economically inactive, social renters”, “routine/intermediate occupation, mixed owner/renters”, “retired, homeowners”, and “professional occupation, homeowners”, which were defined by occupation and housing tenure. The most common group was “routine/intermediate occupation, mixed owner/renters”, however, the group indicative of

higher SES was “professional occupation, homeowners”. Compared to “professional occupation, homeowners”, all other SES classes reported moderate to strong associations with non-drinking while “retired, homeowners” also reported decreased odds of hazardous use. The study found some evidence of an indirect effect of social support and neighbourhood disadvantage on associations but only with regards to “economically inactive, social renters” and non-drinking, and harmful/probable dependence, respectively.

6.5.2 Links with previous research

The development of our SES classes among individuals who met criteria for a mental health problem indicates that those with a mental health problem presented from a range of SES backgrounds. While it was not possible to clarify how long participants have had a mental health problem, these findings were in contrast to theories, such as the social causation hypothesis which argue that conditions associated with SES increase the risk of developing a mental health problem which may then be exacerbated by not having the resources to seek support (Mossakowski, 2014). Our findings may be explained by the broad scope of mental health problems, and a sensitivity analysis revealed that the prevalence of “economically inactive, social renters” was highest among those who met criteria for a SMI which is consistent with previous research which reported associations between lower individual and parental SES and schizophrenia (Agerbo et al., 2015; Luo et al., 2019) and bipolar disorder (Smith et al., 2013), respectively.

We hypothesised that more advantaged SES classes would have increased odds of non-drinking, however, compared to “professional occupation, homeowners”, we found that all other lower SES classes were more likely to report non-drinking which contradicts our hypothesis. These findings may be explained by the “sick-quitter” hypothesis which suggests that individuals no longer drink because they were a previous harmful drinker (Skogen, Harvey, Henderson, Stordal, & Mykletun, 2009) or have a pre-existing condition (Stockwell et al., 2016), which in the context of this study was having a mental health problem. A previous study found having anxiety or depression increased the odds of non-drinking, among men but not women, they also reported having no qualifications or being on the lowest income increased the odds of non-drinking for both genders (Ng Fat & Shelton, 2012). However, it was difficult to understand reasons for non-drinking using cross-sectional data.

We hypothesised that more disadvantaged SES classes would have an increased odd of harmful/probable dependence, however, no associations were found, compared to “professional occupation, homeowners” were found among individuals who met criteria for a mental health problem. The alcohol harm paradox argues that those of lower SES are more likely to experience alcohol harms despite drinking at lower levels (Bellis et al., 2016) which

have been consistently supported by previous research conducted in the general population (Beard et al., 2016; Katikireddi et al., 2017; Probst et al., 2020). A recent study using similar methods to derive SES found higher levels of harmful drinking in “economically inactive homeowners” and “professional renters” compared to “professional homeowners” respectively in the general population (Boniface et al., 2020). While these findings contrast with our current study, both studies showed that occupational grade and housing tenure were associated with alcohol use but there may be differences in how they were associated due to our sample being restricted to those who met criteria for a mental health problem. Our findings, which seemingly contradict the alcohol harms paradox, may be explained by two factors. Firstly, the lack of associations between SES and harmful/probable dependent drinking may be due to overall sample of this study reporting higher levels of harmful/probable dependent drinking, therefore, it would be difficult to find significant associations. For example, previous research has established that the prevalence of harmful/probable dependent drinking was higher among those who meet criteria for a mental health problem (Puddephatt, Jones, et al., 2021). Given the current study’s sample was restricted to those who met criteria for a mental health problem, thus harmful/probable dependence may already be higher, and so it may be that the differences in harmful/probable dependent drinking between SES groups were less salient. Secondly, associations between SES and harmful/dependent drinking among individuals with a mental health problem may depend on the pattern of drinking whereby previous research has shown that the greatest difference in alcohol harms between low and higher SES groups were observed for binge-drinking (Probst et al., 2020).

Some of the associations between SES and alcohol use were partially explained by lower social support and increased neighbourhood disadvantage, specifically among “economically inactive, social renters” and non-drinking, and harmful/probable dependence, and “retired, homeowners” and non-drinking respectively. The stress-buffering model argues that alcohol may be used to cope with stress and that social support acts as a buffer against the use of alcohol when under stress (Cohen & Wills, 1985). Findings from this study suggest that decreased social support increased the odds of non-drinking and harmful/probable dependence, respectively. Lower social support scores among lower SES groups were consistent with a previous study which showed social support scores among lower SES individuals (Smyth, Siriwardhana, et al., 2015) though authors note that the type of social support, specifically emotional support, was important in mental health and this may explain these two different drinking patterns (Smyth, Siriwardhana, et al., 2015; Taylor, 2011).

In addition, when neighbourhood disadvantage was considered, “economically inactive, social renters” had the highest mean neighbourhood disadvantage score. Indeed, associations between “economically inactive, social renters” and harmful/probable

dependence was partially explained by increased neighbourhood disadvantage. The social causation hypothesis, suggest that those living in poorer neighbourhoods may be more likely to experience more stress and report poor mental health (Mossakowski, 2014), and findings from this study indicated the most deprived SES class may use alcohol to cope. This suggestion has been supported in previous research which showed an increase in alcohol consumption among men living in disadvantaged neighbourhoods (Matheson et al., 2012), and an increase in severe hazardous drinking among women living in disordered neighbourhoods (Kuipers, van Poppel, van den Brink, Wingen, & Kunst, 2012).

6.5.3 Strengths and limitations

The current study is one of the first to show differences in associations of alcohol use and SES among individuals meeting criteria for a mental health problem which contrasts with findings from general population samples. We used a range of measures to capture different aspects of SES to develop a more holistic understanding of SES among this population compared to using single measures to assess SES. We also showed that social contexts, such as social support and neighbourhood disadvantage, may play a role in the associations between SES and alcohol use, which can be used to provide more tailored interventions towards the most deprived SES groups.

However, while individuals who met criteria for a mental health problem presented from a range of SES backgrounds, there may have been differences in these classes based upon the severity of the mental health problem as indicated by our sensitivity analysis. In addition, while we used a range of measures to assess SES, we did not include household income due to a large amount of missing data within this dataset (20.98%). We attempted to overcome this through other indicators of income, such as social occupational grade, being in debt and being receipt of any out of work benefits. In addition, due to the cross-sectional nature of the data, it was not possible to explore reasons for non-drinking among lower SES groups with a mental health problem and lack of associations with harmful drinking.

6.5.4 Conclusions

Individuals who met criteria for a mental health problem presented from a range of SES backgrounds. Compared to “professional occupation, homeowners”, those of lower SES had an increased odds of non-drinking. While no associations between SES and harmful/probable dependence was found which contrasts with the alcohol harm paradox. Among lower SES and retired groups, associations with alcohol use via social support or neighbourhood disadvantage suggests that contextual and area-level factors may play a role in the association between SES and alcohol use among those with a mental health problem. Future research should seek to understand the mechanisms of non-drinking among individuals with a mental health problem.

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Chapter 7: Understanding alcohol use and changes in drinking habits among people with a severe mental illness: a qualitative framework analysis study

This Chapter has been submitted for publication to Drug and Alcohol Review as:

Puddephatt, J-A., Makin, H., Jones, A., Gage, S. H. & Goodwin, L. Understanding alcohol use and changes in drinking habits among people with a severe mental illness: a qualitative framework analysis study (under review).

7.1 Foreword

What is already known from the previous Chapter (Chapter 4, 5 and 6)?

- Chapter 4 and 5 show that individuals meeting criteria for a mental health problem have at least a two-fold increase in the odds of reporting alcohol use (including non-drinking) compared to those without the respective problem and these associations are stronger among those meeting criteria for more severe problems and at more severe levels of AUD
- Chapter 6 shows that individuals with a mental health problem are likely to present from a range of SES backgrounds which are defined by their occupation and housing tenure
- Chapter 6 suggests that among those meeting criteria for a mental health problem, lower SES groups, compared to higher SES, have a nearly five-fold increase in the odds of non-drinking which may be explained by poor mental health
- Chapter 6 suggests that, among those meeting criteria for a mental health problem, there are associations between the most deprived SES group and non-drinking and harmful/probable dependence via social support and neighbourhood disadvantage, respectively, indicating that those from the most disadvantaged groups are more likely to experience worsened alcohol outcomes

What does the current Chapter aim to do?

- This Chapter aims to understand why individuals with a SMI are more likely to be non-drinkers or harmful drinkers
- This Chapter aims to explore the role of experiencing mental health symptoms on alcohol use
- This Chapter aims to explore how drinking patterns may change over time among a sample of drinkers and non-drinkers who have previously drunk alcohol and who have a SMI

What new findings does this Chapter add?

- This Chapter shows that individuals with a SMI drink more problematically over time, before their diagnosis, and do so to cope specifically with trauma, SMI symptoms or stress
- This Chapter shows that there are differences in the patterns of drinking when experiencing specific SMI symptoms among individuals with the same SMI diagnosis where some participants with bipolar disorder drink more when feeling manic and less when feeling low or vice versa
- This Chapter shows that changes in alcohol use occur, for non-drinkers, before or while getting formal support whereas for drinkers, this changes during or after getting formal support
- Findings from this Chapter suggests that an individual's SES does not influence their past and current alcohol use which contradicts some of the findings from the previous Chapters
- This Chapter shows that changes in alcohol use are facilitated through significant life events, receiving the correct diagnosis and treatment which have important implications on the current treatment pathways for those experiencing declines in their mental health
- This Chapter shows that, in contrast with findings from the previous Chapters, current drinkers drink in a more controlled way but this may be explained by this sample being previous former heavy drinkers and are now engaged with community mental health organisations
- This Chapter shows that non-drinkers manage this through reminders of past selves and avoiding situations which may trigger a decline in their mental health whereas drinkers manage this through stopping drinking before getting drunk, parental drinking, changing the reasons why they drink. These reasons provide important implications on how to address alcohol use among individuals with a SMI
- Overall, this Chapter support the self-medication hypothesis and drinking motives where alcohol can be used to cope, particularly when not receiving timely support, however, drinking to cope motives are more complex

7.2 Introduction

Approximately 32.5% of the global population drink alcohol (Griswold et al., 2018), while 5.1% of individuals aged 15 or over had an alcohol use disorder (AUD) (World Health Organization, 2019). Prevalence estimates for different mental health problems vary. Around 4.4% and 3.9% of adults reported having a depressive or anxiety disorder, globally (World Health Organization, 2017), whereas the prevalence of more severe mental illnesses (SMI, defined as bipolar disorder, schizophrenia or other psychotic condition problems (Hardoon et al., 2013)) ranges from 2.63 - 5.10% depending on the type of problem (Moreno-Küstner et al., 2018). Mental health problems contribute towards living with a disability (Whiteford et al., 2015), and having a SMI can result in serious functional impairment and interfere with major life activities (National Institute for Mental Health, 2020). Alcohol and mental health problems often co-occur (Glantz et al., 2020; Lai et al., 2015; Puddephatt, Irizar, et al., 2021), and research has shown strong associations between SMIs and harmful alcohol use (Grant et al., 2015; Puddephatt, Jones, et al., 2021). Given the known associations between alcohol and SMIs, and the burden of having a co-occurring problem, it is important to understand the mechanisms around alcohol use among individuals with a SMI.

The self-medication theory argues that people with a mental health problem may use alcohol specifically to cope with an acute decline in mental health. Alcohol may be used initially to enhance low mood or other symptoms but over time this becomes a maladaptive coping response and can worsen symptoms (Khantzian, 1997). This association can differ across mental health problems, for example 17% of people with bipolar disorder reported harmful drinking, whereas the prevalence was 8% among those with probable psychotic disorder (Puddephatt, Jones, et al., 2021). Qualitative research suggests that there may be differences in drinking patterns based upon the specific symptoms an individual experiences. For example, among those with bipolar disorder, alcohol consumption increased when experiencing low mood but decreased during the manic phase (Healey et al., 2009). Other research has shown that, among those with a SMI, psychological symptoms associated with their mental health, such as paranoia, reduced the likelihood that they used substances as individuals knew it would worsen symptoms (Bradizza & Stasiewicz, 2003). Therefore, coping with mental health may take the form of different drinking patterns (including non-use).

The prevalence of non-drinking has increased recently, particularly among specific groups, e.g. those aged 16-24 and of White ethnicity (Ng Fat, Shelton, & Cable, 2018). Reasons for not drinking may be due to health reasons (Rosansky & Rosenberg, 2020), being no longer interested in drinking alcohol (Bernards, Graham, Kuendig, Hettige, & Obot, 2009), symptoms of poor mental health (Bradizza & Stasiewicz, 2003; Healey et al., 2009), being a

former harmful drinker or being on medication (Skogen et al., 2011). Research have shown associations with non-drinking and mental health problems (Sarich et al., 2019; Skogen et al., 2011), more recently, 50% of those meeting criteria for probable psychotic disorder were found to be non-drinkers (Puddephatt, Jones, et al., 2021). However, reasons why some individuals with a SMI drink alcohol and others do not are not well-known, therefore, it is difficult to understand factors which facilitate changes in drinking patterns among individuals experiencing such mental health problems.

Consequently, the current study aimed to use qualitative methods to explore i) how have current and previous drinkers with a SMI used alcohol, ii) how people's drinking patterns change when they experience specific symptoms of their SMI and, iii) whether drinking patterns have changed since receiving their diagnosis.

7.3 Methods

Ethical approval was obtained from the Research Ethics Committee at the University of Liverpool (ref. 6337). The following methods and results are reported in accordance with the COsolidated criteria for REporting Qualitative research (Tong et al., 2007).

7.3.1 Participants and sample size

Participants were purposively recruited from community mental health organisations in the North-West of England. Participants were invited to take part in a telephone or online semi-structured interview via a gatekeeper from each organization based upon i) being a drinker or non-drinker (but had previously drunk alcohol), ii) diagnosis of a SMI, including bipolar disorder, schizophrenia, or other psychotic conditions (Haroon et al., 2013; National Health Service England, 2019) and, iii) living independently within the community. Individuals with a current AUD or previous AUD who had received a diagnosis in the last two years were not eligible to participate. Eligibility was confirmed by a trained female postgraduate researcher (JP) before arranging a time and date for the interview. We aimed to recruit an equal number of drinkers and non-drinkers so comparisons could be made. We continued to recruit participants until data saturation had been reached.

7.3.2 Interviews

Seventeen one-to-one semi-structured interviews were conducted, from September to November 2020. Interviews were developed by the study team and amended using feedback from a participatory involvement group. A topic guide which asked questions around drinking sessions, symptoms of their SMI, reasons for drinking or not drinking, and support received for their mental health (see appendix for interview schedule), was used. Similar questions were asked in relation to prior to and immediately after receiving their diagnosis (a definitive

timepoint for each participant) and their current drinking or non-drinking to allow for comparisons to be made with regards to changes in drinking patterns over time.

7.3.3 Procedure

After being contacted by the gatekeeper from the community mental health organization, participants expressing an interest in taking part were emailed (by the researcher, JP) a participant information sheet, outlining the aims and procedure of the study. Participants were prompted to ask questions before agreeing to take part in the study. After participants confirmed that they met inclusion criteria and agreed to take part, they were sent a consent form via email to return to JP. No relationship with participants were established prior to study commencement other than to confirm eligibility and answer questions.

Once a signed consent form was received, the researcher sent all participants a questionnaire to complete ahead of the interview about their demographic information and, for drinkers, alcohol use using the Alcohol Use Disorder Identification Test (World Health Organization, 2001). When the questionnaire was returned, a date and time of interview was arranged. Prior to the interview commencing, participants were required to confirm their name for identification purposes. Interviews were conducted by JP and audio-recorded using a digital dictaphone with only the researcher present. Upon completion of the interview, participants were debriefed and reimbursed with a £20 high-street voucher for their time. They were subsequently sent a copy of their transcript, via email, and confirmed as accurate by participants.

7.3.4 Analysis

Data were transcribed verbatim by an external transcriptionist ($n=9$) or by JP ($n=7$). Raw transcripts were checked for accuracy alongside the original audio recordings and then pseudoanonymised based on whether they were a drinker (identified as D) or non-drinker (identified as ND). Pseudoanonymised transcripts and responses from the questionnaire were then stored and managed using NVivo 12.

Data was analysed using framework analysis. Framework analysis is not aligned to a particular epistemological or theoretical approach and was selected as it allows for comparisons to be made within and between participants and groups of individuals, e.g. drinkers and non-drinkers, to provide a better understanding of a particular topic (Gale et al., 2013). This method is also useful for policy research or where there is scope to provide information about factors which contribute towards differences in experiences. Framework analysis consists of seven stages; transcription, familiarization, coding, developing a working analytical framework, applying the analytical framework, charting data into the framework matrix, and interpreting the data (Gale et al., 2013).

For analyses, JP conducted interviews and made field notes simultaneously. JP familiarised themselves with each transcript and made further notes and memos about the data. JP coded two drinker and two non-drinker transcripts using inductive and deductive coding. Some codes were decided *a priori* in accordance with the research questions; however, the majority were developed inductively. An initial framework was developed from this coding and discussed with a postgraduate researcher (HM) who had also read a proportion of transcripts. Amendments were made to the framework and a further four transcripts were coded by JP and then a proportion of transcripts were randomly selected and second coded by HM to confirm inter-rater reliability (agreement rate=83.60%). After second coding was complete, JP and HM discussed the codebook and final changes were made. Coding using the framework was then conducted with the remaining transcripts. Coding was facilitated by NVivo 12. Data was then charted into a matrix using Microsoft Excel with summaries provided by category or code. Then, JP interpreted data to identify patterns both within the whole sample and subsample of drinkers and non-drinkers to explore similarities and differences between the groups. Memos and reflexive notes were made throughout the analytical process.

7.4 Results

Seventeen participants were invited to participate. One participant was subsequently excluded as they disclosed in the interview that they had never drunk alcohol. This participant was reimbursed for their time. No repeat interviews were conducted. In total, 16 interviews were conducted with saturation reached at nine interviews for drinkers and seven for non-drinkers. The mean duration of interview was 39 minutes and 59 seconds.

7.4.1 Participant characteristics

There were an equal number of males and females, the majority aged between 35-54 and of non-White British ethnicity. Among drinkers, four reported low-risk alcohol use, two hazardous use and three harmful/probable dependence (see table 18).

Table 18: Participant characteristics

| | | <i>N</i> (%) |
|-----------------------|--------|--------------|
| Gender | Male | 8 (50.0) |
| | Female | 8 (50.0) |
| Age | 25-34 | 1 (6.3) |
| | 35-44 | 6 (37.5) |
| | 45-54 | 6 (37.5) |
| | 55-64 | 3 (18.8) |
| Marital status | Single | 6 (37.5) |

| | | |
|--|---|----------|
| | Married/civil partnership | 4 (25.0) |
| | Divorced/separated/widowed | 6 (37.5) |
| Ethnicity | White British | 7 (43.8) |
| | White Other | 3 (18.8) |
| | Asian British | 4 (25.5) |
| | Mixed Other | 1 (6.3) |
| | Other | 1 (6.3) |
| Education | University degree or higher | 7 (43.8) |
| | Teaching qualifications, BE, BTEC | 2 (12.5) |
| | A-Levels | 3 (18.8) |
| | GCSE's (grade C or above) | 3 (18.8) |
| | GCSE's (grade D-F) | 1 (6.25) |
| Mental health diagnosis | Bipolar disorder only or with one other mental health diagnosis | 8 (50.0) |
| | Schizophrenia or any other psychotic disorder | 8 (50.0) |
| AUDIT score (for the drinkers sample) | Low-risk use (AUDIT score of 0-7) | 4 (44.4) |
| | Hazardous use(AUDIT score of 8-15) | 2 (22.2) |
| | Harmful use (AUDIT score of 16-19) | 3 (33.3) |

7.4.2 Overview of themes and subthemes

Our analysis reports seven key themes and 12 subthemes related to how individuals with an SMI used alcohol, how drinking patterns changed with the symptoms they experience and after receiving their SMI diagnosis (see figure 12). Our thematic map illustrates how, prior to diagnosis, alcohol was initially used for social reasons but over time drinking was used more to cope with either trauma, specific mental health symptoms or stress which led to participants experiencing physical and social consequences of their drinking. Most non-drinkers stopped drinking completely around the time that they were experiencing serious declines in their mental health and remained abstinent since. Whereas drinkers began changing their drinking patterns after receiving their diagnosis, though took different approaches towards these changes, and report now controlling their drinking and changed the reasons why they drink. For all participants getting the right support for both their mental health and drinking was important in making these changes.

The thematic map shows the process of participants' changes in drinking. Trauma-, SMI-symptom-, and stress-based coping sub-themes were linked with "becoming a problem drinker" theme because participants reported drinking for these reasons. These subthemes were connected because participants reported drinking for one or multiple of these reasons which only alleviated issues temporarily, hence the double arrow. It was when participants' mental health or drinking deteriorated significantly that they sought help and their drinking patterns began to change; hence links from "becoming a problem drinker" theme to "getting the right support" and "impact of receiving SMI diagnosis". Non-drinkers managed their mental health through not drinking alcohol hence the link between themes "becoming a problem drinker" to "managing mental health through abstinence". Whereas drinkers adopted different drinking approaches before their current drinking habits hence the link between themes "approaches to drinking after diagnosis" and "controlled drinking habits". Current drinking or non-drinking habits were facilitated by getting the right mental health or alcohol support. Current habits were also influenced by having their current SMI diagnosis and establishing appropriate treatment hence the link between "getting the right support" and "impact of SMI diagnosis" with "managing mental health through abstinence" and "controlled drinking habits", respectively.

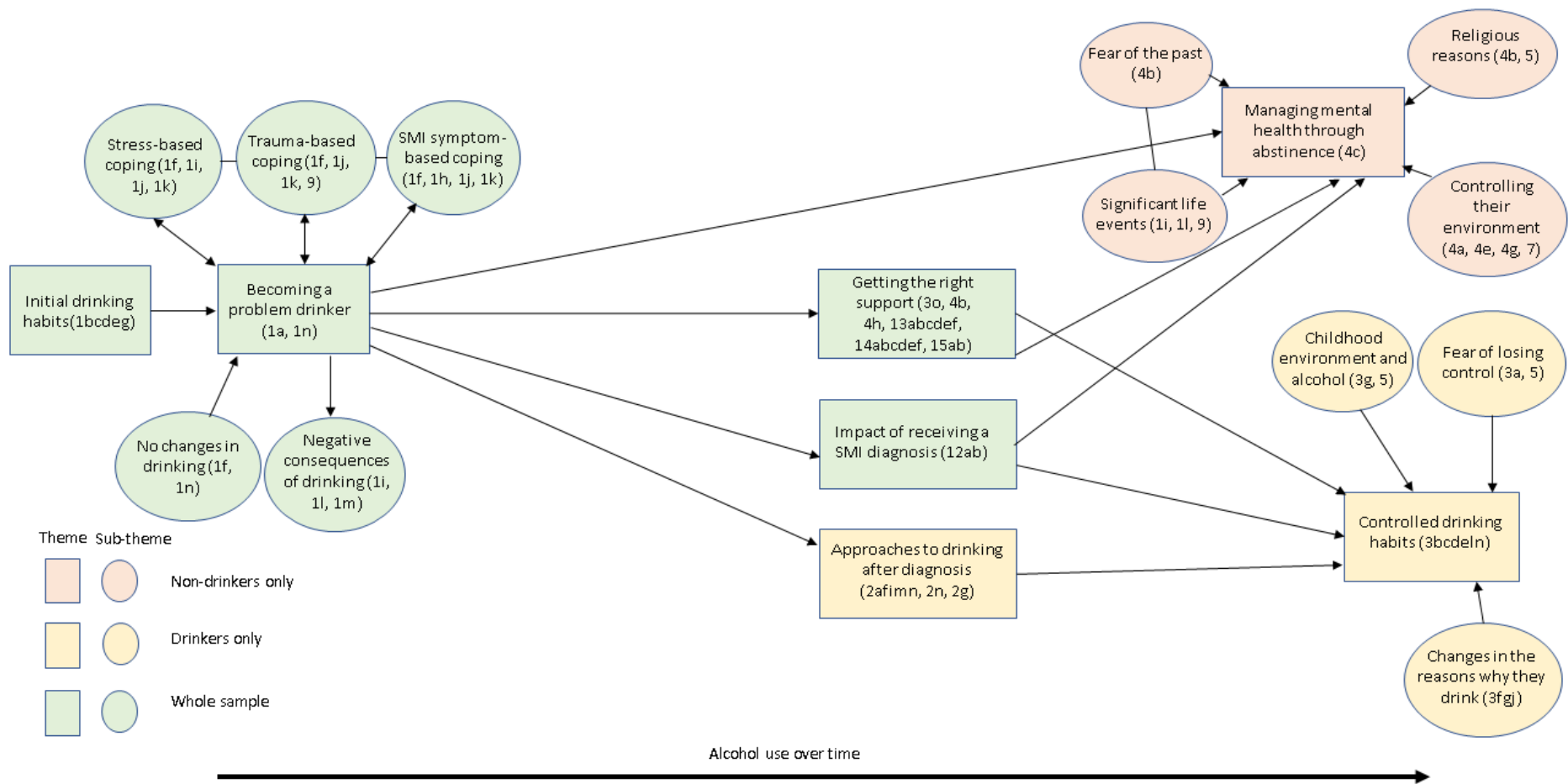


Figure 12: A thematic map illustrating the themes and subthemes

7.4.3 Major theme – Initial drinking habits (relates to complete sample)

Prior to their mental health diagnosis, the majority of participants started to drink alcohol when they were with friends in their teenage years because drinking was the appropriate thing to do at that time. A minority of drinkers from an ethnic minority background began drinking later in life, nonetheless, all drank for enjoyment and because of the social environment they were in where they tended to drink on the weekend with others rather than alone.

“usually in the evening, night out...err there was occasion I would have it on my own but it became very much connected to friends, out and drinking rather than me alone drinking” (P4D)

During the early stages of drinking, participants seemed to drink in a way that was not problematic or to cope, except for one participant who started drinking later in life when their family life was deteriorating and began drinking to cope with their worsened circumstances.

“it was about eight years ago. I was going through a stressful time with my husband...I couldn’t find no way out... things started going from bad to worse erm in regards of losing my kids, losing my mental health and I just thought “you know what? I’m gonna have a drink” just cope with it.” (P7D)

7.4.4 Major theme – Becoming a problem drinker (relates to complete sample)

Over time, participants’ drinking increased in quantity and frequency prior to their mental health diagnosis. For some, they described being unable to stop drinking once they started, indicating a lack of control around their drinking. As participants’ drinking worsened, they described reasons for drinking changing and used alcohol more to cope with specific issues or symptoms they were experiencing. Drinking alcohol managed their mental health or other issues well for a period of time, however, this was not sustainable and experienced either mental or physical consequences of their drinking. For all participants, it was only when their mental health and drinking had deteriorated that they then sought help for their mental health and/or drinking.

“it kind of just becomes part of your every day, like you know you eat and then you have a drink.” (P2ND)

7.4.4.1. Sub-theme - Trauma-based coping

Several participants within this sample reported experiencing traumatic events in their childhood and early adulthood which was initially managed on their own, however, over time alcohol was used more to cope or forget these experiences. However, drinking in this way resulted in them reliving these memories and felt worse for doing so. Nonetheless, this pattern

seemed to continue prior to their diagnosis until their mental health had deteriorated to such an extent that they needed to get help.

“before my diagnosis erm I probably drank to forget a lot because I suffered a lot of sexual violence...so I erm like would block try and block things out” (P2D)

“So the last time was definitely more of a suicide attempt like I was like I’m just going to drink until I die...I think when it was the last time I had a really good therapist at the time and I was just like I don’t want to go there again, like I was really depressed at that time and I just thought I don’t want to be in hospital again.” (P2D)

7.4.4.2. Sub-theme - SMI symptom-based coping

Participants experienced a range of symptoms related to their SMI, including hypermania, low mood, and hallucinations for several years and initially managed this on their own, however, as their symptoms worsened, alcohol was used more to cope. Coping in this way worked but shortly thereafter felt worse in the days after they stopped drinking, indicating that drinking to cope with their SMI symptoms became cyclical.

“I think I was just drinking to mask my depression and mask my thoughts. Whereas if it started to wear away, all I could see was my depression and see it was still there.” (P7D)

There were some differences in the patterns of drinking based on the symptoms experienced. For example, some participants with bipolar disorder drank more when they felt symptoms of hypermania to calm these feelings down and drank less when feeling depressed. For others with bipolar disorder, it was vice versa.

“I did when I felt more depressed in that phase the low phase I drank more but when I was in a high state I could kind of do less alcohol” (P4D)

“as the peaks and troughs came then yes I could erm you know for a couple of years when I was really depressed I didn’t drink at all I suppose. Erm its as it went up and down and it become more manic then the drinks would get worse” (P8D)

7.4.4.3. Sub-theme - Stress-based coping

Some participants drank more when they were unable to cope with on-going events in their personal or work life where it was used to clear thoughts and became their main coping technique for these issues. However, as noted above, drinking in this way only temporarily relieved these problems and returned once sober indicating a cyclical pattern as with subthemes “trauma-based coping” and “SMI-based coping”.

“I literally lost everything and then the drinking began in the social housing and I was abusive to people outside. Erm just started to get worse and worse, thinking that my life’s turned upside

down...my thoughts were just going, looking forward to that bottle, to that drink, to that erm place that it took me. Erm that solitude. Erm I haven't got no friends but I've got this drink as a friend.” (P7D)

“The funny thing was that when I started drinking, things started becoming apparently clear. It just started clearing, sifting through all of the rubbish and giving you clear thoughts for some reason. That was on a temporary basis, it wasn't on a permanent basis.

Interviewer: ‘how long would that last?’

Respondent: ‘it would only last up until I went to sleep and then slept it off then back again, normal to the foginess and everything else” (P7D)‘

7.3.4.4. Sub-theme - No changes in drinking

Drinking remained stable for a minority of participants prior to their mental health diagnosis. These participants did not believe their drinking was an issue and tested this through periods of abstinence to ensure that they could stop drinking when they wanted to.

“...it [drinking habits] didn't change for a few years but I would go erm one night of the weekend...and we would go to friend houses and then some of us would go to the pub. My then friend and I would go play pool and drink erm up to about five pints of beer.” (P5D)

7.3.4.5. Sub-theme - Negative consequences of drinking

Over time, participants experienced physical and mental effects of drinking as their habits worsened, such as feeling high while drinking but low and sick in the days afterwards. They also experienced more negative consequences over time, such as hospitalisation or getting into trouble with the police. These negative experiences became apparent during the later stages of their drinking and shortly before getting help.

“The high was enjoyable but after that no, I mean quite often after I'd be sick as well even after just a small amount of alcohol” (P8ND)

“I was hospitalised 3 times for drinking too much.” (P2D)

7.4.5 Major theme - Getting the right support (relates to complete sample)

The majority of non-drinkers stopped drinking just before or as they received help for their mental health, however, getting the right support helped manage their mental health and/or drinking. Whereas drinkers changed their drinking habits after getting mental health support and their SMI diagnosis. However, this process took multiple attempts over several years due to difficulties in accessing help and getting a correct diagnosis which relied on the participant persevering with engagement with services.

“I didn’t get support because whenever I’d go to see them they’d say “you’re not you’re not psychotic, you don’t have schizophrenia and you’re not we only see people that you know literally you erm are on lots of medication because of their voices and things like that”. So it’s almost like I kept falling between the cracks” (P5ND)

Once the correct diagnosis was received, participants reported difficulties in accessing support and treatment which suited them. Services were described as medication-focussed, which while often were necessary, participants preferred alternative therapies. In many cases, they described conducting their own research on available treatments that doctors were not aware of and then requesting a referral through the doctor.

“...until I found like places where I could do courses for my wellbeing and things like [mental health third sector service] you know...well they referred me actually to [psychiatric service] that’s off [location] and that was like too far to go...so I just said I’ve heard about this place called [mental health third sector service] I said its closer, so he said well you could go there and then that just opened a new chapter up for me” (PID)

Once participants had the right support, they reported being able to cope with their mental health and reported changing their drinking, for example some drinkers stopped drinking temporarily while adjusting to the medication or engaging with therapy.

“because of my erm medication and being diagnosed I knew that drinking was not permissible anymore” (P4D)

“I’ve just had a lot of therapy to deal with like trauma that’s happened to me. So I’m better but it’s not as traumatic anymore and I know that alcohol doesn’t help so I just don’t want to do that” (P2D)

7.4.6 Major theme – Impact of receiving a SMI diagnosis (relates to complete sample)

Participants experienced delays in receiving their SMI diagnosis and had multiple previous diagnoses which delayed appropriate treatment. When they received their SMI diagnosis, some were relieved to have a label which explained their behaviour and made them accountable for managing their mental health.

“I just it [the diagnosis] felt like justified of being so poorly and not really being where I wanted to be in life... it was like well I’m really poorly so that’s why I can’t do all things yet and I need to get better in order to do them. So it kind of helped that really” (P2D)

For others, there was a sense of shame for having a SMI because this was not accepted in society. Some participants, including one non-drinker, drank more initially after their

diagnosis because of this perception and implications of having a SMI, including taking medication that they did not want to take.

“unfortunately having schizophrenia doesn’t mean that er you know the newspapers are very nice to people who are schizophrenia, er schizophrenic you know? ...I suppose, you know, I drank a bit more to kind of dull that a little bit so that I didn’t feel as affected by it” (P6D)

The initial point of diagnosis seemed important to participants in terms of understanding what having the diagnosis meant even if for some it did not impact the way in which they drank but rather how they became more accountable for managing their mental health and changing their identity to adapt to the implications of the diagnosis on their employment and future prospects.

“well I think with bipolar, at first I was a bit resent, you know, until I understood it and I remember when I told my brother I cried and thought “ooo I’ve bipolar ooo” you know, and I was quite upset about it...I want to be normal. I was a professional [occupation], you know, I’d done years and years and I would be the one, in terms of my identity you know as a [occupation], erm, and identity is a big issue for me” (P5ND)

This process after the diagnosis seemed to take time for some participants to come to terms with and to understand through courses and additional reading around the causes of their diagnosis before becoming accepting of this.

7.4.7 Major theme – Approaches towards drinking after their diagnosis (relates to drinker sample)

After receiving their diagnosis, drinkers either stopped drinking completely for a period of time, drank less or drank more than prior to their diagnosis. Among drinkers who stopped drinking completely, this was because of the support they received and the medication to manage their symptoms. However, some participants stopped drinking because of the side effects of the medication where they were not physically able to.

“I realised then that I couldn’t mix alcohol and medication together and I did wanna get better in myself and I literally erm stopped it. I went cold turkey” (P7D)

“I didn’t drink it [alcohol] because I had the medication to take and it was knocking me out so I wouldn’t be awake to drink it” (P1D)

Some drinkers drank more heavily after receiving their mental health diagnosis to either cope with the side effects of medication, such as an increased appetite, or because the treatment was not working and so alcohol was used to help them cope with their mental health. Whereas, other drank to a lesser extent because of the environment that they were in rather than drinking to cope with their mental health, stress or trauma.

“I did try to kind of go well if I have something heavy like a heavy liquid in my body it might kind of curb that so I had erm I kind of used beer to do that. Erm and that made things erm I mean I felt a lot better for doing it but erm unfortunately it didn’t stop me from being hungry” (P6D)

“I think the things I noticed is that I kind of didn’t look forward to drinking after my diagnosis but then I was caught up in environments where there was alcohol” (P4D)

7.4.8 Major theme – Managing mental health through abstinence (relates to non-drinkers sample)

All non-drinkers in this sample stopped drinking completely without a gradual decrease in their drinking. Most non-drinkers stopped when they experienced serious declines in their mental health or as they received help for their mental health. One non-drinker continued to drink initially after their diagnosis because they did not believe the support they received for their SMI helped. Reasons for not drinking included, the impact drinking had on the participant, cultural beliefs, and significant life events. Taking this approach seemed linked with non-drinkers getting access to the right mental health and alcohol support, finding alternative ways of coping with their mental health, managing their environment whilst also accepting their SMI diagnosis.

7.5.8.1. Sub-theme – Religious reasons

A minority of participants stopped drinking because this contradicts the values of their religion and felt guilty for doing so. Before their diagnosis, some participants described not focussing on their religious values at times (where abstaining from alcohol was assumed) and being in situations where drinking alcohol was encouraged. Nowadays, these participants described prioritising their religion and mental health, and maintaining abstinence through avoiding certain situations which have previously triggered declines in their mental health and subsequently led to drinking.

“So you know I get into relationships and things like that that which I shouldn’t be doing if I’m thinking about my religion so that goes out of the window.” (P2ND)

7.5.8.2. Sub-theme – Fear of the past

A main reason for not drinking among non-drinkers nowadays was the fear of what had occurred in the past when they were drinking and returning to that way of living. Specifically, non-drinkers described not wanting mind-altering substances due to traumatic events which had occurred prior to their diagnosis had worsened their mental health and led to experiencing negative consequences. This was particularly notable among non-drinkers who received support for their alcohol problems and described themselves as an alcoholic where they previously experienced severe negative consequences of drinking.

“...when I get up and I put my socks on I’ve got gratitude, I’ve got gratitude because I think of my beds dry, there’s no one in it that shouldn’t be in because I was terrible.” (P1ND)

This sub-theme was also linked with “significant life events” as, for other non-drinkers, they described being in fear of traumatic events while they were drinking which contributed towards their decision to stop drinking alcohol.

“because of the terrible traumatic experience that I thought I associated with drink that that cut that part off from me its dangerous for me” (P3ND)

7.5.8.3. Sub-theme – Significant life events

The majority of non-drinkers reported significant life events in the lead up to their diagnosis which were pivotal in changing their drinking, such as experiencing a breakdown in their mental health through work, severe symptoms they were experiencing, or leaving relationships which was the main access to alcohol. Non-drinkers acknowledged that in the lead up to these events, alcohol had been used to manage these issues which was no longer sustainable.

“I didn’t know what’s happening, I knew everything is wrong but err the one thing like I told you coincidentally one night I said to, because in these 6 weeks I used to use it to sleep I wasn’t able to sleep. I said this can’t be right it’s as simple as that and I stopped drinking...in the middle of the breakdown I stopped drinking” (P6ND)

7.5.8.4. Sub-theme – Controlling their environment

Nowadays, non-drinkers described using a combination of the support they had to manage their mental health but also manage their environment to facilitate them not drinking. For some non-drinkers, they avoided environments where alcohol was available or people who were a trigger for their mental health which ensured that they were not tempted to drink. This seemed particularly salient among non-drinkers who had previously had problems with alcohol and had engaged with alcohol treatment and nowadays engage with other activities and avoid locations or people who consume alcohol so that they do not drink.

“when I was at AA and they would preach abstinence completely like you can’t control it, that’s what they were saying you know so. I just wanna touch wood and hope that I don’t. It’s almost like I wanna keep away from drama, erm negative people...so that I can not you know trigger, try to avoid the trigger” (P5ND)

“the friends I do have and see quite regular no they don’t drink they’re in recovery” (P1ND)

7.4.9 Major theme – Controlled drinking habits (relates to drinker sample)

Among drinkers, they described themselves as currently drinking in a way where they were in control of their drinking and stop before feeling tipsy or drunk. They described a range of

methods in managing this, such as restricting the amount of alcohol they drink and not drinking when they experienced symptoms of their SMI. Nowadays, drinkers in this sample used previous experiences with heavy drinking, childhood environment and drinking for different reasons to manage current drinking habits.

7.4.9.1. Sub-theme – Fear of losing control

The majority of drinkers were fearful of being vulnerable or of experiencing negative consequences from drinking. They described wanting to be in control of themselves when drinking and not relying on others to look after them. It seemed that this fear of losing control influenced restricting their drinking in a way which meant that they were in control of their behaviour when they drank. In addition, the majority of drinkers reported a family history of heavy drinking which seemed to contribute towards their fear of losing control and being vulnerable when they drank and so seek not to repeat history.

“There’s these are like all these popular drinks and all that that people go for and I think oh that 2 just does me but wonder what would happen if I drunk all 6 so.. no... I’m too scared I don’t want to throw up and choke” (P1D)

“I won’t drink two days in a row you know I leave it to one drink once a week because I like feeling in control of things I suppose. Erm I know that I have the disposition same as my parents to use alcohol to manage my, because I’ve got general anxiety disorder as well...” (P3D)

7.4.9.2. Sub-theme – Childhood environment and alcohol

As mentioned previously, several drinkers described a childhood with parents who were problem drinkers therefore believed that they had a predisposition to drink more problematically. Participants described this history as a deterrent for continuing to drink at levels of their parents which may be explained by the negative consequences they witnessed through their parent’s drinking.

“I’ve always erm been afraid of being out of control and if something happened because of what I’ve seen in the past with my dad here when we were growing up and like sick coming down his nose and out of his mouth” (P1D)

Whereas a minority of drinkers came from a culture where drinking was prohibited and restricted their drinking because they believed they were susceptible to the effects of alcohol.

“I had one erm just so that I could, because I don’t really come from a family of drinkers so much. I got a bit worried about my immunity kind of thing to it.” (P6D)

7.4.9.3. Sub-theme – Changes in the reasons why they drink

Compared to drinking both before and after their SMI diagnosis, the majority of drinkers were content with their current drinking because they enjoy it and the feeling alcohol gives. Reasons for drinking have changed from before their diagnosis and seemed to understand when not to drink alcohol, for example not drinking when they feel anxious, which may have been facilitated by the mental health support they have had.

“when I’m anxious I know that a drink would calm me down but that is exactly why I don’t have one” (P3D)

However, a minority of drinkers, notably harmful drinkers as indicated by their AUDIT score, stored alcohol as a last resort in case they cannot access their medication or other forms of support because of the current coronavirus pandemic. Nonetheless, this sub-group no longer drank for the same reasons prior to their diagnosis.

“I had my appointment last month well I’m not going to see him until about Christmas/January time so if that’s [lockdown] going to happen then what the hell am I going to do? Erm you know and because so many other people are, you know, using all the services and stuff, I just think well you need to kind of do a bit of self-medicating sometimes” (P6D)

7.5 Discussion and Conclusions

The current study explored how individuals with a SMI use alcohol, how drinking patterns change over time and reasons for drinking and not drinking. We found a gradual increase in participants’ drinking which related to a decline in mental health before receiving their diagnosis, whereby over time, alcohol was used to cope with aspects of their lives before receiving help for either their mental health or alcohol problem. Most non-drinkers stopped drinking either before or while receiving help for their mental health or alcohol problem, either because their mental health had deteriorated, significant life changes, or engagement with rehabilitation. Whereas drinkers changed drinking patterns while or after receiving their mental health diagnosis; some stopped drinking whereas others drank to cope with changes in their circumstances. We found that drinkers now used alcohol in a controlled way and have changed the reasons why they drink through the support that they received or because of events which occurred in the past. The role of receiving the right support and the impact of receiving a diagnosis of a SMI were important factors for participants in this study and acted as both barriers and facilitators towards managing their mental health and changing the way in which they drink.

Participants primarily drank because of the environment they were in, but over time they drank to cope. This supports both the self-medication hypothesis (Khantzian, 1997) and the drinking motives model proposed by Cooper (Cooper, 1994) which posits that individuals

drink for either i) social, ii) enhancement, iii) conformity or iv) coping reasons. However, our findings suggested that drinking to cope was more complex and had a cyclical pattern; some drank to cope with previous traumatic events, specific mental health symptoms they were experiencing, or stressful life events, or a mixture of the three. This is consistent with previous research which found that mental health influenced upcoming changes in heavy drinking (Bell et al., 2015). Elsewhere, research has shown that trauma-related drinking to cope mediated the relationship between post-traumatic stress disorder (PTSD) symptoms and alcohol use problems (Hawn, Bountress, Sheerin, Dick, & Amstadter, 2020), while a review reported associations between childhood treatment and some stressful life events with an increased risk of harmful drinking (Keyes, Hatzenbuehler, & Hasin, 2011). Focusing on specific issues related to drinking have been found to be more effective than treatment as usual among individuals with co-occurring PTSD and substance use disorder (Roberts, Roberts, Jones, & Bisson, 2015). Our findings showed that, among non-drinkers, a decision was made where drinking to cope was no longer sustainable and sought alternative coping mechanisms whereas drinkers stopped drinking to cope which was facilitated by the support received in managing their mental health. This suggests that when assessing alcohol use, specific reasons for drinking should be identified which could tailor interventions more appropriately.

Our finding of non-drinkers managing their environment, particularly those who had received treatment for their drinking, indicate that there was a need to change the groups they identified with, for example drinkers, and the social environments they were in to facilitate long-term abstinence. This supports the Social Identity Model of Recovery where an individual's membership with a group shifts to another to align with their newfound purpose which may have been prompted by significant life events or wanting to change their lifestyle (Best et al., 2016). It may be that interventions which promote belongingness to a group or support network which includes individuals who have co-occurring alcohol and mental health problems may facilitate long-term changes through promoting shifts in their identity.

Participants reported difficulties accessing help for their mental health and alcohol problems which compounded their mental health problems and worsened their drinking. Participants described getting current support through their own persistence, but that treatment often involved waiting lists and experimentation with medication rather than addressing underlying issues. Issues in accessing and affording support has been found in previous research (Kantor, Knefel, & Lueger-Schuster, 2017; Priester et al., 2016). For example, among bipolar patients, there were delays of up to 62 days in getting a diagnosis which may delay access to treatment (Patel et al., 2015), further delays may be longer if measuring when first symptoms of a SMI occurred (Chen, Farooq, et al., 2019; Hirschfeld & Vornik, 2003). Elsewhere, it has been suggested that an individual's perception of treatment, in particular

towards medication, should be considered to improve adherence (Jawad, Watson, Haddad, Talbot, & McAllister-Williams, 2018). Indeed, we found that perceptions of support and value or efficacy of medication contributed towards both the worsening and sustained changes in drinking behaviour among both drinkers and non-drinkers in this sample. Therefore, it is necessary to improve access to services for both assessment and treatment of a SMI while also considering individual preferences.

We also found that it took time for participants to accept their SMI diagnosis, including the perceptions and implications of this. Some participants described drinking to cope with the diagnosis initially while the majority educated themselves on what the diagnosis meant for them before accepting this. Our findings have been supported by previous qualitative research among service users with psychosis which found that there was a lack of understanding of psychosis and increased stigma of having such illness (Burke, Wood, Zabel, Clark, & Morrison, 2016). Notably, our findings indicated a negative perception of having a SMI compared with other mental or physical illnesses and previous research has shown associations between a higher level of internalized stigma with treatment adherence (Livingston & Boyd, 2010). For other participants, their diagnosis took time to accept because it became part of their identity and were concerned with the implications of the diagnosis replacing elements, such as their occupation, as their identity. This partially supports the Social Identity Theory (Tajfel, 1978) which describes the cognitive processes underlying a person's identity and how this changes, particularly socio-culturally, when an individual's identity changes. In this context, some participants in this sample described how having a mental health diagnosis meant that it took over their identity and became part of a group that they did not want to be a part of or did not associate with. It was through time and learning about their diagnosis where they became accepting of this. Such issues could be addressed through educating newly diagnosed individuals about their diagnosis. Qualitative research of a psychoeducation programme for bipolar disorder found that providing information about medication, personal triggers and phases of the illness provided a better understanding of managing the illness through other coping techniques (Poole, Smith, & Simpson, 2015).

Other factors, such as childhood environment, contributed towards current alcohol use. For drinkers, the impact of heavy parental drinking was described as a major reason for the way in which they drink nowadays, though prior to their diagnosis this group were heavy drinkers. Previous research has shown associations between parental drinking and alcohol expectancies in children (Smit, Voogt, Otten, Kleinjan, & Kuntsche, 2019), and predicted adolescent/problem drinking (Ryan, Jorm, & Lubman, 2010; Yap, Cheong, Zaravinos-Tsakos, Lubman, & Jorm, 2017). However, there has been less research to understand declines in later alcohol use among individuals with a family history of harmful drinking though one qualitative

study among young people noted that some did not drink because of this (Törrönen, Roumeliotis, Samuelsson, Kraus, & Room, 2019). Given that parental drinking was particularly salient among drinkers in this sample, it may be that being engaged with mental health organisations contributed towards this, nonetheless, parental drinking and restricting alcohol use should be explored further.

Finally, fear of not being in control and of past events while drinking contributed towards current drinking and non-drinking. There has been little research conducted in this area, however, one qualitative study of mental health service users' experiences of continuity of care found that being afraid was a core category and affected engagement with services, avoiding exposure as well as fear in regards to their experience with psychosis (Sweeney, Gillard, Wykes, & Rose, 2015). It may be that the feeling of fear extends towards the decision to drink or not to drink among individuals with a SMI or engage in other behaviours and future research should explore the role of fear further as this may provide implications on the mechanisms through which an individual chooses to engage in a behaviour.

7.5.1 Strengths and limitations

Our study provides a unique insight into different patterns of drinking among individuals with a SMI and how this changed over time in relation to their SMI diagnosis. Nonetheless our study is not without limitations. Firstly, we explored alcohol use among individuals with a SMI who lived independently in the community. There may be differences in our findings compared to individuals recruited in secondary care who were not engaged with community mental health organisations. We chose to focus on those living independently in the community as we sought to explore patterns among drinkers and non-drinkers, whereas including individuals from secondary services would be prohibited from drinking at the time of the interviews taking place. Secondly, our interviews were conducted during the coronavirus pandemic whereby research suggests that there have been changes in drinking patterns and mental health (Irizar et al., 2021; Jacob et al., 2021); we attempted to account for this in the interviews whereby questions around alcohol use during the pandemic were asked to account for potential changes during this time compared to their usual drinking or non-drinking habits though this factor did not seem to have a marked impact on their current drinking for the majority of participants. Thirdly and relatedly, it is possible that participants' mental health may have deteriorated because of the pandemic, particularly given that a recent systematic review showed that around a quarter of global population reported experiencing CMD symptoms (Nochaiwong et al., 2021) which is slightly higher than an earlier systematic review (Steel et al., 2014). However, participants in this sample seemed to be coping with the pandemic and this may have been because of the support they have had. Finally, while not the focus of this study, Liverpool is the third most deprived local authority area in England

(Liverpool City Council, 2019), and participants' drinking could have been used to cope with their SES circumstances. However, participants rarely discussed their SES in relation to their drinking instead other issues, such as their mental health symptoms and traumatic events, were discussed as reasons. It is important to note that nearly half of participants in this sample had a University degree or higher, which may explain why SES was rarely discussed. It may also be that there was a risk of social desirability bias in participants' responses because of their personal characteristics, such as SES, and the sensitive nature of the questions (Bergen & Labonté, 2019), however, the interviewer made the nature of the questions clear prior to participant's arranging an interview and were reassured throughout the interview to give honest answers.

7.5.2 Conclusions

We found that alcohol use was used to cope with trauma, symptoms specific to having a SMI, and stressful life events, particularly prior to participants receiving their SMI diagnosis. The role of getting the right support, stigma of having a SMI, parental drinking, fear, and significant life events were important factors in being a drinker or non-drinker. Our findings indicate a need to explore reasons for drinking to cope further while also highlight a need for better access to mental health and alcohol support as individuals may use alcohol when the right support was not available.

7.6 Acknowledgements

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Chapter 8. General Discussion

8.1. Foreword

What is already known from the previous Chapters?

- Chapter 1 and 3 provide an overview of previous literature and theories to explain the co-occurrence of alcohol use and mental health problems and the methodological approaches that can be used to examine co-occurring alcohol and mental health problems and the role of SES
- Chapter 4 establishes that there is a higher prevalence of AUD among individuals with a CMD, compared to those without a CMD, and that associations with AUD potentially differ by the specific type of CMD
- Chapter 5 show associations of non-drinking, hazardous and harmful/probable dependence across a range of mental health problems, compared to individuals who did not meet criteria for the respective problem, in a representative sample of adults. In addition, findings from Chapter 5 indicate that SES partially accounts for some of the associations between alcohol use and mental health problems
- Chapter 6 show the social profiles of individuals who meet criteria for a mental health problem are characterised by occupation and housing tenure. This Chapter also shows that, compared to higher SES groups, lower SES is associated with a higher prevalence of non-drinking but not harmful/probable dependence. This Chapter also shows that social support and neighbourhood disadvantage partially explain alcohol use among the most deprived SES groups who meet criteria for a mental health problem
- Chapter 7 show that alcohol is used to cope over time, and specifically with trauma, SMI symptoms and stress. Findings from Chapter 7 indicate that changes in drinking occur either during significant life events, after receiving appropriate support or during significant declines in mental health. Further, drinkers in this sample now drink in a more controlled way compared to their previous habits which are in contrast with findings of associations between SMI and harmful drinking shown in Chapter 5. In addition, Chapter 7 highlights the need for timely, accessible support to facilitate long-term changes in alcohol use and improved mental health

What does the current Chapter aim to do?

- This Chapter discusses the overarching aims of the thesis and how findings have supported or contradicted psychological theories, extended on previous literature, and the implications and recommendations of the thesis.

What new findings does this Chapter add?

- This Chapter collates the overall findings of the thesis in the context of current psychological theories and previous research, as opposed to presenting new findings.
- This Chapter discusses the implications of the findings of the thesis in the context of current recommendations for the treatment of co-occurring alcohol and mental health problems based upon the prevalence estimates and qualitative findings from this thesis.
- Finally, this Chapter provides clear pathways through which individuals with co-occurring alcohol and mental health problems can be appropriately supported

8.2 Aim one: Review of the existing literature

An overview of the literature outlined in Chapter 1 highlighted that although alcohol use and mental health problems co-occur, this pattern was not well-known across the spectrum of mental health problems. For example, there was an abundance of literature which examined associations of AUD and mental health problems, such as depression and AUD (Grant et al., 2015) but there was less research on associations with other types of alcohol use which might be harmful to health, such as binge-drinking, despite longitudinal evidence indicating that changes in mental health potentially influenced drinking patterns (Bell et al., 2015; Berg et al., 2019). In addition, Chapter 1 showed that indicators of SES, such as level of education and housing tenure, were associated with both AUD (Beard et al., 2016; Bellis et al., 2016) and mental health problems (Boniface et al., 2020; Goodwin et al., 2018), but there was limited evidence to examine how these characteristics were associated with co-occurring alcohol and mental health problems. Therefore, it was difficult to understand i) the extent to which alcohol use co-occurred across the range of mental health problems, and ii) how the patterning of co-occurring alcohol and mental health problems differed by SES.

The overarching aim of Chapter 4 of this thesis was to synthesize the current literature on the prevalence of alcohol use among individuals with and without a CMD, the role of SES, and then estimate the extent to which those with a CMD report AUD, including binge-drinking and alcohol consumption. Given the range of mental health problems, this synthesis and meta-analysis was restricted to CMDs broadly defined as depressive (MDD and dysthymia) and anxiety/phobic (GAD, panic disorder, OCD, SAD), and PTSD, and phobias) disorder (World Health Organization, 2017). A previous systematic review and meta-analysis of the prevalence and associations of AUD among individuals with a CMD (Lai et al., 2015) was published in 2015, however, this review only reported associations between MDD, and any anxiety disorder with AUD, respectively, therefore it was difficult to understand how associations with AUD differ across the spectrum of CMDs. Further, the review also included bipolar disorder which can be considered a SMI (Hardoon et al., 2013), which could have impacted on the review findings.

The systematic review identified 512 studies but only 51 met inclusion. Of those included in the review, MDD was the most studied type of CMD compared to SAD which was not studied in any of those included in the review. Of those 51 studies, 17 were included in the meta-analysis which showed that 15% of individuals with a CMD reported any AUD compared to 8% of those without a CMD, with a two-fold increase in the likelihood of reporting any AUD among individuals with a CMD. The prevalence was higher when examining the prevalence of AUD by severity where 12% of those with a CMD reported moderate/severe AUD compared to 7% of those reported mild AUD. These findings were

consistent with previous research which has shown that the prevalence and associations of MDD with AUD were stronger as the level of AUD severity increased (Boschloo et al., 2011; Grant et al., 2015). This indicates that alcohol is used at increasingly harmful levels among those with a CMD, compared to those without, suggesting that alcohol may be used to cope with poor mental health thus supporting the self-medication theory (Khantzian, 1997).

In addition, findings from Chapter 4 showed that associations of reporting any AUD were similar across individuals with a mood compared to an anxiety/phobic disorder (mood disorder: OR=2.00, 95% CI=1.62-2.47; anxiety/phobic disorder: OR=1.94, 95% CI=1.35-2.78). These findings were similar to an earlier meta-analysis which reported a two-fold increase in the odds of reporting alcohol abuse/dependence among individuals with MDD or anxiety disorder (Lai et al., 2015). However, a sensitivity analysis reported in Chapter 4 showed that individuals with PTSD have a two-fold increase in the associations with AUD while associations with other anxiety/phobic disorders became non-significant. This extends on findings from the previous meta-analysis as it shows that grouping types of CMDs together assumes that the patterns of AUD are similar across specific CMDs, however, this Chapter showed that this was not the case and that the patterning of AUD depends on the specific type of CMD.

Chapter 4 also reported substantial heterogeneity across studies and Chapter 1 highlighted that some of the differences in associations with alcohol use and mental health problems may be explained by demographic and SES characteristics. For example, the alcohol harms paradox argues that those of lower SES may be more likely to experience alcohol harms due to having multiple disadvantages such as poor mental health (Bellis et al., 2016). Such disadvantages may explain high levels of heterogeneity within this meta-analysis, however due to a lack of reporting of these characteristics within included studies, it was not possible to explore this in Chapter 4 but was explored further in Chapter 5.

The systematic review also aimed to examine the prevalence of other patterns of alcohol use, such as binge-drinking and alcohol consumption, among individuals with and without a CMD to establish whether those with a CMD drink in a similar way, however, due to differences in the measures and cut-offs used, it was not possible to conduct a meta-analysis for these alcohol outcomes. Instead, a narrative synthesis of binge-drinking identified the majority of studies focused on depression. The synthesis reported that four of the five studies found a higher prevalence of binge-drinking among individuals with a CMD compared to those without which suggest that the patterning of alcohol use among those with a CMD extends beyond an AUD. Whereas the narrative synthesis of alcohol consumption was mixed. This narrative review highlighted that some patterns of alcohol use are less understood

compared to others, which makes it difficult to subsequently understand how individuals with a mental health problem use alcohol in different ways.

Findings from Chapter 4 were five-fold. Firstly, individuals with a CMD were more likely report mild and moderate/severe AUD. Secondly, there were differences in associations of AUD with specific types of CMD. Thirdly, much of the current evidence examined the prevalence and associations of AUD with MDD while associations with SAD and other CMDs have not yet been established, therefore it is difficult to understand the patterning of co-occurring alcohol and specific CMDs. Fourthly, much of the current evidence focused on associations between CMD and AUD as opposed to other patterns of alcohol use. Finally, there was limited research which examined the role of SES among individuals with and without co-occurring alcohol and mental health problems. These implications informed the aims of Chapters 5 and 6 to examine; i) the prevalence and associations of alcohol use, including non-drinking, among participants who meet criteria for a range of specific mental health problems, compared to those who did not, and ii) identify SES profiles of participants who meet criteria for a mental health problem and examine associations with alcohol use to gain a better understanding of the role of SES.

8.3 Aim two: Estimating the level of co-occurring alcohol and mental health problems

In the aforementioned section, an overview of the literature, systematic review and meta-analysis highlighted gaps in the evidence to illustrate alcohol use across different mental health problems and how SES accounts for this. Chapter 5 aimed to address some of these gaps using data from the 2014 APMS which is a large cross-sectional survey conducted in England and uses validated measures to assess whether participants meet criteria for a range of mental health problems, beyond CMDs, alcohol use, and SES. Further, given that previous research has shown that individuals with a mental health problem may no longer drink alcohol to manage their mental health (Skogen et al., 2011), Chapter 5 also examined the prevalence and associations of non-drinking across the range of mental health problems.

Chapter 5 found the prevalence of non-drinking, hazardous and harmful/probable dependence was higher among participants who met criteria for specific mental health problems (including CMDs and SMIs), compared to participants who did not meet criteria for the respective problem. The prevalence of non-drinking was highest among participants who met criteria for probable psychotic disorder with around 52% compared to 22% of those did not meet criteria with a three-fold increase in the odds after adjusting for demographic and SES characteristics. A previous study conducted among the British adult population reported that the prevalence of current, but not lifelong abstinence was 28% among those with a CMD while the prevalence was 39% among those with personality disorder (Skogen et al., 2011).

However, findings from Chapter 5 found that the prevalence of non-drinking among participants who met criteria for depression was 36% and 27% for anxiety whereas it was 18% for antisocial personality disorder and 31% for borderline personality disorder; the former two problems could be categorized as a CMD and latter two as more severe mental health problems. The discrepancies in the findings from Chapter 5 with the previous study by Skogen and colleagues highlight the need to specify mental health problems beyond broad categorizations of mental health problems, such as CMDs or personality disorders.

Further, previous research has indicated that those with a mental health problem may not drink alcohol because they may be on medication, were a previous harmful drinker (Healey et al., 2009; Skogen et al., 2011) or worsened mental health (Sarich et al., 2019). The consistent increased prevalence and association of non-drinking across different mental health problems, suggests that declines in mental health may lead to non-drinking, thus, lending support for the “sick-quitter” hypothesis (Skogen et al., 2009). Due to the cross-sectional nature of the APMS, it was not possible to explore previous drinking patterns in this Chapter, however, this point will be discussed further in section 8.5 in the qualitative analysis. In addition, there may be differences depending on age and gender as some research reported associations among younger age groups (Ng Fat et al., 2018) or women aged under 35 (Ng Fat & Shelton, 2012). Chapter 5 accounted for such characteristics and SES, however, associations between non-drinking and mental health problems remained significant (excluding anxiety disorder) suggesting that there are strong associations between non-drinking and mental health problems regardless of certain individual characteristics.

Chapter 5 also found that the prevalence of hazardous use was higher across most mental health problems (excluding depression, phobia and probable psychotic disorder), compared to those without the respective problem. The prevalence of hazardous use was highest for bipolar disorder where nearly 22% reported hazardous use compared to 17% those who did not meet criteria and a two-fold increase in the odds after adjustment for demographic and SES characteristics. A previous study using data from the UK reported an increased prevalence among participants with hypomania/mania (28%, (Davis et al., 2020)) but this might be explained by i) symptoms not fully encompassing bipolar disorder, which tend to also include low mood, and ii) the prevalence including harmful alcohol use. Unlike non-drinking, individuals who met criteria for some mental health problems were not more likely to report hazardous use, compared to low-risk, and this was similar to previous research which reported inconsistent associations with alcohol abuse (Regier et al., 1990; Swendsen et al., 2010) or mild AUD (Grant et al., 2015). This suggests that, in contrast with the self-medication hypothesis (Khantzian, 1997), it may be that associations with hazardous drinking are specific

to the type of problem an individual has rather than alcohol being used to cope with any mental health problem.

For harmful/probable dependence, the prevalence was highest among participants who met criteria for all specific mental health problems, compared to those without the respective problem. The prevalence was highest among participants who met criteria for ASPD where over 20% reported harmful/dependent drinking, compared to 3% of those who did not, with an eight-fold increase in the odds of reporting harmful/probable dependence. This extends on the findings from Chapter 4 which reported a two-fold increase in the odds of reporting moderate/severe AUD among participants with a CMD to show strong associations across a range of mental health problems. Further, data from both early and recent population-level surveys showed stronger associations for severe AUD, particularly among individuals with SMIs (Grant et al., 2015; Kessler et al., 1997; Lai et al., 2015; Regier et al., 1990; Swendsen et al., 2010). However, findings from this analysis extends on research which focus on predominately US-based populations. It also extends on the self-medication hypothesis by indicating that people with a mental health problem use alcohol at more harmful, rather than hazardous, levels but it could not be established the reasons for drinking as this is not measured in the APMS.

Findings from Chapter 5 were particularly novel as it shows increased associations between non-, hazardous, and harmful/probable dependence with specific mental health problems which have not been previously shown. By examining different patterns of alcohol use in this way, it showed that the co-occurrence of alcohol and mental health problems was complex. Further, these findings lend some support to the “sick-quitter” hypothesis, self-medication hypothesis (Khantzian, 1997) and theories of drinking motives (Cooper, 1994). Those with a mental health problem may no longer drink alcohol due to declines in their mental health (“sick-quitter” hypothesis) though it may also be the case that those with a mental health problem drink alcohol, at more harmful levels (self-medication hypothesis), and to cope with these issues (drinking motives). However, it is important to note that the reasons for the different patterning of alcohol use among individuals with a mental health problem are difficult to establish using cross-sectional data. Nonetheless, these findings illustrated the complexity of co-occurring alcohol and mental health problems as it showed that people with a mental health problem were not only more likely to drink alcohol at levels which could be harmful to their health but that they were also non-drinkers. Associations between alcohol use and mental health problems may be explained by demographic and SES characteristics, as theorized by the alcohol harms paradox (Bellis et al., 2016) and social causation hypothesis (Mossakowski, 2014). Indeed, partial attenuations after adjustment for these characteristics in Chapter 5 suggest that this might be the case. However, it is difficult to understand the ways

in which these characteristics affect associations as the analysis only controlled for individual characteristics.

Findings from Chapter 5 were three-fold. Firstly, those meeting criteria for a mental health problem were more likely to report non-drinking, hazardous or harmful/probable dependence indicating that there is not a linear association between mental health problems and increased alcohol use. Secondly, associations with alcohol use were higher among those who meet criteria for more severe mental health problems indicating that those with more severe problems may be in most need of support. Thirdly, demographic and SES characteristics may explain some of the associations between mental health problems and alcohol use. However, this Chapter used individual measures of SES even though different measures of SES can be associated with alcohol use in different ways (Beard et al., 2016), particularly when examining associations within specific populations.

Other analytical approaches, such as LCA, can be used to identify characteristics of groups based upon responding to a range of indices in a similar way. In the context of this thesis, LCA can be used to group individuals based upon responding to different indices of SES, and specifically among those with a mental health problem given findings from Chapter 4 and 5. Through establishing SES profiles of individuals with a mental health problem, its role in the association with alcohol use can then be examined in a more holistic way.

8.4 Aim three: Examining socioeconomic status, alcohol use and the indirect effect of social support and neighbourhood disadvantage among individuals with a mental health problem

Thus far in this thesis, it has been shown that individuals with a mental health problem were more likely to report alcohol use, including non-drinking, and that SES partially attenuates these associations. Current theories suggest that those of lower SES are disproportionately more likely to experience alcohol harms (Bellis et al., 2016) and poor mental health (Mossakowski, 2014). Further, being of lower SES may exacerbate issues, particularly if an individual has co-occurring alcohol and mental health problems. One study examined these theories in the general population and found that some associations between SES and harmful drinking (Boniface et al., 2020). However, there is limited research which explores these theories in populations where alcohol use is known to be higher, such as groups with mental health problems.

In addition to the aforementioned issues, discussions with a PPI group with lived experience of mental health problems highlighted additional factors, such as social support and the area that an individual lives in, were important factors in how an individual is able to manage their mental health. These discussions led to further review of theories around

contextual factors which were discussed in Chapter 1 sections 1.5.3 and 1.5.4. Briefly, social support refers to the social resources an individual perceives as available which meets their emotional, informational or instrumental needs (Gottlieb & Bergen, 2010). Cohen and Wills posit that social support acts as a buffer against poor health outcomes, and that higher levels of social support may reduce the likelihood of using maladaptive behaviours, such as alcohol use (Cohen & Wills, 1985). Whereas the social causation hypothesis argue that individuals living in neighborhood's with increased poverty may be more likely to experience stress which may result in poor mental health and increased alcohol use (Mossakowski, 2014). Therefore, it could be proposed that decreases in social support and neighbourhood advantage exacerbates alcohol use among individuals with mental health problems, particularly when considering their SES. However, to date this has not been explored in the published literature.

Chapter 6 aimed to address these gaps in the literature through using the same dataset in Chapter 5, the 2014 APMS, however, Chapter 6 restricted this sample to participants who met criteria for a mental health problem given the known increased odds of alcohol use, including non-drinking, shown in Chapter 5. Chapter 6 aimed to extend on findings from both previous research and from Chapter 4 and 5 by understanding i) how individuals were clustered based upon multiple indicators of SES to define latent classes, ii) associations of identified SES profiles with alcohol use among those who met criteria for a mental health problem, and iii) whether there was an indirect effect of social support and neighbourhood disadvantage on these associations, respectively.

To address the first aim of Chapter 6, indicators of SES such as educational level, housing tenure, and aspects of income were used to reflect the multidimensional nature of SES (Beard et al., 2019; Collins, 2016) and a four-class model was best-fitting. The four SES groups were defined as i) “economically inactive, social renters”, ii) “routine/intermediate occupation, mixed owner/renters”, iii) “retired, homeowners” and iv) “professional occupation, homeowners”. This indicates that SES was characterised by occupation and housing tenure.

These findings are somewhat similar to that of Boniface and colleagues (Boniface et al., 2020) who conducted a LCA of SES within the general population living in an area of London. Some of the classes following the analysis are labelled as “professional homeowners” and “economically inactive renters”. However, findings from Chapter 6 extends on Boniface and colleagues finding as it showed that some groups were identified through the type of rented accommodation and why they were not working which has not been reported previously. These findings may be explained by the type of mental health problem an individual has, particularly given that Chapter 1 outlines differences in the impact of having a CMD or SMI

(National Institute for Mental Health, 2020). A sensitivity analysis in Chapter 6 shows that of those who met criteria for a CMD, nearly 43% were “routine/intermediate occupation, mixed owner/renters” whereas, of those who met criteria for an SMI, 40% were “economically inactive, social renters”. This indicates that more severe problems may be experienced among the lowest SES groups, partially supporting the social causation hypothesis, however, due to the cross-sectional nature of the APMS, it was not possible to determine the timeline of the decline in an individual’s mental health.

Secondly, Chapter 6 reported associations of alcohol use across three identified SES profiles, compared to “professional occupations, homeowners”, as this was indicative of being the highest SES group. All other SES classes had increased odds of non-drinking with odds highest among “economically inactive, social renters” who were five times more likely to be a non-drinker (OR=4.98, 95% CI=3.03-8.21). While “retired, homeowners” had a decreased odds of hazardous use (OR=0.48, 95% CI=0.27-0.85) whereas no associations with harmful/probable dependence were found. This is in contrast with the alcohol harms paradox and indicates that, among those with a mental health problem, those of lower SES are not more likely to drink at harmful levels compared to those of higher SES.

Previous research among adolescent populations reported increases in non-drinking among those on lower income (Livingston, 2014) or unemployed (Ng Fat et al., 2018) which corresponds with “economically inactive, social renters” group from the Chapter 6’s findings. While research among older adults aged 45 and above reported that consumption was higher among higher SES individuals or those who were employed or educated (Bonevski, Regan, Paul, Baker, & Bisquera, 2014) which partially corresponds with the lack of associations with hazardous or harmful/probable dependence identified in Chapter 6, though alcohol consumption is one aspect of hazardous or harmful/probable dependence. Further, the lack of significant associations of SES and hazardous or harmful/probable dependence may be explained by the population studied as individuals with a mental health problem had higher a prevalence of hazardous or harmful/probable dependence compared to those without (Puddephatt, Jones, et al., 2021). This would also explain why these findings differ to that of Boniface and colleagues (Boniface et al., 2020).

These findings potentially lends support to the “sick-quitter” hypothesis, that is individuals stop drinking due to being a previous harmful drinker (Skogen et al., 2009) or because of a pre-existing condition (Stockwell et al., 2016). In addition, these groups may have used medication for their mental health where alcohol use is discouraged, particularly given that the prevalence of “economically inactive, social renters” was highest among those who

met criteria for a SMI. However, it is difficult to understand these mechanisms using quantitative methods which led to the development of Chapter 7.

Thirdly, Chapter 6 aimed to explore the indirect effect of SES with alcohol use via social support and neighbourhood disadvantage among individuals who met criteria for a mental health problem. The associations between “economically inactive, social renters” and non-drinking via social support was significant, this was also found among “retired, homeowners”. Whereas the association between “economically inactive, social renters” and harmful/probable dependence via social support was also significant. This suggests that lower perceived social support increased the odds of non-drinking and harmful/probable dependence among the lowest SES group and retired group which contradict Cohen and Will’s buffer hypothesis (Cohen & Wills, 1985). These findings may be explained by the type of social support with previous research among treatment-seeking populations reported increased mutual help involvement predicted reductions in the severity of alcohol use while increased family conflict predicted increased psychiatric severity at follow-up (Haverfield, Ilgen, Schmidt, Shelley, & Timko, 2019). Elsewhere, social support was not predictive of alcohol outcomes at follow-up among individuals in substance use treatment (Warren, Stein, & Grella, 2007). Nonetheless, there has been little research in this area which are specific to individuals experiencing poor mental health and living in the general population, therefore, it is difficult to understand the ways in which support facilitates non- and harmful drinking among these SES groups.

Regarding neighbourhood disadvantage, Chapter 6 also showed that increased neighbourhood disadvantage partially explained associations between “economically inactive, social renters” and harmful/probable dependence which provides some support for the social causation hypothesis (Mossakowski, 2014). Though this only seemed the case for the most deprived SES group. While there has been limited research on alcohol use, mental health, SES and neighbourhood disadvantage, recent research has found that there may be differences in the associations between neighbourhood disadvantage and alcohol use based on demographic characteristics and drinking motives. For example, Heim and colleagues found that drinking motives accounted for 36% of the variance of problematic alcohol use, further, there were differences in the associations based on gender and age while lower SES groups endorsed higher coping motives (Heim, Monk, & Qureshi, 2021). Other research has also shown that individuals living in more deprived neighbourhoods endorse higher coping motives for drinking and increased consumption with gender differences shown in these associations (Martin, Inchley, & Currie, 2019). Our findings of the associations between the most deprived SES group and harmful/probable dependence through neighbourhood disadvantage may be explained by demographic characteristics and coping drinking motives whereby living in areas

of high levels of disadvantage may cause stress whereby individuals drink alcohol to cope. The lack of indirect effect of neighbourhood disadvantage may be explained by other drinking motives and demographic characteristics, such as social motives and gender (Karriker-Jaffe et al., 2016; Martin et al., 2019). Nonetheless, these findings suggest that the environment an individual lives in should be considered when examining co-occurring alcohol and mental health problems.

In summary, findings from Chapter 6 were four-fold. Firstly, individuals who met criteria for a mental health problem were more likely to present from a range of SES backgrounds, not necessarily limited to lower SES. Secondly, compared to “professional occupation, homeowners”, all other SES had increased odds of non-drinking. Thirdly, compared to “professional occupations, homeowners”, all other SES groups were not associated with harmful/probable dependence. Fourthly, associations between “economically inactive, social renters” and “retired, homeowners” and non-drinking and harmful/probable dependence via social support and neighbourhood disadvantage were significant and that those from the most deprived groups are at most risk. Some of these findings contradict existing theories and it is difficult to understand the differences in drinking patterns using quantitative, cross-sectional data.

Taken together and with existing findings from Chapter 4 and 5, Chapter 7 used qualitative methods to attempt to address some of the issues outlined thus far in this thesis to develop a better understanding of why there were differences in drinking patterns among people with a mental health problem, how contextual factors, such as support, influenced alcohol use and how alcohol use change depending on the mental health of an individual.

8.5 Aim four: Understanding alcohol use among individuals with a severe mental health problem

In this thesis thus far, quantitative data has shown that i) individuals with a CMD were more likely to report an AUD compared to those without a CMD but gaps around specific CMDs and reporting SES characteristics on these associations are identified, ii) individuals with specific mental health problems had increased odds of non-drinking, hazardous or harmful/probable dependence, particularly individuals who met criteria for more severe mental health problems, and that SES partially attenuated some of these associations and iii) there were a range of SES groups among those who met criteria for a mental health problem but associations with alcohol use were only found with non-drinking and, in some cases, hazardous, and some of these associations were partially explained by social support and neighbourhood disadvantage. However, due to the nature of quantitative, cross-sectional

methods, it has not been possible to understand why these patterns of associations were occurring.

Qualitative methods were used in Chapter 7 to understand how alcohol was used among individuals with a SMI, how drinking patterns change when experiencing symptoms of their mental health problem and how this changed since receiving their diagnosis, and reasons for drinking or not drinking alcohol. Higher associations with both non-drinking and hazardous and above use among individuals who met criteria for more severe mental health problems were reported in Chapter 5, therefore, Chapter 7 focused on obtaining accounts from individuals with a diagnosis of a SMI who were either current drinkers or non-drinkers but have previously drank alcohol.

Using framework analysis, Chapter 7 reported that both drinkers and non-drinkers began drinking because of the social environment they were in but that over time drinking for most participants became a problem whereby it was used to either cope, and this became a vicious cycle. This provides support for the self-medication hypothesis (Khantzian, 1997) and drinking motives (Cooper, 1994) whereby those with an SMI drank initially for social and conformity reasons but then over time alcohol was used to cope. However, findings from Chapter 7 indicated that drinking to cope is more complex and based on three specific reasons: trauma, symptoms of having a SMI, and stress.

Previous research has shown that drinking to cope may be more specific, for example, a recent study compared trauma-related drinking to cope and drinking to cope as mediators of PTSD and alcohol use problems among individuals with a history of trauma found an indirect effect of PTSD and alcohol use problems through trauma-related drinking to cope (Hawn et al., 2020). In addition, drinking to cope was more likely when experiencing low mood and decreased when experiencing paranoia or mania (Bradizza & Stasiewicz, 2003; Healey et al., 2009). A recent study which examined latent class trajectories of alcohol use within the general population and found that the odds of becoming a heavy drinker from an abstainer increased after experiencing a stressful life event (e.g. death of a parent, saw violence) whereas the odds of becoming an abstainer from a heavy drinker also increased after experiencing a stressful life event (Hoyland & Latendresse, 2018) which suggests that stressful events can influence alcohol use in different ways. While findings from Chapter 7 supported previous research, these findings are one of the first to highlight different reasons for coping among those with a SMI and indicates that services should establish the reasons why to identify additional appropriate treatment pathways which could be used alongside treatment.

In addition, findings from Chapter 7 showed that non-drinkers changed their drinking habits either before or during getting support for their mental health whereas drinkers changed

drinking habits either during or after getting support. All except one non-drinker stopped drinking completely either on their own or through rehabilitation before or during getting support for their mental health and continued not drinking until the date of the interview. Non-drinkers described being content with not drinking and that medication and other coping mechanisms manage their mental health therefore alcohol is not needed. This highlights how the use of appropriate support facilitates long-term changes in alcohol use.

These findings of non-drinkers may explain previous findings from Chapters 5 and 6 as Chapter 7 indicated that current non-drinkers in this sample previously drank in a problematic way and now manage their non-drinking through alternative coping mechanisms. This, in turn, provides support for the self-medication hypothesis whereby long-term changes in drinking were influenced through finding an alternative coping response which met the needs of the individual and managed mental health symptoms. This corresponds with previous longitudinal research among an adolescent population at risk of psychosis which found that baseline maladaptive coping strategies were associated with declines in mental health symptoms whereas baseline adaptive coping strategies were associated with better social functioning 12-months later (Jalbrzikowski et al., 2014). While systematic reviews among people with psychosis showed that cognitive behavioural therapy, motivational interviewing and psychoeducation result in reductions in alcohol use (Baker, Hiles, Thornton, Hides, & Lubman, 2012) indicating alternative support can help to facilitate changes in alcohol use. Although not all participants interviewed in Chapter 7 did not explicitly state the types of support or treatment they completed, findings showed that changes in drinking habits were facilitated through alternative coping strategies and being aware of triggers. This indicates a need to promote awareness of the individual's mental health problem and how alcohol can affect mental health to enable a better understanding of managing their mental health.

Among drinkers and upon receiving their SMI diagnosis, all participants reported changes in drinking habits but in three different ways; temporary abstinence while identifying the right treatment plan, reductions in alcohol use or increases in alcohol use to cope with the implications of having an SMI. The former group described not drinking because of the medication they were using while establishing an appropriate treatment plan. Whereas the latter described the negative stigma of having a SMI which meant a change in identity and career and drank more to cope with this. This has been found in research among individuals with a mental health problem whereby internalized stigma and stereotypes of mental illness increased anticipated negative consequences (Clement et al., 2015) and decreased treatment adherence (Livingston & Boyd, 2010). A meta-synthesis of qualitative research reported that participants seek to understand the causes of their SMI and that there was a need to change their identity upon receiving their diagnosis (Kaite, Karanikola, Merkouris, &

Papathanassoglou, 2015). It may be that providing further education around the causes, management and implications of a diagnosis on the individual would facilitate acceptance in potential changes to an individual's lifestyle and promote an awareness of what the diagnosis might mean for service users. This could subsequently minimize the likelihood of using maladaptive behaviours, such as alcohol use, to cope with a diagnosis.

Chapter 7 also reported that all drinkers described currently drinking in a more controlled way and to a lesser extent than before which contrasted with findings from Chapter 5, but this might be explained by the sample being recruited through community mental health organisations. A range of techniques were described but all participants now drank for enjoyment and avoided alcohol when they experienced certain symptoms. Nonetheless, a minority of drinkers with higher AUDIT scores used alcohol as a last resort in cases where they are not able to get access to medication for their mental health. Some factors are described frequently among drinkers which influence current drinking habits, such as history of heavy parental drinking and fear of losing control, in which participants witnessed their parents heavy drinking during childhood and, therefore, did not want to repeat history while the majority also reported not wanting to lose control of themselves while drinking.

Chapter 7 also highlighted additional factors which contributed towards both previous and current drinking habits. The childhood environment and parental drinking acted as a deterrent towards current alcohol use even though most participants described drinking heavily prior to their diagnosis. Previous research has consistently shown that parental AUD was associated with increased risk of the child reporting an AUD (Jones, Lichtenstein, Grann, Långström, & Fazel, 2011), and alcohol-related disease later in life (Holst, Tolstrup, & Becker, 2022). This suggests that these factors may serve as both a facilitator and barrier to using alcohol depending on the resources an individual has to cope with declines in their mental health. This has been found in previous longitudinal research among the general population whereby the childhood environment and increasing adverse childhood events was only associated with mid-life drinking but not older-age drinking (Leung, Britton, & Bell, 2015). While this study was not specific to individuals with a mental health problem, and also showed no association between parental mental health/alcohol problems and later alcohol use, it indicates that parental drinking may be more pivotal for young adulthood drinking and that factors may not have direct effect on particular health behaviours.

Finally, while previous findings from Chapters 5 and 6 suggested that SES plays a role in the co-occurrence of alcohol use and mental health problems, SES factors were rarely discussed in interviews in Chapter 7. Although theories, such as the alcohol harms paradox (Bellis et al., 2016) and social causation hypothesis (Mossakowski, 2014) have been discussed,

Chapter 7 suggested that SES did not contribute towards their alcohol use. One participant in Chapter 7 discussed being grateful for living more comfortably now that they do not drink alcohol, this was only raised by one participant, and it did not appear that their SES or living conditions influenced previous drinking habits. Instead, trauma, symptoms of SMI, and stress were some of the key reasons why individuals drank alcohol. Given that the alcohol harms paradox argues that individuals of lower SES are more likely to experience alcohol harms (Bellis et al., 2016) while the social causation hypothesis argues that individuals from lower SES are more likely to experience poor mental health (Mossakowski, 2014), our findings are in contrast to these theories. It may be that SES is more implicit, therefore, participant's may have responded differently if they were interviewed by another peer, particularly if the topics were sensitive. Previous research has indicated that responses differ depending on whether the interviewer has similar lifestyle characteristics as the participant compared to an interviewer who is a researcher (Davies & Baker, 1987). In addition, social and environmental factors were not the focus of the interviews, nonetheless, given that SES is rarely mentioned throughout all transcripts across both drinkers and non-drinkers, it is possible that alcohol use was influenced by other factors than SES. These qualitative findings could be explored further across other types of mental health problems, such as CMDs, to see whether there are differences in the patterns of drinking and non-drinking, and whether SES plays a role among different mental health problems.

Findings from Chapter 7 were five-fold. Firstly, findings provided greater context for the findings of Chapters 4, 5 and 6 in that that individuals with an SMI may use alcohol more over time to cope, but not necessarily to only cope with their mental health. Secondly, drinking to cope with trauma, mental health and stress, and finding alternative coping strategies provided some support for the self-medication hypothesis (Khantzian, 1997) and drinking motives (Cooper, 1994) theories and there should be further investigation of how addressing reasons for drinking facilitate long-term changes in alcohol use. Thirdly, other factors such as the childhood environment and parental drinking influence both previous and current alcohol use but in different ways and there is a need to examine this across other mental health problems. Fourthly, the overarching feeling of fear was a deterrent for either drinking among non-drinkers or drinking to excess among current drinkers, but this has not been explored in previous research. Finally, there is a need to have available support for individuals seeking help which provides further information about receiving a SMI diagnosis and potential treatment pathways in a timely manner to minimize the likelihood of further deteriorations in mental health and use of alcohol to manage this.

8.6 Future directions

The findings from this thesis identified several gaps in the literature and future directions for research. Firstly, a systematic review and meta-analysis (Chapter 4) showed that much of the literature on associations between AUD and CMD focused on MDD, whereas no studies were conducted for SAD, and it was not possible to conduct a formal meta-analysis stratified by the specific type of CMD. Therefore, further international evidence is required to examine associations of AUD across specific types of CMD, and other problems beyond CMD. This would establish how the patterns of AUD differ across the different type of mental health problems as shown in Chapter 5. In doing so, research will be able to better identify individuals with specific mental health problems who may be at most risk of using alcohol in a harmful way. Further, much of the literature identified in Chapter 4 focused on AUD rather than other patterns of alcohol use, such as binge-drinking, therefore it was not possible to understand whether the patterns of alcohol use were similar among individuals with and without CMD. Future research should explore this further and use more consistent measures and cut-offs so that it can be established whether those with a specific mental health problem are more likely to drink continuously heavy or drink heavily on single occasions.

Secondly, a secondary analysis of a large dataset representative of the English general population (Chapter 5) showed that co-occurring alcohol and mental health problems were prevalent but that the prevalence varied by the type of mental health problem and drinking pattern (non-drinking, hazardous and harmful/probable dependence). Previous research in the general population has shown differences based upon the type of mental health problem and severity of alcohol use (Grant et al., 2015; Leray et al., 2011) but much of the current literature has not acknowledged such differences. For example, this thesis showed that individuals with specific mental health problem were not only more likely to drink at hazardous and above levels, compared to low-risk levels, they were also more likely to be non-drinkers. Both Grant and colleagues (Grant et al., 2015) and Leray and colleagues (Leray et al., 2011) reported associations of alcohol use across different mental health problems, but did not report associations with non-drinking. Future international research should continue to examine alcohol use, including non-drinking, among individuals with and without specific mental health problems to see whether similar patterns occur. In addition, future research should seek to understand the characteristics of those who choose to stop drinking, particularly in young people where it is becoming more common to not drink.

Thirdly and relatedly, qualitative findings in Chapter 7 indicated that non-drinkers managed this through the environment that they were in as well as the consequences of previous drinking habits. Further, findings suggest that non-drinkers managed their mental health through maintaining abstinence and having other coping skills. There is relatively

scarce data on non-drinking among individuals with a mental health problem in comparison to AUD, therefore these findings provide a novel insight into changes in alcohol use among individuals with a SMI. Future research should seek to understand how mental health problems are managed, what coping skills are in place and whether there is any other substance use among non-drinkers who have specific mental health problems, beyond those with a SMI. In doing so, this will establish whether changes in drinking and current coping skills are similar across the range of mental health problems and may help to inform current services who are treating individuals who have a current co-occurring alcohol and mental health problem.

Fourthly, there has been much evidence to show that SES was associated with alcohol use, and that individuals of lower SES were more likely to experience alcohol harms (Beard et al., 2016; Bellis et al., 2016; Lewer, Meier, Beard, Boniface, & Kaner, 2016). A recent study showed that individuals not currently working who were either homeowners or renters were more likely to report harmful drinking but they also found those in professional occupations who were renters were also more likely to report harmful drinking, compared with low-risk drinking (Boniface et al., 2020). However, findings from Chapter 6 suggested there may be differences in the associations of SES with alcohol use depending on the type of population as SES was only associated with harmful/probable dependence via social support or neighbourhood disadvantage among “economically inactive, social renters” among those who met criteria for a mental health problem which partially contradicts the alcohol harms paradox. Therefore, examination of the alcohol harms paradox among other subpopulations where alcohol use may differ compared to the general population should be explored. In addition, further investigation of the role of social support and neighbourhood disadvantage among co-occurring alcohol and specific mental health problems is required to better understand the mechanisms through which these contextual factors influence these associations.

Fifthly, findings from Chapter 7 of this thesis suggested that, among individuals with a SMI, individuals drank to cope specifically with either trauma, symptoms of their SMI or stress. The drinking motives model argues that individuals drink for either i) social, ii) enhancement, iii) conformity, or iv) coping reasons (Cooper, 1994), but findings from Chapter 7, indicate that coping reasons are too simplistic. Previous research supports findings from Chapter 7 where a significant indirect effect of PTSD and problem drinking through both trauma-related drinking to cope and drinking to cope motives was found (Hawn et al., 2020). Elsewhere, previous research has suggested that drinking motives may differ based upon demographic and SES characteristics. For example, recent studies in adolescent populations found that males use less coping motive skills (Martin et al., 2019) while lower SES groups use coping motives for alcohol consumption (Heim et al., 2021). Future research should examine whether there are specific reasons for drinking among individuals with other types of

mental health problems, for example, those with a CMD or more specific mental health problems. In addition, future research could explore whether there are differences based upon an individual's demographic characteristics and occupation. This will establish whether drinking to cope motives should be assessed in more detail and how this might differ across demographic groups. This will also inform services who could potentially explore reasons for drinking to identify additional appropriate care pathways.

Finally, this thesis has established the prevalence of co-occurring alcohol and mental health problems and issues around getting support to both alcohol and mental health support. There are recommendations to provide better services for individuals with both issues (Public Health England, 2017), however, based on qualitative findings from Chapter 7, services should be made available with shorter delays to accessing specialist support. Findings from Chapter 7 also indicated a need for better implementation of support services which were not area-dependent or reliant on individuals having the financial means and perseverance to pay or seek treatment, and that such treatment can also be accessed through services beyond GP surgeries. When treatment is delivered, staff should be trained to address both alcohol and mental health problems or have processes in place to make timely referrals to additional specialist services. Future research should seek to understand where delays can be minimized from when people initially seek support to being referred for specialist services. In addition, future research should seek to understand pragmatic ways in which staff are able to complete training to treat those with a co-occurring alcohol and mental health problem.

8.7 Clinical implications and policy

Taken together, the quantitative and qualitative findings of this thesis showed that alcohol use (including non-drinking) co-occurs across a range of specific mental health problems. The level of this co-occurrence varies by the type of mental health problem where individuals with more severe problems have stronger associations, and by the severity of alcohol use where associations were strongest for harmful/probable dependent drinking. In addition, individuals who met criteria for a mental health problem present from a range of SES backgrounds but those from lower SES backgrounds are more likely to non-drinkers, compared to high SES groups, and that increased neighbourhood disadvantage and low social support may facilitate non-drinking and harmful/probable dependent drinking among the most deprived or retired groups. Finally, interviews with individuals who had a SMI indicated that alcohol was used as a maladaptive coping response for the trauma, mental health symptoms, and stress that they experienced. Changes in alcohol use were facilitated through either a deterioration in mental health or significant life events prompting a change in drinking patterns and seeking help. Previous traumatic experiences, fear of losing control or repeating family history, and having better coping strategies maintain non-drinking and controlled drinking habits which was

facilitated by getting the right mental health support. However, SES did not seem to influence decisions to drink or not drink though religion and cultural background did for some ethnic minority participants. With these findings in mind, the following clinical implications and recommendations are made.

8.7.1 Clinical implications

- The Quality Outcomes Framework (QOF) currently reimburses practices for screening for depression, schizophrenia, bipolar disorder, and other psychotic conditions. Further, practices are advised to use their professional judgement as to whether to screen for alcohol consumption and suggests that this should be screened annually (British Medical Association and NHS England, 2021). Chapter 1 highlighted the importance of identifying when someone may be experiencing problems and Chapters 4 and 5 showed that other mental health problems, such as anxiety and phobia, were also prevalent in the general population, and that alcohol use was also prevalent, particularly among individuals who met criteria for a mental health problem. It is recommended that practices should be reimbursed for screening for a wide range of mental health problems and alcohol use to minimize the likelihood of mental health or alcohol use worsening.
- In addition to the current screening of mental health problems which are incentivized by the QOF, when screening for alcohol use, the reasons for alcohol use should be discussed with service users, particularly if service users screen for a mental health problem. Findings from Chapter 7 showed that alcohol may be used to cope for specific reasons. By discussing reasons for alcohol use, clinicians will be able to identify whether alcohol is being used for maladaptive reasons and whether there are additional issues which may require referral for specialist treatment.
- As part of the Advancing Our Health publication by the Department for Health and Social Care (DHSC; (Department for Health and Social Care, 2019)), a free NHS Health Check Assessment was developed to screen for a range of health risks, including alcohol use. However, only individuals aged 40-74 who do not already have a pre-existing health condition are eligible for this assessment, however other may not be eligible because they have a mental health problem which could be classed as a pre-existing condition. Further, individuals who meet criteria and are registered with a GP are automatically invited to attend this screening every five years. This is problematic as findings from Chapters 4 and 5 showed that adults who met criteria for a mental health problem were more likely to drink alcohol at more harmful levels, therefore these individuals may not be eligible. In addition, this criterion is reliant on individuals being registered with a GP or having the awareness of this assessment and

then referring themselves, which can exacerbate health inequalities. Based on findings from Chapter 4, 5 and 6, it is recommended that this assessment is made available to adults of all ages and who have pre-existing mental health conditions. In addition, further effort should be made to offer this assessment to groups who may not be registered with a GP.

- OHID released a report in 2017 on recommendations for co-occurring alcohol/drug use and mental health problems. This report emphasised the need for a “no wrong door” policy and that there should be a 24/7 response to those in crisis with individuals having access to care when they need it and in settings they wish (Public Health England, 2017). Qualitative findings from Chapter 7 indicated that this was not the case and was compounded by area-level differences in availability of services, waiting lists and having complex problems. This has also been shown in previous research which reported delays in terms of receiving a diagnosis (Hirschfeld & Vornik, 2003; Patel et al., 2015) and treatment (Baker, 2020; Ellinghaus et al., 2021). The NHS Long Term Plan (NHS England, 2019) and DHSC (Department for Health and Social Care, 2019) outline plans to better integrate services to support service users across and within services. Based on findings from this thesis, it is recommended that integrated services should have clear pathways to accessing mental health and other support which is not only clear to the service but to the service user. This should also be delivered in a timely manner to minimize the risk of individuals using alcohol to manage their mental health.
- The NHS Long Term Plan outlines plans to include care for individuals with a SMI and co-existing substance use, and for those with complex needs but these plans are vague and do not acknowledge that there may be differences in the patterns of this co-occurrence by the type of mental health problem and type of substance (NHS England, 2019). Further, findings from this thesis showed that the co-occurrence of alcohol extend beyond those with a SMI to other more common problems, therefore, it is recommended that care is delivered to individuals who have co-occurring alcohol and mental health problems which are tailored by the type of mental health problem as qualitative findings from this thesis suggest differences in the levels of alcohol use by the type of mental health symptoms an individual experiences.
- This thesis identified that those with a mental health problem were likely to present from a range of SES backgrounds, but these were typically characterised by occupation and housing tenure. In addition, those in social rented accommodation, who were economically inactive, lived in the areas of disadvantage and/or limited social support were at most risk of drinking in a harmful way. Therefore, it is

recommended that ICS' develop integrated services across primary and community services with these groups in mind and that extended efforts are made to make areas of the highest deprivation aware of the available mental health services.

- The NHS Long Term Plan outlines plans for an additional 370,000 individuals with a SMI to receive community-based physical and mental healthcare by 2023/2024 (NHS England, 2019), this thesis showed that of those who received mental health support for their SMI, many benefitted from being provided with information about their diagnosis, what may cause it, how it can be managed and how alcohol can worsen this. Previous research of delivering a psychoeducation programme for individuals with bipolar disorder reported a better understanding of managing their diagnosis (Poole et al., 2015). Therefore, it is recommended that mental health services provide information on specific mental health problems upon diagnosis, how to manage their diagnosis and on how alcohol can impact mental health in addition to any other pharmacological treatment which might be in place.

8.7.2 Policy recommendations

Based on findings on the co-occurrence of alcohol use across a range of mental health problems, how SES was associated with alcohol use via contextual factors and issues with accessing services, the following recommendations are made for policy.

- The NHS Long Term plan led to the development of ICS which aim to develop partnerships in local places and with provider organisations, including primary care, community care, charities, where a primary care network is developed in neighbourhoods (NHS England and NHS Improvement, 2020). This is a voluntary system though it is due to become mandatory. Nonetheless, it is recommended that services involved in ICS' are available locally, particularly in the most deprived areas, and can be accessed through presenting to different services, not limited to primary, secondary or community services but also police services.
- The introduction of ICS' involves allocating funding for services which are based on population health outcomes (NHS England and NHS Improvement, 2020). This thesis showed that co-occurring alcohol and mental health problems were prevalent, however, this is not currently reflected in public health data on co-occurring substance misuse and mental health issues where only current data on smoking prevalence is available (Office for Health Improvement and Disparities, 2022). Therefore, this thesis recommends that if integrated systems are to be informed by health outcomes, then the latest data on co-occurring alcohol and mental health problems, stratified by the type of mental health problem and severity of alcohol use should be routinely

available and up to date to ensure that the commissioning of services are informed by the most recent statistics.

- According to OHID recommendations, it is everyone's job (including commissioner's and joint providers) to have responsibility for the care of individuals with co-occurring alcohol and mental health problems (Public Health England, 2017). The DHSC have recently announced the Mental Health Recovery Plan where £500 million will be allocated to improving mental health and there is also a call for evidence for the new ten-year plan to improve mental health (Department for Health and Social Care, 2021). Findings from this thesis recommend that aspects of this funding should be ring-fenced for individuals who have co-occurring alcohol and mental health problems. Further, this thesis recommends that aspects of this funding are ring-fenced for the most deprived groups who are economically inactive and living in the most disadvantaged areas with clear pathways of accessing and supporting these groups.
- Finally, in the last decade several public health strategies have been developed, such as the NHS Long Term Plan (NHS England, 2019), Mental Health Recovery Plan (Department for Health and Social Care, 2021), and Advancing Our Health (Department for Health and Social Care, 2019), which describe an increase in the commissioning of mental health services for both CMDs and SMIs and integrating services more appropriately. However, there has been limited strategies for alcohol use or co-occurring alcohol and mental health problems other than a publication by OHID on the treatment of co-occurring alcohol/drug use and mental health problems (Public Health England, 2017) in the last decade. The last formal alcohol strategy was published a decade ago (Home Office, 2012) with promises to publish an updated strategy in 2018 which did not materialize and instead a publication on Advancing Our Health was released (Department for Health and Social Care, 2019). This publication only includes one section on alcohol use and there was no mention of co-occurring mental health problems. This thesis showed the extent to which alcohol and specific mental health problems co-occurred; therefore, it recommends an updated alcohol strategy which describes specific plans to access and treat groups who have a co-occurring mental health problem. It is also recommended that the strategy for alcohol among individuals with co-occurring mental health problems reflect the differences in patterns of this co-occurrence based upon the specific type of problem. In doing so, this will provide clear up-to-date guidance on tackling alcohol problems for local authorities and organisations.

8.8 Strengths and limitations

There are a number of strengths and limitations to this thesis which will be described in more detail below.

8.8.1 Strengths

The mixed methods approach of this thesis allowed for the identification of the prevalence of alcohol use among individuals with and without a mental health problem, both globally and in England, using validated measures of alcohol use and mental health. The mixed methods approach also allowed for the exploration of the reasons underpinning co-occurring alcohol and mental health problems, how alcohol may be used to cope with mental health and how individuals managed their mental health. By using one of two methodologies utilized in this thesis, it would not have been possible to establish both the magnitude and mechanisms underlying co-occurring alcohol and mental health problems.

In addition, this thesis was one of the first to review the global evidence of the prevalence of different patterns of alcohol use, including AUDs, binge-drinking and alcohol consumption, across a range of CMDs in the general population. Findings from the review highlighted gaps in the evidence base regarding specific types of CMDs, different patterns of alcohol use and a lack of reporting of SES characteristics.

This thesis was also one of the first to report the prevalence and associations of alcohol use, including non-drinking, across a range of mental health problems in the general population in England which demonstrated that co-occurring alcohol and mental health problems were more complex, that is having a mental health problem did not necessarily increase the odds of drinking at more harmful/probable dependent levels but that they were also more likely to be non-drinkers. In addition, this thesis also provided insight into the alcohol harms paradox among those who met criteria for a mental health problem, and demonstrated that in this population, compared to higher SES classes, lower SES was not associated with harmful/probable dependent drinking. Further, this thesis explored additional contextual factors which suggested that among those who met criteria for a mental health problem, the lowest SES groups, living in the most deprived areas and who have less social support may be at most risk for harmful/probable dependent drinking. These findings were also strengthened by methodology which used a large dataset that is representative of the general population in England and used validated measures of alcohol use and mental health problems.

Finally, qualitative interviews with participants with a diagnosis of a SMI provided potential explanations of the quantitative findings from this thesis. It showed that drinking patterns changed over time, with drinking becoming more of a problem and as a means to cope

with trauma, symptoms of their diagnosis and stress, providing support for the self-medication hypothesis but also highlighting that drinking to cope was more complex among this population. Further, interviews show that upon getting help for their mental health, participants utilised different approaches towards their drinking through either abstention or drinking more to cope with their diagnosis, and that once the right support had been accessed, participants sustain long term changes in their mental health and alcohol use.

8.8.2 Limitations

While there are several strengths to this thesis, there are limitations. Firstly, while the thesis included a review of the evidence of the prevalence of different patterns of drinking among individuals with and without a CMD, these findings are restricted to types of CMD and not to other types of mental health problems. This limitation was partly addressed by previous research focusing on SMI as discussed in Chapter 1 and also by this thesis through examining the prevalence and associations of alcohol use across a broader range of mental health problems in Chapter 5.

Secondly, the quantitative aspect of this thesis was cross-sectional, therefore causality cannot be inferred, and as discussed in Chapter 1, it is known that co-occurring alcohol and mental health problems are likely to be bidirectional though research has shown that mental health may influence alcohol use (Bell & Britton, 2014). The qualitative aspect of this thesis partly addressed this limitation by exploring alcohol use over time and does indicate that alcohol was used to cope with mental health problems, but other longitudinal designs would be required to infer causality.

Thirdly, alcohol use was measured using the AUDIT which only assesses alcohol use in the last 12 months, therefore, quantitative findings of associations with non-drinkers may be explained by participants being previous harmful drinkers. Qualitative findings from Chapter 7 suggested that non-drinkers comprise of those who previously drank in a harmful way, however, this aspect also only recruited non-drinkers who used to drink alcohol and it may be that there were differences between non-drinkers who have never drank alcohol and non-drinkers who have previously drank alcohol.

Fourthly, although the quantitative aspect of this thesis used a large dataset, there were issues with power with stratifying the latent class analyses and regression analyses in Chapter 6 by the type of mental health problem (e.g., CMDs and SMIs), therefore, it was not possible to conduct sensitivity analyses. A sensitivity analysis of the prevalence of latent classes of SES by CMD and SMI indicated that there were some differences, but it was not possible to stratify this analysis further.

Finally, the qualitative aspect of the thesis explored alcohol use among individuals with a SMI diagnosis, however, these findings may differ among individuals with other mental health problems, such as a CMD. Nonetheless, the qualitative findings of this thesis highlighted some issues that are likely to occur across different types of mental health problems.

8.9 Conclusions

Using a mixed methods approach, this thesis aimed to establish the prevalence of alcohol use across a range of mental health problems and understand how this patterning may differ by SES. The findings provide a novel contribution to the theoretical literature and current estimates of the co-occurrence of alcohol and mental health problems which provide important implications and recommendations to policy and practice. Several conclusions can be made from the findings of this thesis.

Firstly, there were differences in the prevalence of alcohol use depending on the specific type of mental health problem an individual has which supports the self-medication hypothesis and the need for integrated specialist services. This also highlights the importance of considering mental health problems individually rather than using broad categorisations. Secondly, the prevalence of non-drinking was higher among individuals who met criteria for a range of mental health problems, indicating that the co-occurrence of alcohol and mental health problems were more complex and further investigation of the prevalence of non-drinking across specific mental health problems should be explored globally. Thirdly, among individuals who met criteria for a mental health problem, associations between lower SES groups and alcohol use were only significant for non-drinking which contradicts the alcohol harms paradox in this sample. Fourthly, decreased social support and increased neighbourhood disadvantage partially explained some of associations between the lowest SES groups and harmful/probable dependent drinking, indicating that integrated services should seek to ensure that these are accessible for the most deprived groups. Fifthly, drinking to cope was more complex among individuals who had more severe mental health problems and these mechanisms should be identified early in the treatment process for service users who have co-occurring alcohol and mental health problems. Finally, this thesis identified several gaps and directions for future research. Future research should continue to acknowledge differences in the patterns of alcohol use, including non-drinking, based on the specific type of mental health problem on a global scale. Future research should also seek to better understand the role of SES on alcohol use among individuals with specific mental health problems and how social support and areas of disadvantage can affect the likelihood of harmful drinking. This thesis recommends the need for regular screening of a range of mental health problems to minimize the likelihood of using alcohol to cope with deteriorations in mental health. This thesis also

highlights the need for current plans for integrated services to be mandatory with extended efforts to reach the most deprived groups living in social accommodation and most disadvantaged areas.

Appendices

Figure S1: 12-month and lifetime associations of alcohol use disorder (AUD) among those with a common mental disorder (CMD), compared to those without, after removing Kinley et al 2009 study (N=353,660) (Chapter 4)

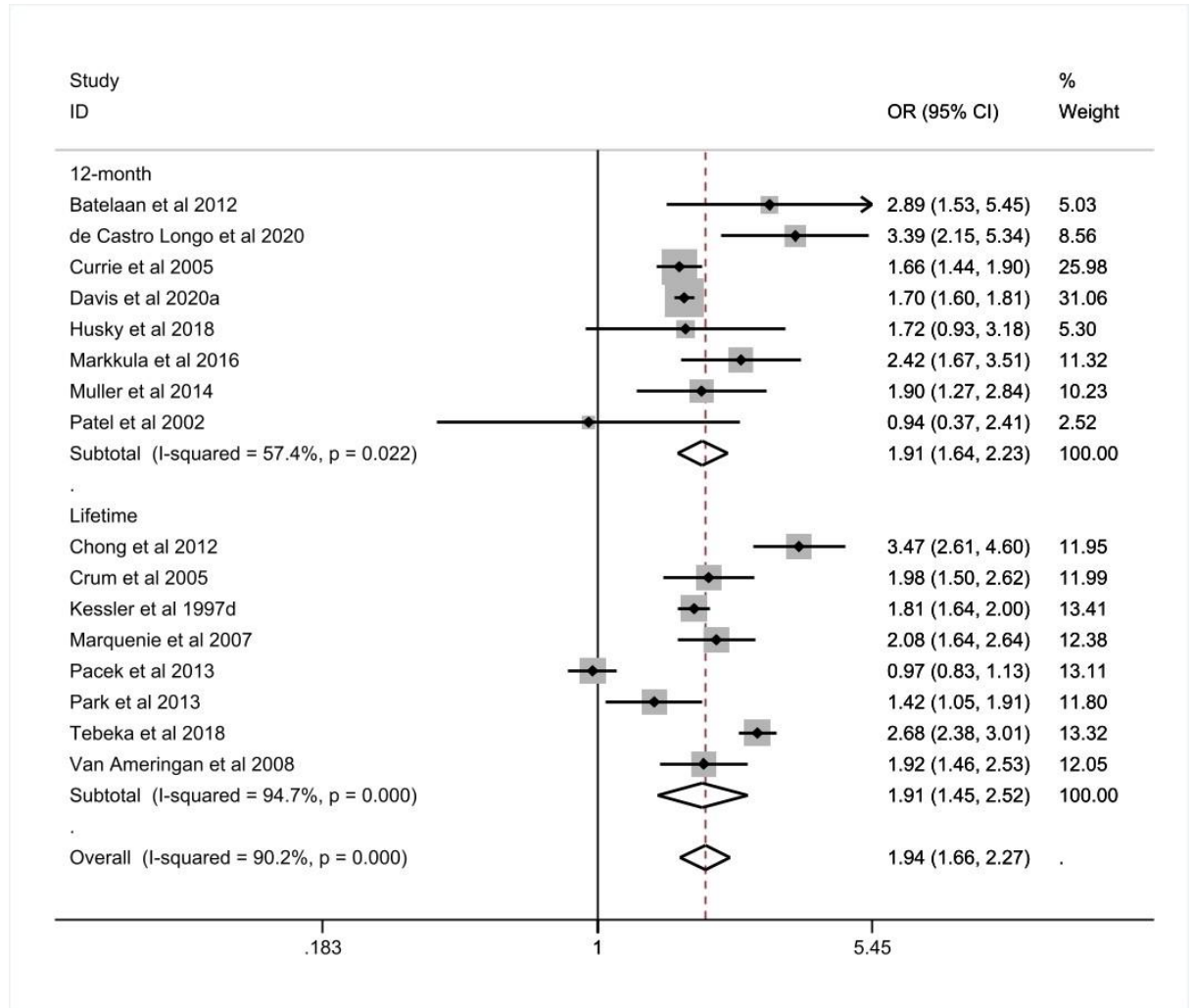


Figure S2: 12-month and lifetime associations of any alcohol use disorder (AUD) stratified by type of common mental disorder (CMD), compared to those without, after removing Patel et al 2002 study (N=373,637) (Chapter 4)

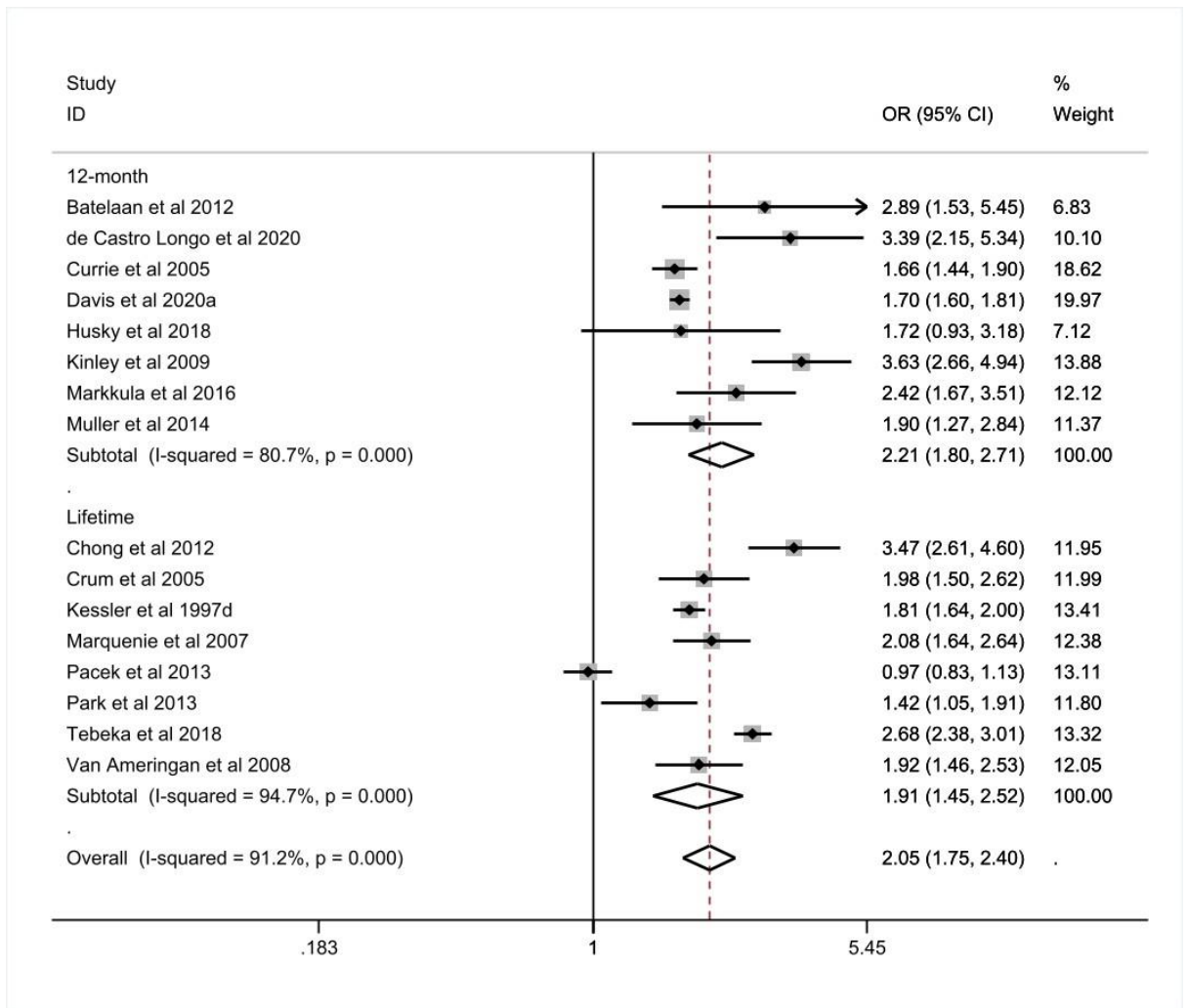


Table S1: Associations of Moderate/Severe AUD Among Those With an Anxiety or Mood Disorder Compared to Those Without (N=210,121) (Chapter 4)

| Moderate/severe AUD | OR | 95% CI lower | 95% CI upper | Weight | Heterogeneity (I ²) | p |
|----------------------------|------|--------------|--------------|--------|---------------------------------|------|
| Anxiety disorder | | | | | | |
| Batelaan et al 2012 | 2.89 | 1.53 | 5.45 | 9.69 | | |
| de Castro Longo et al 2020 | 5.46 | 3.11 | 9.58 | 10.26 | | |
| Kinley et al 2009 | 3.63 | 2.66 | 4.94 | 12.05 | | |
| Marquenie et al 2007 | 2.08 | 1.64 | 2.64 | 12.42 | | |
| Muller et al 2014 | 1.90 | 1.27 | 2.84 | 11.45 | | |
| Pacek et al 2013 | 0.97 | 0.83 | 1.13 | 12.77 | | |
| Park et al 2013 | 2.06 | 1.42 | 2.98 | 11.67 | | |
| Patel et al 2002 | 0.94 | 0.37 | 2.41 | 7.45 | | |
| Van Ameringan et al 2008 | 1.93 | 1.46 | 2.53 | 12.24 | | |
| Subtotal | 2.12 | 1.43 | 3.14 | 100.00 | 92.20% | 0.01 |
| Mood disorder | | | | | | |
| Crum et al 2005 | 1.98 | 1.50 | 2.62 | 17.26 | | |
| Currie et al 2005 | 1.68 | 1.31 | 2.15 | 18.22 | | |
| Davis et al 2020 | 1.70 | 1.60 | 1.81 | 22.37 | | |
| Husky et al 2018 | 1.74 | 0.77 | 3.96 | 6.08 | | |
| Markkula et al 2016 | 2.42 | 1.68 | 3.51 | 14.55 | | |
| Tebeka et al 2018 | 2.68 | 2.83 | 3.01 | 21.53 | | |
| Subtotal | 2.02 | 1.60 | 2.57 | 100.00 | 89.60% | 0.01 |

Table S2: Associations of Any AUD Among Those With Any Anxiety Disorder (excluding PTSD and OCD) and Among Those with PTSD (N=137,916) (Chapter 4)

| Any AUD | OR | 95% CI lower | 95% CI upper | Weight | Heterogeneity (I ²) | p |
|--|-------------|--------------|--------------|---------------|---------------------------------|-------------|
| Any Anxiety Disorder (excluding PTSD and OCD) | | | | | | |
| Batelaan et al 2012 | 2.89 | 1.53 | 5.45 | 18.49 | | |
| Kinley et al 2009 | 3.63 | 2.66 | 4.94 | 21.83 | | |
| Pacek et al 2013 | 0.97 | 0.83 | 1.13 | 22.79 | | |
| Park et al 2013 | 1.42 | 1.05 | 1.91 | 21.91 | | |
| Patel et al 2002 | 0.95 | 0.37 | 2.41 | 14.98 | | |
| Subtotal | 1.71 | 0.93 | 3.16 | 100.00 | 93.90% | 0.01 |
| PTSD | | | | | | |
| De Castro Longo et al 2020 | 3.39 | 2.15 | 5.34 | 27.68 | | |
| Muller et al 2014 | 1.90 | 1.27 | 3.84 | 31.21 | | |
| Van Ameringan et al 2008 | 1.93 | 1.46 | 2.53 | 41.11 | | |
| Subtotal | 2.24 | 1.60 | 3.13 | 100.00 | 59.10% | 0.18 |

Table S3: Associations of Any AUD Among Those With a CMD Compared to Those Without Stratified by Continent (N=365,331) (Chapter 4)

| Continent | OR | 95% CI lower | 95% CI upper | Weight | Heterogeneity (I²) | p |
|--------------------------|-------------|---------------------|---------------------|---------------|--------------------------------------|-------------|
| Europe | | | | | | |
| Batelaan et al 2012 | 2.89 | 1.53 | 5.45 | 7.72 | | |
| Davis et al 2020 | 1.70 | 1.60 | 1.81 | 19.57 | | |
| Husky et al 2018 | 1.72 | 0.93 | 3.18 | 8.02 | | |
| Markkula et al 2016 | 2.42 | 1.67 | 3.51 | 12.90 | | |
| Marquenie et al 2007 | 2.08 | 1.64 | 2.64 | 16.23 | | |
| Muller et al 2014 | 1.90 | 1.27 | 3.84 | 12.20 | | |
| Patel et al 2002 | 0.95 | 0.37 | 2.41 | 4.50 | | |
| Tebeka et al 2018 | 2.68 | 2.38 | 3.01 | 18.86 | | |
| Subtotal | 2.06 | 1.65 | 2.59 | 100.00 | 86.40% | 0.01 |
| North America | | | | | | |
| Crum et al 2005 | 1.98 | 1.50 | 2.62 | 15.68 | | |
| Currie et al 2005 | 1.66 | 1.44 | 1.90 | 17.71 | | |
| Kessler et al 1997 | 1.81 | 1.64 | 2.00 | 18.08 | | |
| Kinley et al 2009 | 3.63 | 2.66 | 4.94 | 15.18 | | |
| Pacek et al 2013 | 0.97 | 0.83 | 1.13 | 17.56 | | |
| Van Ameringan et al 2008 | 1.93 | 1.46 | 2.53 | 15.79 | | |
| Subtotal | 1.82 | 1.37 | 2.42 | 100.00 | 93.70% | 0.01 |

Table S4: Associations of Any AUD Among Those With a CMD Compared to Those Without Stratified by the Decade Data was Collected (N=224,835)
(Chapter 4)

| Decade in which data was collected | OR | 95% CI lower | 95% CI upper | Weight | Heterogeneity (I ²) | p |
|------------------------------------|-------------|--------------|--------------|---------------|---------------------------------|-------------|
| 1990's | | | | | | |
| Batelaan et al 2012 | 2.89 | 1.53 | 5.45 | 3.95 | | |
| Crum et al 2005 | 1.98 | 1.50 | 2.62 | 17.05 | | |
| Kessler et al 1997 | 1.81 | 2.64 | 2.00 | 55.56 | | |
| Marquenie et al 2007 | 2.08 | 1.64 | 2.64 | 21.57 | | |
| Patel et al 2002 | 0.95 | 0.37 | 2.41 | 1.87 | | |
| Subtotal | 1.91 | 1.68 | 2.17 | 100.00 | 22.20% | 0.38 |
| 2000's | | | | | | |
| de Castro Longo et al 2020 | 3.39 | 2.15 | 5.34 | 8.16 | | |
| Chong et al 2012 | 3.47 | 2.61 | 4.60 | 9.37 | | |
| Currie et al 2005 | 1.66 | 1.44 | 1.90 | 10.09 | | |
| Husky et al 2018 | 1.72 | 0.93 | 3.18 | 6.95 | | |
| Kinley et al 2009 | 3.63 | 2.66 | 4.94 | 9.21 | | |
| Markkula et al 2016 | 2.42 | 1.67 | 3.51 | 8.77 | | |
| Muller et al 2014 | 1.90 | 1.27 | 3.84 | 8.56 | | |
| Pacek et al 2013 | 0.97 | 0.83 | 1.13 | 10.04 | | |
| Park et al 2013 | 1.42 | 1.05 | 1.91 | 9.28 | | |
| Tebeka et al 2018 | 2.68 | 2.38 | 3.01 | 10.15 | | |
| Van Ameringan et al 2008 | 1.93 | 1.46 | 2.53 | 9.43 | | |
| Subtotal | 2.11 | 1.59 | 3.26 | 100.00 | 93.80% | 0.01 |

Figure S3: A funnel plot illustrating the heterogeneity of having any alcohol use disorder (AUD) among those with any common mental disorder (CMD) (N=382,201) (Chapter 4)

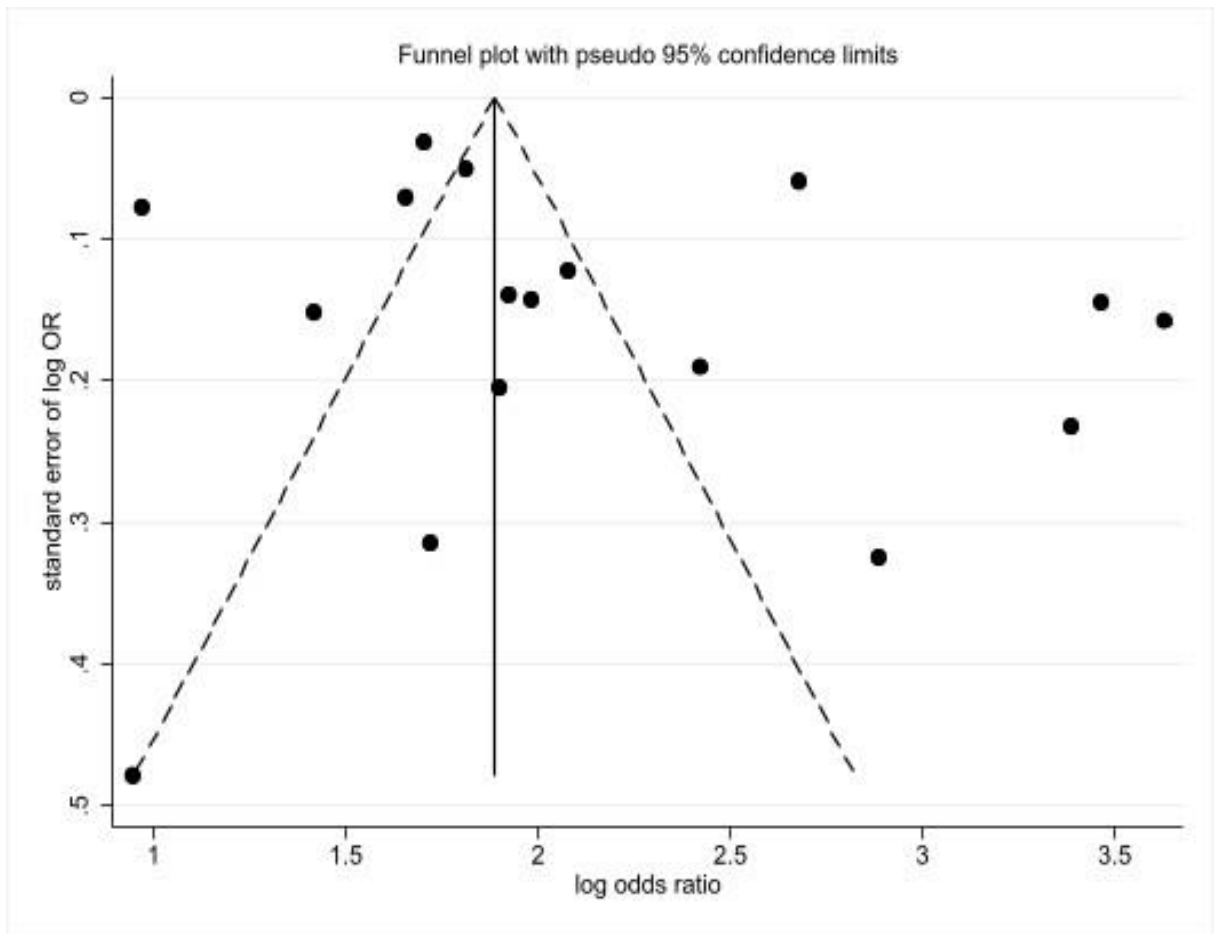


Figure S4: A funnel plot illustrating the heterogeneity of having any alcohol use disorder (AUD) among those with any common mental disorder (CMD) stratified by the decade in which the study was conducted (N=224,835) (Chapter 4)

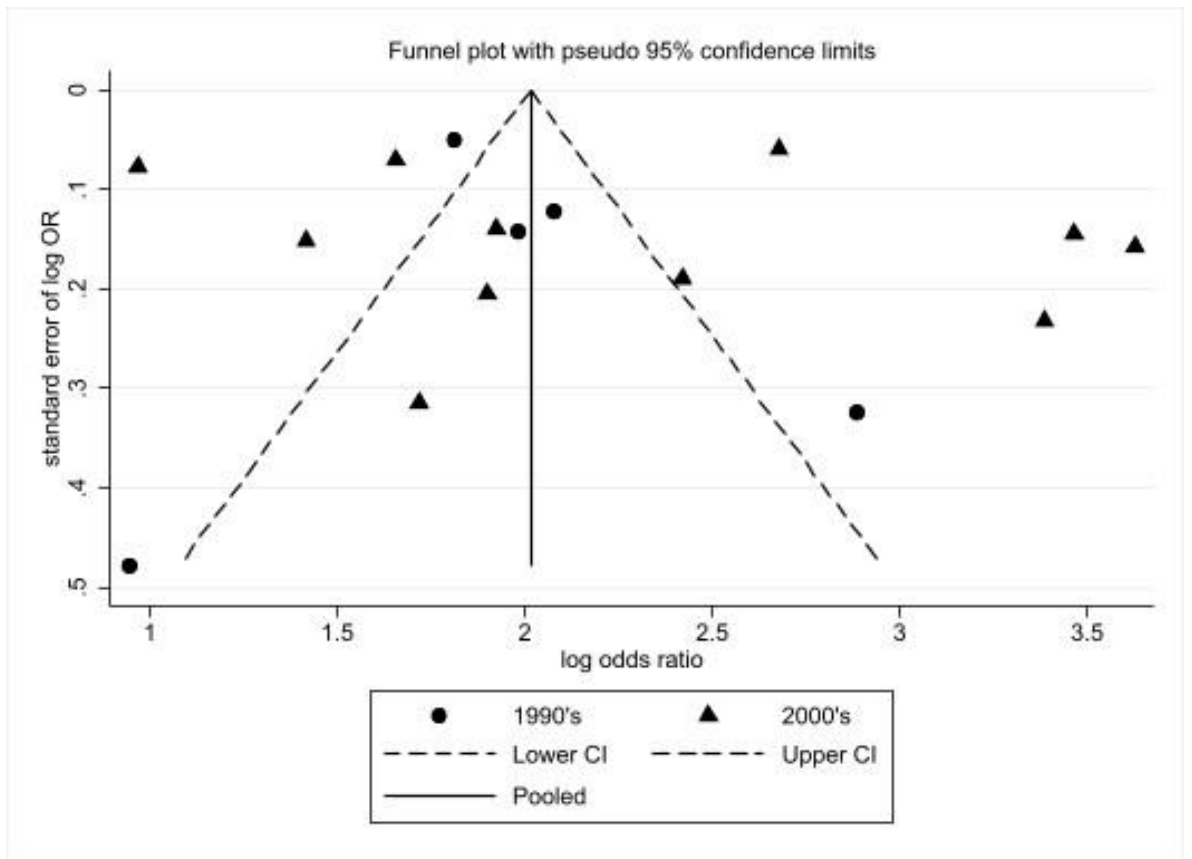


Figure S5: A funnel plot illustrating the heterogeneity of having any alcohol use disorder (AUD) among those with any common mental disorder (CMD) stratified by the continent in which the study was conducted in (N=382,201) (Chapter 4)

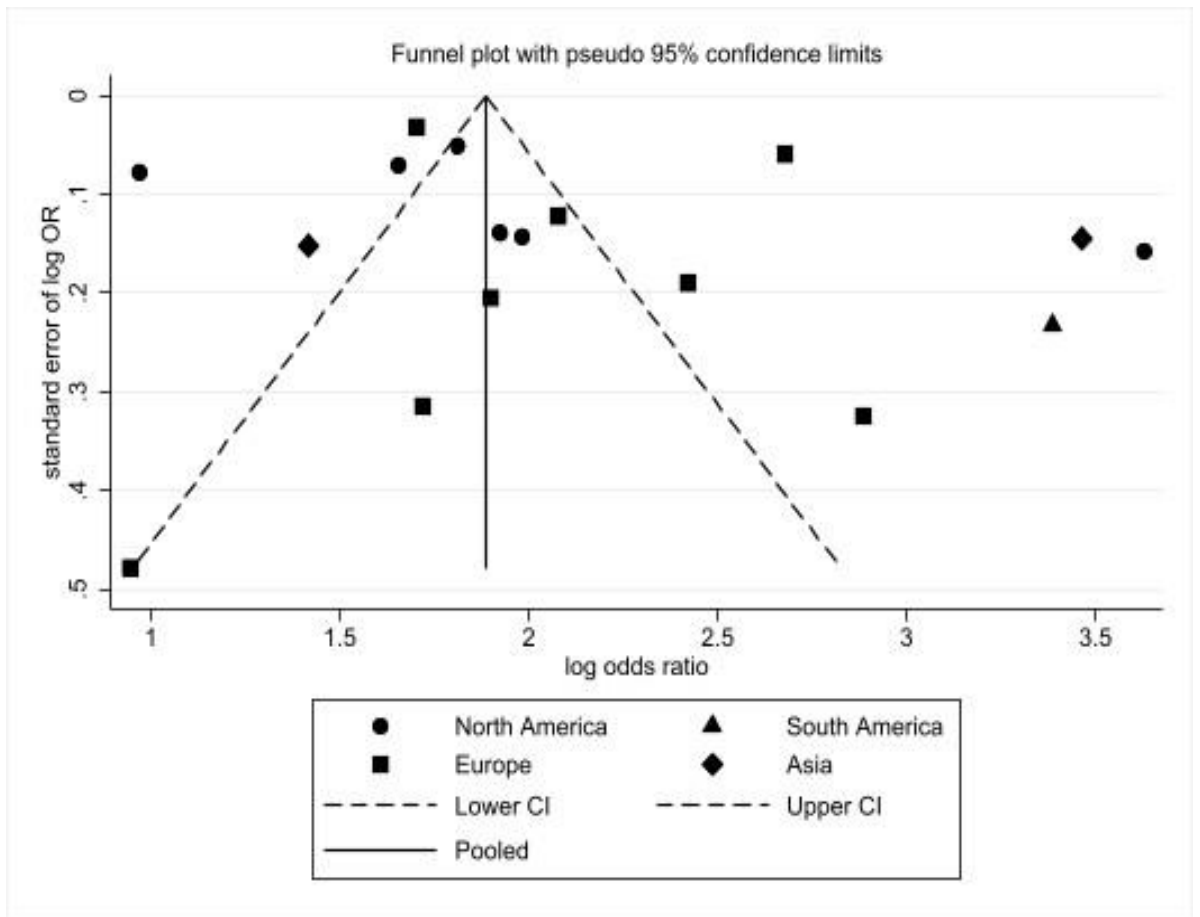


Figure S6: A funnel plot illustrating the heterogeneity of having any alcohol use disorder (AUD) among those with any common mental disorder (CMD) stratified by each study's bias score (N=382,201)

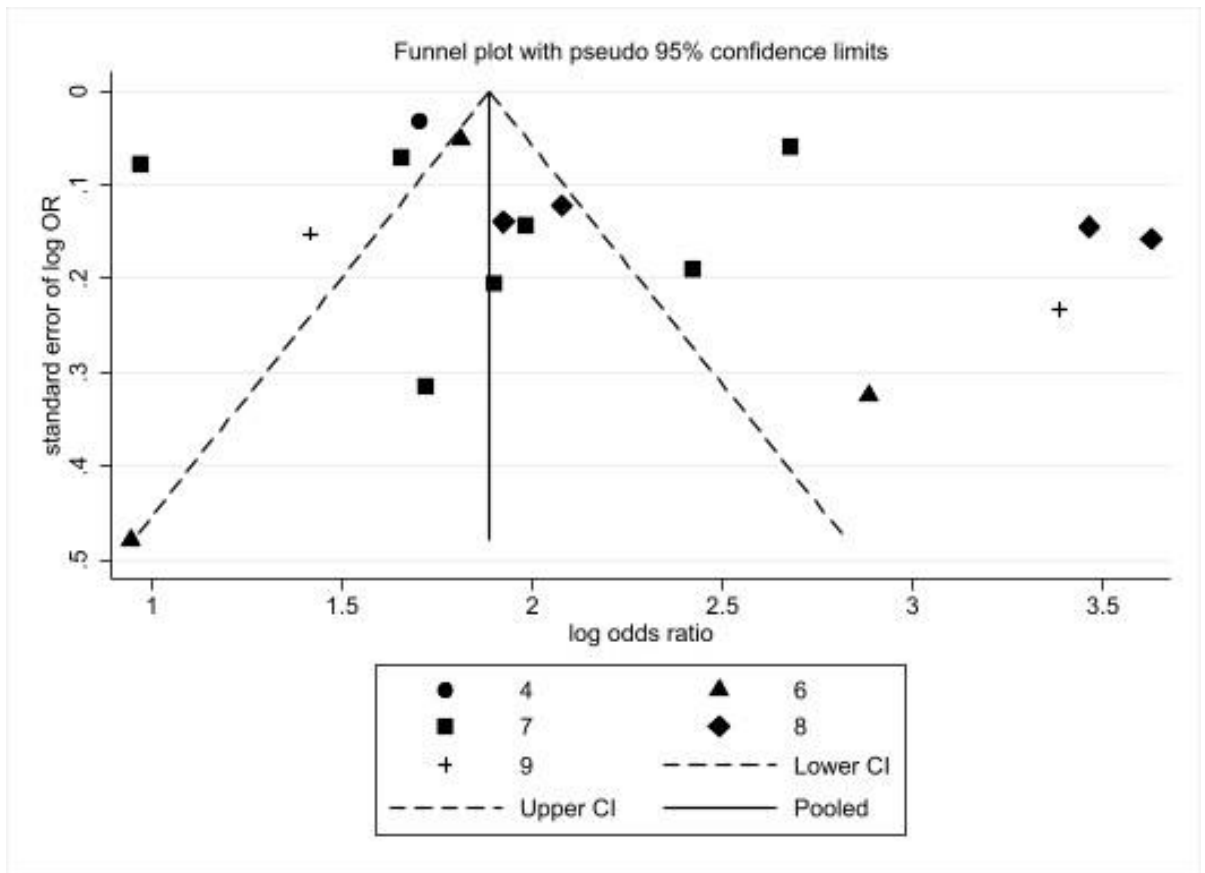


Figure S7: Funnel plot to explore publication bias (Chapter 4)

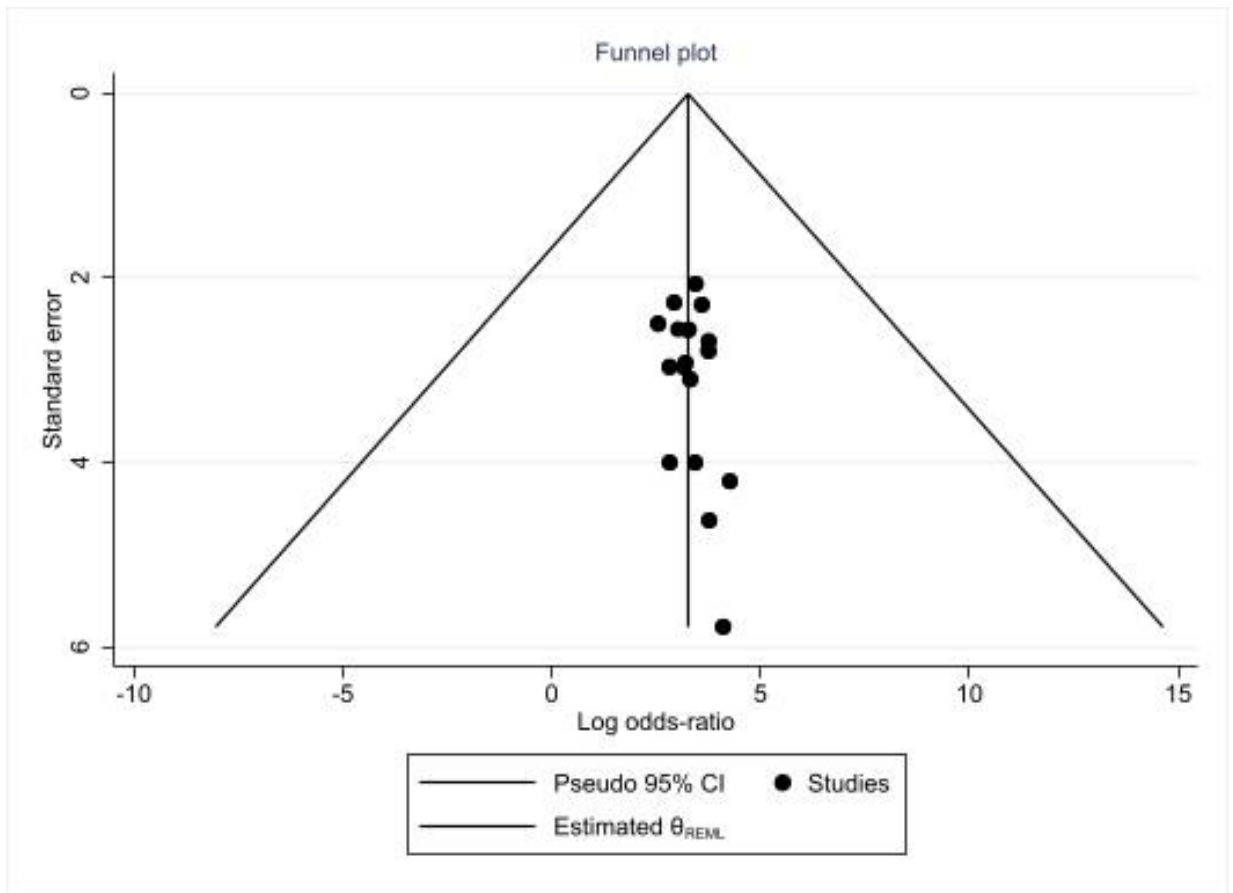


Table S5: Associations of Moderate/Severe AUD Among Those With an Anxiety or Mood Disorder Compared to Those Without (N=210,121) (Chapter 4)

| Moderate/severe AUD | OR | 95% CI lower | 95% CI upper | Weight | Heterogeneity (I ²) | p |
|----------------------------|------|--------------|--------------|--------|---------------------------------|------|
| Anxiety disorder | | | | | | |
| Batelaan et al 2012 | 2.89 | 1.53 | 5.45 | 9.69 | | |
| de Castro Longo et al 2020 | 5.46 | 3.11 | 9.58 | 10.26 | | |
| Kinley et al 2009 | 3.63 | 2.66 | 4.94 | 12.05 | | |
| Marquenie et al 2007 | 2.08 | 1.64 | 2.64 | 12.42 | | |
| Muller et al 2014 | 1.90 | 1.27 | 2.84 | 11.45 | | |
| Pacek et al 2013 | 0.97 | 0.83 | 1.13 | 12.77 | | |
| Park et al 2013 | 2.06 | 1.42 | 2.98 | 11.67 | | |
| Patel et al 2002 | 0.94 | 0.37 | 2.41 | 7.45 | | |
| Van Ameringan et al 2008 | 1.93 | 1.46 | 2.53 | 12.24 | | |
| Subtotal | 2.12 | 1.43 | 3.14 | 100.00 | 92.20% | 0.01 |
| Mood disorder | | | | | | |
| Crum et al 2005 | 1.98 | 1.50 | 2.62 | 17.26 | | |
| Currie et al 2005 | 1.68 | 1.31 | 2.15 | 18.22 | | |
| Davis et al 2020 | 1.70 | 1.60 | 1.81 | 22.37 | | |
| Husky et al 2018 | 1.74 | 0.77 | 3.96 | 6.08 | | |
| Markkula et al 2016 | 2.42 | 1.68 | 3.51 | 14.55 | | |
| Tebeka et al 2018 | 2.68 | 2.83 | 3.01 | 21.53 | | |
| Subtotal | 2.02 | 1.60 | 2.57 | 100.00 | 89.60% | 0.01 |

Table S6: Prevalence of alcohol use among those meeting criteria for one or more CMD or SMI (Chapter 5)

| | | Non-drinking | Low risk | Hazardous use | Harmful/probable dependence | |
|---------------------------|-----------|----------------------------|----------------------------|----------------------------|------------------------------------|--------------|
| | | N (weighted %, 95% CI) | N (weighted %, 95% CI) | N (weighted %, 95% CI) | N (weighted %, 95% CI) | Total |
| Total number of CMDs** | None | 1,485 (22.15, 20.88-23.47) | 3,953 (58.80, 57.36-60.22) | 943 (16.53, 15.48-17.63) | 141 (2.53, 2.10-3.04) | 6,522 |
| | Any one | 131 (25.80, 21.14-31.09) | 230 (47.50, 41.13-53.96) | 77 (18.88, 13.51-25.74) | 35 (7.82, 5.45-11.10) | 473 |
| | Any two | 56 (33.00, 26.25-40.52) | 67 (39.75, 31.05-49.15) | 23 (16.37, 12.65-20.93) | 19 (10.88, 6.83-16.91) | 165 |
| | All three | 29 (51.64, 37.48-65.55) | 14 (28.69, 13.76-50.35) | 8 (8.75, 3.02-22.82) | 7 (10.92, 2.47-37.24) | 58 |
| Total number of SMIs** | None | 1,636 (22.52, 21.29-23.80) | 4,201 (58.14, 56.74-59.54) | 1,020 (16.55, 15.51-17.64) | 178 (2.79, 2.36-3.29) | 7,035 |
| | One | 55 (30.97, 23.32-39.82) | 57 (32.47, 23.20-43.35) | 29 (21.06, 10.41-37.97) | 22 (15.59, 8.71-26.08) | 163 |

*CI=Confidence interval **CMD=includes those meeting criteria for depression, anxiety or phobia, SMI=includes those meeting criteria for bipolar disorder or probable psychotic disorder

Table S7: Associations of alcohol use among those meeting criteria for one or more CMD or SMI (Chapter 5)

| Unadjusted ^{ab} | | | | | | | Adjusted for demographic and SES characteristics ^{ab} | | | | | | |
|--------------------------|--------------------------|-------------|-------------------------|-------------|-----------------------------|-------------|--|-------------|-------------------------|---------------|--------------------------|-----------------------------|---|
| Non-drinking | | | Hazardous use | | Harmful/probable dependence | | Non-drinking | | | Hazardous use | | Harmful/probable dependence | |
| MOR (95% CI) | P | | MOR (95% CI) | P | MOR (95% CI) | P | MOR (95% CI) | P | | MOR (95% CI) | P | MOR (95% CI) | P |
| Number of CMD** Any One | 1.44 (1.12-1.86) | 0.01 | 1.41 (1.03-1.94) | 0.03 | 3.83 (2.46-5.97) | 0.01 | 1.33 (1.00-1.78) | 0.05 | 1.47 (1.06-2.05) | 0.02 | 3.76 (2.39-5.93) | 0.01 | |
| Any Two | 2.20 (1.45-3.35) | 0.01 | 1.46 (0.80-2.69) | 0.22 | 6.37 (3.39-11.96) | 0.01 | 1.48 (0.92-2.37) | 0.10 | 1.63 (0.90-2.95) | 0.11 | 5.90 (3.08-11.32) | 0.01 | |
| All Three | 4.78 (2.22-10.28) | 0.01 | 1.08 (0.41-2.86) | 0.87 | 8.86 (3.41-23.04) | 0.01 | 3.39 (1.49-7.74) | 0.01 | 1.16 (0.40-3.40) | 0.79 | 5.90 (2.08-16.75) | 0.01 | |
| Number of SMI** Any One | 2.46 (1.66-3.66) | 0.01 | 2.28 (1.29-4.02) | 0.01 | 9.96 (5.70-17.40) | 0.01 | 2.21 (1.44-3.39) | 0.01 | 2.04 (1.15-3.62) | 0.02 | 6.82 (3.72-12.49) | 0.01 | |

*Note: MOR = multinomial odds ratio, CI = confidence interval, bold indicates significant results **CMD=includes those meeting criteria for depression, anxiety or phobia compared to those not meeting criteria for any, SMI=includes those meeting criteria for bipolar disorder or probable psychotic disorder, compared to those not meeting criteria for any.

^aThe reference group for all alcohol use analyses are the remainder of the sample reporting low risk alcohol use

^bThe references group for all mental health analyses are not meeting criteria for the respective mental health problem

Table S8: Interaction between gender and symptoms of CMD (Chapter 5)

| | MOR (95% CI) | P |
|-------------------------------------|---------------------|----------|
| Female and moderate symptoms of CMD | -0.03 (-0.22-0.15) | 0.72 |
| Female and severe symptoms of CMD | 0.00 (-0.19-0.20) | 0.98 |

**Bold text indicates significance*

Table S9: STROBE Checklist (Chapter 5)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| | Item No | Recommendation | Page No |
|------------------------------|---------|--|---------|
| Title and abstract | 1 | (a) Indicate the study’s design with a commonly used term in the title or the abstract | 2 |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3-4 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4 |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | 4 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 4 |
| Participants | 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 4 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5-7 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5-6 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 7 |
| Study size | 10 | Explain how the study size was arrived at | 7 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 4-7 |

| | | | |
|---------------------|-----|--|-------------------------------|
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | 7 |
| | | (b) Describe any methods used to examine subgroups and interactions | 7 |
| | | (c) Explain how missing data were addressed | 7 |
| | | (d) If applicable, describe analytical methods taking account of sampling strategy | 7 |
| | | (e) Describe any sensitivity analyses | 7 |
| Results | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 7 |
| | | (b) Give reasons for non-participation at each stage | 7 |
| | | (c) Consider use of a flow diagram | NA |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7-8, Table 1 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 7 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 7-9, Tables 1, 2 and 3 |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 7-9, Tables 1, 2 and 3 |
| | | (b) Report category boundaries when continuous variables were categorized | 5-6 |
| | | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 and supplementary materials |

Discussion

| | | | |
|--------------------------|----|--|-------|
| Key results | 18 | Summarise key results with reference to study objectives | 9-10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 11-12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-12 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 9-12 |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 14 |

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

Table S10: An overview of mental health problems included in the study and the measures used to assess criteria (Chapter 6)

| Type of mental health problem | Measure used |
|---|--|
| Depression (including mild, moderate, and severe) | Clinical Interview Schedule-Revised (CISR) |
| Anxiety (including generalized anxiety disorder, obsessive compulsive disorder, and panic disorder) | CISR |
| Phobia (including social, specific and agoraphobia) | CISR |
| Post-Traumatic Stress Disorder | PTSD Checklist-Civilian |
| Bipolar Disorder | Mood Disorder Questionnaire |
| Anti-Social Personality Disorder | Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II) |
| Borderline Personality Disorder | SCID-II |
| Probable Psychotic Disorder | Psychosis Screening Questionnaire and self-reported hospital stays |
| Attention Deficit Hyperactivity Disorder | Adult ADHD Self-Report Scale-v1.1 |

Table S11: Sample characteristics of the 2014 APMS sample stratified by meeting criteria for a mental health problem (Chapter 6)

| | | Has mental health problem (N=1,463) | Does not have a mental health problem (N=6,083) |
|---|--|--|--|
| Gender | Male | 576 (49.31) | 2,482 (48.73) |
| | Female | 887 (50.69) | 3,601 (51.27) |
| Age | 16-34 | 422 (41.06) | 1,173 (28.48) |
| | 35-54 | 574 (35.55) | 1,902 (32.97) |
| | 55-74 | 384 (19.52) | 2,031 (27.10) |
| | 75+ | 85 (3.87) | 977 (11.45) |
| Ethnicity | White | 1,294 (86.36) | 5,519 (87.58) |
| | Non-white | 158 (13.64) | 547 (12.42) |
| Social occupational grade | Managerial/professional | 300 (21.56) | 1,495 (26.85) |
| | Intermediate | 139 (9.70) | 539 (8.95) |
| | Lower supervisory | 85 (6.15) | 341 (6.28) |
| | Student | 50 (6.78) | 96 (3.11) |
| | Retired | 245 (11.46) | 2,022 (24.50) |
| | Never worked/not worked in the past year | 628 (43.39) | 1,559 (29.78) |
| In receipt of any out of work benefits | No | 1,105 (81.37) | 5,739 (95.57) |
| | Yes | 644 (18.63) | 306 (4.43) |
| In debt | No | 1,162 (83.35) | 5,766 (95.27) |
| | Yes | 277 (16.65) | 287 (4.73) |
| Education | Degree or higher | 395 (27.45) | 2,015 (34.73) |
| | A-Level/GCSE | 654 (49.90) | 2,285 (41.59) |
| | Foreign qualifications | 35 (2.30) | 237 (3.42) |
| | No qualifications | 359 (20.62) | 1,484 (20.26) |
| Housing tenure | Homeowner | 695 (49.11) | 4,226 (67.65) |
| | Private renter | 421 (26.69) | 849 (13.33) |
| | Social renter | 331 (24.20) | 973 (19.02) |
| Household composition | Lives alone, without children | 475 (17.75) | 1,720 (14.94) |
| | Lives with another adult, without children | 424 (30.14) | 2,308 (38.26) |
| | Lives in a family | 345 (22.35) | 1,231 (21.25) |
| | Lives in a large adult household | 219 (29.75) | 824 (25.54) |

Table S12: Class probabilities for the individual SES indicators (Chapter 6)

| Variable | Category | Class one | | Class two | | Class three | | Class four | |
|---|--|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | Probability | p | Probability | p | Probability | p | Probability | p |
| Social occupational grade | Managerial/professional | 0.030 | 0.034 | 0.072 | 0.076 | 0.031 | 0.649 | 0.832 | 0.000 |
| | Intermediate/small employers/own account worker | 0.030 | 0.005 | 0.254 | 0.000 | 0.011 | 0.655 | 0.161 | 0.000 |
| | Lower supervisory/technical/routine/semi-routine | 0.124 | 0.000 | 0.413 | 0.000 | 0.028 | 0.565 | 0.000 | 0.693 |
| | Student | 0.013 | 0.085 | 0.141 | 0.000 | 0.000 | 1.000 | 0.000 | 1.000 |
| | Retired | 0.012 | 0.203 | 0.000 | 1.000 | 0.895 | 0.000 | 0.000 | 1.000 |
| | Never/not worked in the past year | 0.791 | 0.000 | 0.012 | 0.000 | 0.035 | 0.214 | 0.008 | 0.696 |
| In debt | No | 0.591 | 0.000 | 0.852 | 0.000 | 0.956 | 0.000 | 0.948 | 0.000 |
| | Yes | 0.409 | 0.000 | 0.148 | 0.000 | 0.044 | 0.002 | 0.052 | 0.002 |
| Receiving any out of work benefits | No | 0.154 | 0.000 | 0.966 | 0.000 | 0.982 | 0.000 | 0.986 | 0.000 |
| | Yes | 0.846 | 0.000 | 0.034 | 0.031 | 0.018 | 0.216 | 0.014 | 0.186 |
| Educational attainment | Degree or higher | 0.096 | 0.000 | 0.166 | 0.000 | 0.223 | 0.000 | 0.714 | 0.000 |
| | A-Level/GCSE | 0.459 | 0.000 | 0.689 | 0.000 | 0.244 | 0.000 | 0.266 | 0.000 |
| | Other | 0.011 | 0.062 | 0.015 | 0.025 | 0.070 | 0.000 | 0.010 | 0.165 |
| | None | 0.434 | 0.000 | 0.129 | 0.000 | 0.464 | 0.000 | 0.009 | 0.799 |
| Housing tenure | Homeowner | 0.119 | 0.000 | 0.505 | 0.000 | 0.709 | 0.000 | 0.678 | 0.000 |
| | Social renter | 0.637 | 0.000 | 0.215 | 0.000 | 0.246 | 0.000 | 0.048 | 0.022 |
| | Private renter | 0.244 | 0.000 | 0.280 | 0.000 | 0.045 | 0.002 | 0.275 | 0.000 |

| Household type | Lives alone, without children | Ref | Ref | Ref | Ref | Ref | Ref | Ref | Ref |
|-----------------------|--|--------------|--------------|---------------|--------------|--------------|--------------|--------------|--------------|
| | Lives with another adult, without children | 1.076 | 0.000 | -2.127 | 0.000 | 1.305 | 0.000 | -0.292 | 0.423 |
| | Family | 0.354 | 0.264 | -0.707 | 0.000 | 1.744 | 0.000 | 0.846 | 0.010 |
| | Large adult household | 0.653 | 0.029 | -0.715 | 0.000 | -15.000 | 999.000 | 0.558 | 0.149 |

*Bold indicates significance

Table S13: A sensitivity analysis showing the prevalence of the latent SES classes by type of mental health problem (Chapter 6)

| | | Class one: “Economically inactive, social renters” (n=361, 21.31%) | Class two: “Routine/intermediate occupation, mixed owner/renters” (n=537, 47.83%) | Class three: “Retired, homeowners” (n=250, 11.91%) | Class four: “Professional occupation, homeowners” (n=315, 18.95%) |
|-------------------------------|-----|--|---|--|---|
| Type of mental health problem | | N (weighted %) | N (weighted %) | N (weighted %) | N (weighted %) |
| CMD | Yes | 228 (24.83) | 240 (42.80) | 134 (13.76) | 131 (18.61) |
| | No | 133 (13.85) | 297 (52.20) | 116 (10.30) | 184 (23.66) |
| SMI | Yes | 102 (40.55) | 59 (39.61) | 16 (5.38) | 24 (14.46) |
| | No | 259 (15.64) | 478 (49.09) | 234 (12.91) | 291 (22.36) |

*CMD=Common mental disorder (including depression and anxiety disorders), SMI=Severe mental illness (including bipolar disorder, probable psychotic disorder and any other psychotic disorder)

Table S14: Mean scores and standard deviations of social support and neighbourhood disadvantage scores stratified by SES classes and alcohol use categories, respectively (Chapter 6)

| | | Social support (n=1,436) | Neighbourhood disadvantage (n=1,436) |
|----------------|---|-----------------------------|---|
| | | M (SD) | M (SD) |
| SES classes | Class 1 – Economically inactive, social renters | 17.90 (3.83) | 23.49 (7.60) |
| | Class 2 - Routine/intermediate occupation, mixed owner/renters | 19.67 (2.43) | 20.83 (7.50) |
| | Class 3 – Retired, homeowners | 19.34 (3.22) | 17.70 (6.46) |
| | Class 4 – Professional occupation, homeowners | 19.98 (2.11) | 19.37 (6.58) |
| Alcohol use | Non-drinker | 18.58 (3.52) | 21.48 (9.93) |
| | Low-risk use | 19.64 (2.59) | 20.03 (7.11) |
| | Hazardous use | 19.56 (2.71) | 20.21 (7.18) |
| | Harmful/probable dependence | 18.56 (3.49) | 22.19 (7.27) |

Table S15: STROBE Checklist (Chapter 6)

STROBE Statement—Checklist of items that should be included in reports of *cross-sectional studies*

| | Item No | Recommendation | Page No |
|------------------------------|---------|--|---------|
| Title and abstract | 1 | (a) Indicate the study's design with a commonly used term in the title or the abstract | 2 |
| | | (b) Provide in the abstract an informative and balanced summary of what was done and what was found | 2 |
| Introduction | | | |
| Background/rationale | 2 | Explain the scientific background and rationale for the investigation being reported | 3-4 |
| Objectives | 3 | State specific objectives, including any prespecified hypotheses | 4 |
| Methods | | | |
| Study design | 4 | Present key elements of study design early in the paper | 4 |
| Setting | 5 | Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection | 4 |
| Participants | 6 | (a) Give the eligibility criteria, and the sources and methods of selection of participants | 4 |
| Variables | 7 | Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable | 5-7 |
| Data sources/ measurement | 8* | For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group | 5-6 |
| Bias | 9 | Describe any efforts to address potential sources of bias | 7 |
| Study size | 10 | Explain how the study size was arrived at | 7 |
| Quantitative variables | 11 | Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why | 4-7 |

| | | | |
|---------------------|-----|--|-------------------------------|
| Statistical methods | 12 | (a) Describe all statistical methods, including those used to control for confounding | 7 |
| | | (b) Describe any methods used to examine subgroups and interactions | 7 |
| | | (c) Explain how missing data were addressed | 7 |
| | | (d) If applicable, describe analytical methods taking account of sampling strategy | 7 |
| | | (e) Describe any sensitivity analyses | 7 |
| Results | | | |
| Participants | 13* | (a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed | 7 |
| | | (b) Give reasons for non-participation at each stage | 7 |
| | | (c) Consider use of a flow diagram | NA |
| Descriptive data | 14* | (a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders | 7-8, Table 1 |
| | | (b) Indicate number of participants with missing data for each variable of interest | 7 |
| Outcome data | 15* | Report numbers of outcome events or summary measures | 7-9, Tables 1, 2 and 3 |
| Main results | 16 | (a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included | 7-9, Tables 1, 2 and 3 |
| | | (b) Report category boundaries when continuous variables were categorized | 5-6 |
| | | (c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period | NA |
| Other analyses | 17 | Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses | 9 and supplementary materials |

Discussion

| | | | |
|--------------------------|----|--|-------|
| Key results | 18 | Summarise key results with reference to study objectives | 9-10 |
| Limitations | 19 | Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias | 11-12 |
| Interpretation | 20 | Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence | 10-12 |
| Generalisability | 21 | Discuss the generalisability (external validity) of the study results | 9-12 |
| Other information | | | |
| Funding | 22 | Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based | 14 |

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

Ethical Approval Letter (Chapter 7)

4 September 2020

Dear Dr Goodwin

I am pleased to inform you that your application for research ethics approval has been approved. Application details and conditions of approval can be found below. Appendix A contains a list of documents approved by the Committee.

Application Details

Reference: 6337

Project Title: Alcohol use among people with lived experience of a mental health problem

Principal Investigator/Supervisor: Dr Laura Goodwin

Co-Investigator(s): Ms Jo-Anne Puddephatt, Dr Suzanne Gage, Dr Andrew Jones

Lead Student Investigator: -

Department: Psychological Sciences

Approval Date: 04/09/2020

Approval Expiry Date: Five years from the approval date listed above

The application was APPROVED subject to the following conditions:

Conditions of approval

Please note: this approval is subject to the restrictions laid out in the Policy on research involving human participants in response to COVID19. Therefore all face-to-face contact with human participants for the purpose of research should be halted until further notice; unless the study has received approval from the research ethics group that reviews requests to conduct face to face research, as described in the Policy on face to face research during the pandemic.

All serious adverse events must be reported to the Committee (ethics@liverpool.ac.uk) in accordance with the procedure for reporting adverse events.

If you wish to extend the duration of the study beyond the research ethics approval expiry date listed above, a new application should be submitted.

If you wish to make an amendment to the study, please create and submit an amendment form using the research ethics system.

If the named Principal Investigator or Supervisor changes, or leaves the employment of the University during the course of this approval, the approval will lapse. Therefore it will be necessary to create and submit an amendment form within the research ethics system.

It is the responsibility of the Principal Investigator/Supervisor to inform all the investigators of the terms of the approval.

Kind regards,

Central University Research Ethics Committee A ethics@liverpool.ac.uk

Participant Information Sheet

1. Title of Study

Alcohol use among people with lived experience of a mental health problem

2. Version Number and Date

V4 11th August 2020

3. Invitation Paragraph

You are being invited to participate in a research study. Before you decide whether to participate, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and feel free to ask us if you would like more information or if there is anything that you do not understand. Please also feel free to discuss this with your friends, relatives and GP if you wish. We would like to stress that you do not have to accept this invitation and should only agree to take part if you want to.

Thank you for reading this.

What is the purpose of the study?

This study aims to understand how people with a mental health problem use alcohol, how this has changed since being diagnosed and the reasons for drinking or not drinking. Previous research has shown that those with a more severe mental health problem are more likely to either drink alcohol or abstain but little is known about the reasons for this. The aim of this study is to understand this in more detail through the use of interviews. It is hoped that the findings from this study will provide a better understanding of patterns of alcohol use in individuals with a mental health problem, which can then be used to inform new treatments and suggest changes to current services. If you have any further questions about taking part in this study, please contact Jo-Anne Puddephatt at joannep@liverpool.ac.uk.

4. Why have I been chosen to take part?

You have been chosen to take part because you have:

- A diagnosis of either bipolar disorder, schizophrenia or other psychotic disorder
- Are aged 18 or older
- Do not have a current or had a previous diagnosis of alcohol use disorder in the last two years.

5. Do I have to take part?

No. Your participation in the study is voluntary and you have the right to withdraw from the study at any stage, without explanation.

6. What will happen if I take part?

If you choose to take part in the study, you will be asked to confirm that you meet the inclusion criteria and will then be sent a consent form, via email, to complete and return to the researcher. Once the researcher has received this, they will arrange a date and time to complete the interview which will take place either online or by telephone and you will also be sent a questionnaire about yourself and alcohol use to complete and return by email beforehand. You may have a friend or family member available in another room or by telephone to call if you would like additional support, though this is not mandatory.

The total time to complete the questionnaire and interview will be around one hour. The interview will involve asking questions about your alcohol use or why you don't drink, early experiences of alcohol both before and after receiving your mental health diagnosis. We would like you to be as honest as possible in your responses to the questions and you will be allowed to ask any additional questions at the end of the interview. You do not have to answer any questions if it makes you feel uncomfortable and you may also pause the interview at any time. If at any point during the session you no longer wish to take part in the study, you may do so without providing an explanation. Information provided in the interview will not be shared with other organisations, however, if information discussed involves a risk to either yourself or someone else, the researcher will be obliged to disclose this to the organisation you were recruited from.

The interview will be audio-recorded using a digital dictaphone. This will be used to transcribe what was discussed in the interview for data analysis. We will send you your transcript, via email, to confirm it is an accurate reflection of what was discussed. Once confirmed accurate, the audio recording will be destroyed after the interview has been transcribed and your personal details and any identifying information will be anonymised with a random number, for example participant 1.

7. How will my data be used?

The University processes personal data as part of its research and teaching activities in accordance with the lawful basis of 'public task', and in accordance with the University's purpose of "advancing education, learning and research for the public benefit.

Under UK data protection legislation, the University acts as the Data Controller for personal data collected as part of the University's research. The Principal Investigator, Dr Laura Goodwin, acts as the Data Processor for this study, and any queries relating to the handling of your personal data can be sent to Dr Laura Goodwin (email: Laura.Goodwin@liverpool.ac.uk).

Further information on how your data will be used can be found in the table below.

| | |
|--------------------------------|---|
| How will my data be collected? | Your data will be collected through a questionnaire and a one-to-one interview which will be audio-recorded using a digital dictaphone. |
|--------------------------------|---|

| | |
|---|---|
| <p>How will my data be stored?</p> | <p>All data will be stored on a secure M Drive with your responses to the questionnaire and consent form stored in a locked cupboard at the University of Liverpool.</p> <p>Your audio recording will be destroyed after it has been transcribed and you will be provided the opportunity to read your transcription before it is anonymised to confirm that it is a true reflection of the interview. Your transcript will be sent to you via email and will be password protected. Your transcript will then be stored on a secure M drive.</p> |
| <p>How long will my data be stored for?</p> | <p>Your transcript, questionnaire and consent form will be stored for 10 years in accordance with the University of Liverpool's Research Data Management Policy.</p> |
| <p>What measures are in place to protect the security and confidentiality of my data?</p> | <p>The study itself will take place in a private room or via a secure platform (e.g. Zoom) and only yourself and the researcher will be present. Information discussed in the interview will not be shared with other organisations unless information disclosed provides a risk to yourself or someone else. You will be notified by the researcher if any information will be disclosed with the organisation you were recruited from.</p> <p>All data will be anonymised with a pseudonym, e.g. participant 1. Any identifying data discussed in the interview will be removed. All data will also be stored on secure M drive with responses to questionnaire and your consent form stored in a locked cupboard. Your audio recording will be destroyed once transcribed.</p> |
| <p>Will my data be anonymised?</p> | <p>Your data will be anonymised with a random identification number, e.g. Participant 1, and any identifying information will be removed.</p> |
| <p>How will my data be used?</p> | <p>Your data will be analysed using a qualitative analysis to explore how people with a mental health problem use alcohol and whether this has changed since receiving their mental health diagnosis. Your data will be written up as part of a PhD thesis, academic papers and presented at conferences. Your data may be used to support these findings, however, your personal information will not be used and it will not be possible to identify you in the findings.</p> |
| <p>Who will have access to my data?</p> | <p>The research team (Jo-Anne Puddephatt, Dr Laura Goodwin, Dr Andy Jones and Dr Suzi Gage) will have access to your questionnaire, audio recordings and anonymised transcripts. A professional transcriptionist will also have access to your</p> |

| | |
|--|--|
| | audio recording as this is required for them to transcribe the interview, however, the recording will be sent via a secure link and destroyed once transcribed and confirmed accurate with yourself. |
| Will my data be archived for use in other research projects in the future? | No. |
| How will my data be destroyed? | Your questionnaire and consent form data will be shredded and disposed of in a secure bin at the University of Liverpool. Your audio and interview data will be deleted securely from the M Drive. |

Transferring data outside the EU

Not applicable.

8. Expenses and / or payments

Upon completion of the questionnaire and interview, you will be reimbursed with a £20 Love2Shop voucher for your time and travel.

9. Are there any risks in taking part?

There are not any anticipated major risks to participants, there are possible minor risks which could arise, which include finding some questions uncomfortable to answer. The questions will focus on previous and current alcohol use and reasons drinking or not drinking both before and after receiving your mental health diagnosis which you may find uncomfortable. There are also some questions around early experiences of alcohol use. If at any point you feel uncomfortable or do not want to answer a question, you can let the researcher know and the interview will be paused for a break and you will not be obliged to answer the question. You may have a friend or family member readily available, either in person or telephone, should you need additional support though this is not mandatory. After the interview, if you do have concerns about your alcohol use or mental health we recommend that you speak with your GP and we will also provide details of local and national alcohol and mental health agencies who can offer you help. Below is a list of local agencies, including their opening times.

If you disclose feelings of self-harm or intentions to harm someone else, the interviewer will be obliged to inform the Principal Investigator and the gatekeeper of the organisation you were recruited from within 24 hours of the disclosure. The researcher will notify you of this prior to doing so.

10. Are there any benefits in taking part?

There are no known benefits to taking part in the study, however, your answers will provide an insight into alcohol use among those with a mental health problem and you will be reimbursed for your time and travel.

11. Discussing sensitive or distressing topics

The study will involve discussing your alcohol use and non-use prior to and after receiving your mental health diagnosis which may trigger remembering a specific life event and cause some emotional distress. You do not have to answer any questions that you may be uncomfortable with. If at any point you do become distressed, the researcher will pause the interview to provide time for you to consider whether to continue or withdraw from the study. You may also have a friend or family member in a different room or available on the telephone if you need additional support though this is not mandatory. After the interview, you will be provided with details of local and national alcohol and mental health agencies

While the questions will focus on your alcohol use and non-use prior to and after receiving your mental health diagnosis and your responses will not be shared with others, should you disclose that you are currently feeling suicidal or intend to harm someone, the researcher is obliged to disclose this information to both the Principal Investigator and the gatekeeper you were recruited from. You will be informed if this information will be shared prior to the researcher doing so.

12. What will happen to the results of the study?

The results of the study will form part of a PhD thesis and will be published in an academic journal and presented at conferences. The results will be accessed by academics interested in the research, however, your data will not be identifiable from the results. We will also send you an overview of the findings of the study via email.

13. What will happen if I want to stop taking part?

You can withdraw your participation from the study at any time, without explanation. Unless your results have already been anonymised, your details and data will be destroyed, and no further use made of them. If your results have already been anonymised, unfortunately, it will not be possible to destroy your data.

If you wish to withdraw from the study then please contact Jo-Anne Puddephatt (joannep@liverpool.ac.uk / 0151 794 1109) who will then destroy your data unless it has been fully anonymised and withdrawal will not be possible.

14. What if I am unhappy or if there is a problem?

If you are unhappy, or if there is a problem, please feel free to let us know by contacting Dr Laura Goodwin (0151 795 8730) and we will try to help. If you remain unhappy or have a complaint which you feel you cannot come to us with then you should contact the Research Ethics and Integrity Office at ethics@liv.ac.uk. When contacting the Research Ethics and Integrity Office, please provide details of the name or description of the study (so that it can be identified), the researcher(s) involved, and the details of the complaint you wish to make.

The University strives to maintain the highest standards of rigour in the processing of your data. However, if you have any concerns about the way in which the University processes your personal data, it is important that you are aware of your right to lodge a complaint with the Information Commissioner's Office by calling 0303 123 1113.

If you have any concerns about your alcohol use or mental health, you may contact one of the below organisations for additional support:

Alcohol agencies

Liverpool Community Alcohol Service

Provides support, treatment and advice for people in varying stages of an alcohol dependency.

Website: <http://www.liverpoolalcoholservice.nhs.uk>

Opening hours: Monday-Friday 9:00-17:00

Contact number: 0151 471 7784

Action on Addiction

An abstinence-based recovery programme for individuals and families affected by drug and/or alcohol addiction.

Website: www.actiononaddiction.org.uk

[Opening hours: Mon–Wed 9–8pm, Thur 9am–7pm, Fri 9am–5pm, Sat 9am–2pm, Sun 10am–6pm](#)

Contact number: 0300 330 0659

Person Shaped Support

Provides support to families, young carers and young people affected by drug and alcohol misuse in the family.

Website: www.psspeople.com

Contact number: 0151 702 5555

Alcohol Change UK

Provides support and information about alcohol use in the United Kingdom.

Website: www.alcoholchange.org.uk

Mental health agencies

Talk Liverpool

Provides support for stress, depression and anxiety

Website: <https://www.talkliverpool.nhs.uk/>

Opening hours: Monday to Friday 8:00-18:00

Contact number: 0151 228 2300

Samaritans

Provides confidential support for those in crisis

Website: <https://www.samaritans.org/branches/liverpool/>

Opening hours: All day

Contact number: 0330 094 5717

15. Who can I contact if I have further questions?

If you have further questions with regards to the study, please contact either the Principal Investigator Dr Laura Goodwin: Room 2.31 Eleanor Rathbone Building, Liverpool, L69 7ZA, Laura.Goodwin@liverpool.ac.uk or researcher Jo-Anne Puddephatt, joannep@liverpool.ac.uk.

Contact details of the investigatory team can be found below:

Dr Andy Jones, ajj@liverpool.ac.uk, 0151 794 1120

Dr Suzi Gage, suzi.gage@liverpool.ac.uk, 0151 794 1106

Participant Consent Form (Chapter 7)

Participant consent form

Version number & date: V3 23rd June 2020

Research ethics approval number: TBC

Title of the research project: Alcohol use among people with lived experience of a mental health problem

Name of researcher(s): Jo-Anne Puddephatt, Dr Laura Goodwin, Dr Andy Jones, Dr Suzi Gage

- Please
- initial box
1. I confirm that I have read and have understood the information sheet dated 23rd June 2020 for the above study, or it has been read to me. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.
 2. I understand that I must not take part if I have a current diagnosis of alcohol use disorder or that I have had a diagnosis of alcohol use disorder in the last two years
 3. I understand that taking part in the study involves completing a questionnaire and an audio recorded one-to-one interview.
 4. I understand and agree that my participation will be audio recorded and I am aware of and consent to your use of these recordings for the following purposes: transcription and data analysis.
 5. I understand that my participation is voluntary and that I am free to stop taking part and can withdraw from the study until the point of my transcript being anonymised without giving any reason and without my rights being affected. In addition, I understand that I am free to decline to answer any particular question or questions.
 6. I understand that I can ask for access to the information I provide and I can request the destruction of that information if I wish at any time until the point of my transcript being anonymised. I understand that following anonymisation I will no longer be able to request access to or withdrawal of the information I provide.
 7. I understand that the information I provide will be held securely and in line with data protection requirements at the University of Liverpool until it is fully anonymised.

- 8. I understand that signed consent forms and questionnaire will be retained in a locked cupboard in the Eleanor Rathbone Building and can be accessed by the research team until 22nd June 2030.
- 9. I understand that a transcript of my interview will be retained for 10 years.
- 10. I agree that my information can be quoted in research outputs such as PhD thesis, academic publication and conferences.
- 11. I understand that my responses will be kept strictly confidential. I give permission for members of the research team to have access to my fully anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.
- 12. I understand that if I disclose information of suicidal thoughts or intent to harm someone, the researcher will be obliged to share this information with the Principal Investigator and the organisation I was recruited from.
- 13. I understand that other researchers on the research team may use my words in publications, reports, webpages, and other research outputs, only if they agree to preserve the confidentiality of the information as requested in this form.
- 14. I agree to take part in the above study.

I have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting:

| | | |
|------------------|------|-----------|
| | | |
| Participant name | Date | Signature |

| | | |
|-------------------------------|------|-----------|
| | | |
| Name of person taking consent | Date | Signature |

Principal Investigator
 Dr Laura Goodwin
 2.31 Eleanor Rathbone Building, L69 7ZA
 0151 795 8730
 Laura.Goodwin@liverpool.ac.uk

Student Investigator
 Jo-Anne Puddephatt
 2.80 Eleanor Rathbone Building, L69 7ZA
 0151 794 1109
 joannep@liverpool.ac.uk

Participant Questionnaire (Chapter 7)

Demographic and socioeconomic characteristics

1. What is your gender?
Male Female Non-binary Prefer not to say
2. What is your age range?
18-24 25-34 35-44 45-54 55-64
65+
3. What is your marital status?
Single Married In civil partnership
Separated/divorced

Widowed Living with partner
4. What is your ethnic origin?

White British White other Black British Black other Asian
British

Asian other Mixed British Mixed other Other ethnic origin
5. What is your highest level of education?
 - a. Degree level
 - b. Teaching qualification or HNCHND, BEC/TEC Higher, BTEC higher or NVQ level 4
 - c. A-Levels/SCE Higher or ONC/OND/BEC/TEC not higher or City and Guilds Advanced Final Level NVQ level 3
 - d. O-level passes (Grade A-C if after 1975) or City & Guilds/Ord GCSE (Grades A-C) or NVQ level 2
 - e. CSE grades 2-5 GCE O-Level (Grades D & E if after 1975) GCSE (Grades D, E, F, G) or NVQ level 1
 - f. CSE ungraded
 - g. Other qualifications (specify)
 - h. No qualifications
6. Is your household owner-occupied?
 - a. Yes
 - b. No – rented
 - c. Other
7. Please describe the type of household you currently live in?
 - a. 1 adult, aged 18-59, no children
 - b. 2 adults, aged 18-59, no children
 - c. Small family
 - d. Large family
 - e. Large adult household
 - f. 2 adults, 1 or both aged 60+, no children
 - g. 1 adult, aged 60+, no children
8. What is your mental health diagnosis?

Alcohol Use Disorder Identification Test (AUDIT)

1. In the last 12 months, how often have you had a drink containing alcohol?
 - a. Never
 - b. Monthly
 - c. Two to four times a month
 - d. Two to three times a week
 - e. Four or more times a week
2. How many standard drinks containing alcohol do you have on a typical day when you are drinking? A standard drink is half a pint of beer, a single measure of spirits or a small glass of wine.
 - a. One or two
 - b. Three or four
 - c. Five or six
 - d. Seven, eight or nine
 - e. Ten or more
3. Thinking about your drinking in the last year, how often do you have 6 or more drinks on one occasion?
 - a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly
 - e. Daily or almost daily
4. How often during the last year have you found that you were not able to stop drinking once you had started?
 - a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly
 - e. Daily or almost daily
5. How often during the last year have you failed to do what was normally expected from you because of drinking?
 - a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly
 - e. Daily or almost daily
6. How often during the last year have you need a first drink in the morning to get yourself going after a heavy drinking session?
 - a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly
 - e. Daily or almost daily
7. How often during the last year have you had a feeling of guilt or remorse after drinking?
 - a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly

- e. Daily or almost daily
8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?
- a. Never
 - b. Less than monthly
 - c. Monthly
 - d. Weekly
 - e. Daily or almost daily
9. Have you or someone else been injured as a result of your drinking?
- a. Yes, during the last year
 - b. Yes, but not in the last year
 - c. No
10. Has a relative, a friend, or a doctor or other health worker been concerned about your drinking or suggested you cut down?
- a. Yes, during the last year
 - b. Yes, but not in the last year
 - c. No

Risk Protocol (Chapter 7)

All participants will be provided with a participant information sheet outlining the true aims of the study and that the questions will focus on alcohol use and non-use both prior to and after receiving their mental health diagnosis, therefore, no deception will be made. All participants will be provided with a debrief sheet detailing local and national alcohol and mental health agencies available should they require additional support. The debrief sheet will be provided at the end of the study.

The risk protocol will be implemented if the interviewer becomes concerned about a participant during the interview. These circumstances include but are not restricted to:

- If someone states that they feel uncomfortable answering a question
- If someone discloses that they are currently feeling suicidal
- If they discuss causing injury or harm to someone else

If any of the above events occur, the student investigator will pause the interview and audio-recording and check the welfare of the participant and allow for an initial cool-down period.

If someone states that they feel uncomfortable answering a question, the following will apply:

- They will be reminded that they do not have to answer any questions they are not comfortable with
- After an initial cool-down period and if the participant appears more settled, the student investigator will ask the participant if they wish to continue with the interview. If they agree, the interview will reconvene, and the recording will start. If the participant wishes to terminate the interview, the student investigator will fully debrief the participant and reimburse them with a £20 Love2Shop voucher for their time
- If the participant continues to appear uncomfortable or anxious then the student investigator will recommend that they terminate the interview but that they may have the option to continue on another day if they want to

If someone discloses that they are currently feeling suicidal, the following will apply:

- The student investigator will recommend that they terminate the interview and the participant will be reimbursed with a £20 Love2Shop voucher for their time. The participant will be fully debriefed and provide information on local and national alcohol and mental health agencies
- The student investigator will also explain that they are obliged to disclose this information to the Principal Investigator and gatekeeper of the organisation they were recruited from within 24 hours of the interview taking place

If they discuss causing injury or harm to someone else

- The student investigator will also explain that they are obliged to disclose this information to the Principal Investigator and gatekeeper of the organisation they were recruited from within 24 hours of the interview taking place
- The student investigator will fully debrief the participant and provide information on local and national alcohol and mental health agencies and will reimburse the participant with a £20 Love2Shop voucher for their time.

Additional considerations

Prior to the interview taking place, the researcher will explain that the participant may have a friend or family member available either in another room or over the phone should they require additional support, however, this is not mandatory.

In the event that the participant ends the phone or online interview when the risk protocol has been triggered, the student investigator will attempt to re-contact them to fully debrief them with the aims of the study and provide information about available local and national alcohol and mental health agencies available.

Debrief Sheet (Chapter 7)

Study title: **Alcohol use among people with lived experience of a mental health problem**

Thank you for completing this study. The aim of this study is to explore alcohol use among people with lived experience of a mental health problem, both prior to and after receiving their diagnosis. The current study was informed by previous research which suggests that those with a more severe mental health problem are more likely to be either a drinker or non-drinker but reasons for this are not well understood. After we have completed our analysis, we will write up the findings as part of a PhD thesis, academic paper and submit an abstract to an academic conference. We will also send you a summary of our findings by email.

If you are concerned about your drinking or mental health, we recommend you speak with your GP. Details of other local and national alcohol and mental health agencies can also be found below:

Alcohol agencies

Liverpool Community Alcohol Service

Provides support, treatment and advice for people in varying stages of an alcohol dependency.

Website: <http://www.liverpoolalcoholservice.nhs.uk>

Opening hours: Monday-Friday 9:00-17:00

Contact number: 0151 471 7784

Action on Addiction

An abstinence-based recovery programme for individuals and families affected by drug and/or alcohol addiction.

Website: www.actiononaddiction.org.uk

[Opening hours: Mon–Wed 9–8pm, Thur 9am–7pm, Fri 9am–5pm, Sat 9am–2pm, Sun 10am–6pm](#)

Contact number: 0300 330 0659

Person Shaped Support

Provides support to families, young carers and young people affected by drug and alcohol misuse in the family.

Website: www.psspeople.com

Contact number: 0151 702 5555

Alcohol Change UK

Provides support and information about alcohol use in the United Kingdom.

Website: www.alcoholchange.org.uk

Mental health agencies

Talk Liverpool

Provides support for stress, depression and anxiety

Website: <https://www.talkliverpool.nhs.uk/>

Opening hours: Monday to Friday 8:00-18:00

Contact number: 0151 228 2300

Samaritans

Provides confidential support for those in crisis

Website: <https://www.samaritans.org/branches/liverpool/>

Opening hours: All day

Contact number: 0330 094 5717

We would like to thank you once again for taking part in our study.

Kind Regards,

Jo-Anne Puddephatt, Dr Laura Goodwin, Dr Andy Jones and Dr Suzi Gage

Table S16: COREQ Checklist (Chapter 7)

A checklist of items that should be included in reports of qualitative research. You must report the page number in your manuscript where you consider each of the items listed in this checklist. If you have not included this information, either revise your manuscript accordingly before submitting or note N/A.

| Topic | Item No. | Guide Questions/Description | Reported or Page No. |
|--|----------|---|----------------------|
| Domain 1: Research team and reflexivity | | | |
| Personal characteristics | | | |
| Interviewer/facilitator | 1 | Which author/s conducted the interview or focus group? | 5 |
| Credentials | 2 | What were the researcher's credentials? E.g. PhD, MD | 3-5 |
| Occupation | 3 | What was their occupation at the time of the study? | 3 |
| Gender | 4 | Was the researcher male or female? | 3 |
| Experience and training | 5 | What experience or training did the researcher have? | 3 |
| Relationship with participants | | | |
| Relationship established | 6 | Was a relationship established prior to study commencement? | 4 |
| Participant knowledge of the interviewer | 7 | What did the participants know about the researcher? e.g. personal goals, reasons for doing the research | 4 |
| Interviewer characteristics | 8 | What characteristics were reported about the interviewer/facilitator? e.g. Bias, assumptions, reasons and interests in the research topic | 4 |
| Domain 2: Study design | | | |
| Theoretical framework | | | |
| Methodological orientation and Theory | 9 | What methodological orientation was stated to underpin the study? e.g. | 4-5 |

| | | | |
|------------------------------|----|--|------------|
| | | grounded theory, discourse analysis, ethnography, phenomenology, content analysis | |
| Participant selection | | | |
| Sampling | 10 | How were participants selected? e.g. purposive, convenience, consecutive, snowball | 3 |
| Method of approach | 11 | How were participants approached? e.g. face-to-face, telephone, mail, email | 3 |
| Sample size | 12 | How many participants were in the study? | 3 and 5 |
| Non-participation | 13 | How many people refused to participate or dropped out? Reasons? | 5 |
| Setting | | | |
| Setting of data collection | 14 | Where was the data collected? e.g. home, clinic, workplace | 3 |
| Presence of non-participants | 15 | Was anyone else present besides the participants and researchers? | 4 |
| Description of sample | 16 | What are the important characteristics of the sample? e.g. demographic data, date | 5 and 21 |
| Data collection | | | |
| Interview guide | 17 | Were questions, prompts, guides provided by the authors? Was it pilot tested? | 3-4 and 22 |
| Repeat interviews | 18 | Were repeat inter views carried out? If yes, how many? | 5 |
| Audio/visual recording | 19 | Did the research use audio or visual recording to collect the data? | 4 |

| | | | |
|---------------------------------|----|---|---------|
| Field notes | 20 | Were field notes made during and/or after the inter view or focus group? | 5 |
| Duration | 21 | What was the duration of the inter views or focus group? | 5 |
| Data saturation | 22 | Was data saturation discussed? | 3 and 5 |
| Transcripts returned | 23 | Were transcripts returned to participants for comment and/or correction? | 4 |
| Domain 3: analysis and findings | | | |
| Data analysis | | | |
| Number of data coders | 24 | How many data coders coded the data? | 5 |
| Description of the coding tree | 25 | Did authors provide a description of the coding tree? | 4-5 |
| Derivation of themes | 26 | Were themes identified in advance or derived from the data? | 5 |
| Software | 27 | What software, if applicable, was used to manage the data? | 4-5 |
| Participant checking | 28 | Did participants provide feedback on the findings? | NA |
| Reporting | | | |
| Quotations presented | 29 | Were participant quotations presented to illustrate the themes/findings? Was each quotation identified? e.g. participant number | 6-12 |
| Data and findings consistent | 30 | Was there consistency between the data presented and the findings? | 6-12 |
| Clarity of major themes | 31 | Were major themes clearly presented in the findings? | 6-12 |
| Clarity of minor themes | 32 | Is there a description of diverse cases or discussion of minor themes? | 6-12 |

Interview schedules (Chapter 7)

For current drinkers

Introduction

1. Can you describe when you first started drinking?
 - a. Prompt: how old were you? Who was it with?
2. When do you think your mental health started getting worse?
 - a. Follow-up: At what age did you receive your diagnosis?
3. To what extent do you feel supported in managing your mental health?
 - a. Prompt: Have you got anyone who will listen to your problems?
 - i. If they say an individual, follow up with:
 1. Where do you tend to talk to them about your problems?
 2. Are they a drinker?
 - b. Follow-up: Are there any activities that help you with your mental health?
 - c. NB: This will give some indication of any routes they may have used and I can follow this up at a later stage in the interview

Alcohol use prior to diagnosis

1. Could you describe your drinking prior to receiving your diagnosis?
 - a. Prompt: When would you find yourself drinking? Who with?
 - b. Prompt: Was there a routine to your drinking e.g. drinking on the weekend?
2. Prior to your diagnosis, were there times when you wouldn't drink?
 - a. Prompt: Can you give an example of when this would be?
3. Prior to your diagnosis, how did you feel when you were drinking?
 - a. Prompt: Did you notice any changes in your mood?
4. Prior to your diagnosis, how did you feel in the days after you had been drinking?
 - a. Prompt: Did you experience any changes in your mood?

Alcohol use shortly after receiving diagnosis

5. After you initially received your diagnosis, how would you describe your drinking?
 - a. Prompt: Did this change at all? If so, how come?
6. After you initially received your diagnosis, did you find any aspects of your life change?
 - a. If yes, was there a particular moment when this occurred?
7. After you initially received your diagnosis, were there times when you wouldn't drink?
 - a. If yes, can you give an example of when this would be?
8. After you initially received your diagnosis, how did you feel when you were drinking?
 - a. Prompt: Were there any changes compared to before your diagnosis?

Current alcohol use

9. How would you describe your drinking these days?
 - a. Follow up: Has this changed since the pandemic?
 - b. Follow-up: Can you describe a typical drinking session before the pandemic?
 - c. Does this differ depending on what you're drinking?
 - d. If so, in what way?
10. When would you say you find yourself wanting to drink?
 - a. Prompt: Is it at a certain time of the day, with certain people?

11. How do you feel when you are drinking? Have you ever thought about not drinking altogether?
 - a. Follow-up: Why?
 - b. Prompt: Could you describe things that stop you from having a drink?
12. Have you ever purposely restricted your drinking?
 - a. Follow-up: If so, in what way?

Concluding question

13. Thank you for answering my questions, was there anything else that you wanted to add about your alcohol use that we may have missed?

For non-drinkers

Introduction

1. Can you describe when you started drinking?
 - a. Prompt: how old were you? Who was it with?
 - b. Can you remember how you felt after your first drinking session?
2. When do you think your mental health started getting worse?
 - a. Follow-up: At what age did you receive your diagnosis?
3. To what extent do you feel supported in managing your mental health?
 - a. Prompt: Have you got anyone who will listen to your problems?
 - i. If they say an individual, follow up with:
 1. Where do you tend to talk to them about your problems?
 2. Are they a drinker?
 - b. Follow-up: Are there any activities that help you with your mental health?
 - c. NB: This will give some indication of any routes they may have used and I can follow this up at a later stage in the interview
4. When did you stop drinking?
 - a. Follow-up: Was this before or after receiving your diagnosis?

Alcohol use prior to diagnosis

5. Could you describe your drinking prior to receiving your diagnosis?
 - c. Prompt: When would you find yourself drinking? Who with?
 - d. Prompt: Was there a routine to your drinking e.g. drinking on the weekend?
6. Prior to your diagnosis, were there times when you wouldn't drink?
 - a. Prompt: Can you give an example of when this would be?
7. Prior to your diagnosis, how would you feel when you were drinking?
 - a. Prompt: Did you notice any changes in your mood?
8. Prior to your diagnosis, how would you feel in the days after you had been drinking?
 - a. Prompt: Did you experience any changes in your mood?

Alcohol use shortly after receiving diagnosis

9. After you initially received your diagnosis, how would you describe your drinking?
 - e. Prompt: Did this change at all? If so, how come?
10. After you initially received your diagnosis, did you find any aspects of your life change?
 - a. If yes, was there a particular moment when this occurred??

11. After you initially received your diagnosis, were there times when you wouldn't drink?
 - a. If yes, can you give an example of when this would be?
14. After you initially received your diagnosis, how did you feel when you were drinking?
 - a. Prompt: Were there any changes compared to before your diagnosis?

Current non-drinking habits

12. What prompted you to stop drinking?
 - a. Follow-up: How did you go about stopping drinking e.g. gradual decrease or stopped completely?
 - b. Follow-up: If not mentioned, did your mental health influence your decision?
13. Do you ever find yourself wanting to drink?
 - a. Follow-up: If yes, when do you find this happens?
 - b. Follow-up: Has this changed since the pandemic?
14. Could you describe things that help stop you from having a drink?
 - a. Prompt: are there certain places where you're less likely to drink?
15. How would you describe other people's reactions when you tell them you don't drink?
 - a. Follow-up: Does it differ between different people?

Concluding question

16. Thank you for answering my questions, was there anything else that you wanted to add about your alcohol use that we may have missed?

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