HHS Public Access

Author manuscript

Drug Alcohol Depend. Author manuscript; available in PMC 2016 November 01.

Published in final edited form as:

Drug Alcohol Depend. 2015 November 1; 156: 176–183. doi:10.1016/j.drugalcdep.2015.09.007.

Smoking, Posttraumatic Stress Disorder, and Alcohol Use Disorders in a Nationally Representative Sample of Australian Men and Women

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Abstract

Background—Posttraumatic stress disorder (PTSD) and alcohol use disorders (AUDs) often co-occur with smoking and tobacco use disorders. Each of these disorders is known to have negative health consequences and impairment independently, but little is known about the impact of their co-occurrence. The aim of the present study is to examine the prevalence, correlates, order of onset, and impact of co-occurring daily smoking, PTSD, and AUDs.

Method—The 2007 Australian National Survey of Mental Health and Wellbeing (2007 NSMHWB) was a nationally representative survey of 8,841 Australians. The survey assessed for 12-month DSM-IV mental disorders; the age respondents first started smoking daily, experienced a traumatic event, or developed problems with alcohol; and self-reported mental and physical health and impairment.

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Conflict of Interest: Nothing declared

Results—There were systematic patterns of co-occurrence between daily smoking, PTSD, and AUDs. Daily smoking and problems with alcohol use tended to develop after first trauma exposure, which is broadly consistent with the self-medication hypothesis. Daily smoking, PTSD, and AUDs were also associated with additive negative effects on mental and physical health and functioning, after controlling for demographics.

Conclusions—Smoking, PTSD, and AUDs commonly co-occur in this nationally representative sample of Australian men and women, and this comorbidity was associated with greater severity of mental and physical health problems and impairment in several areas of functioning. This study highlights the importance of identifying and eliminating these patterns of co-occurrence, potentially through integrated interventions.

Keywords

PTSD; alcohol use disorders; smoking; comorbidity

1. INTRODUCTION

Tobacco use in the form of cigarette smoking is a leading cause of preventable disease, morbidity, and mortality worldwide (US Department of Health and Human Services (USDHHS), 2004; World Health Organization, 2008) and remains a serious health problem despite recent declines in prevalence (King et al., 2012; National Center for Health Statistics, 2007). Approximately 18 per cent of U.S. adults (Centers for Disease Control and Prevention, 2009) and more than 3.5 million Australians smoke (Lawrence et al., 2009). Individuals who smoke incur substantially increased risk for a host of problems including cancer, stroke, heart disease, arthritis, and blindness, among others (DHHS, 2014). Thus, the importance of understanding correlates of smoking behaviours, and their interrelationships, cannot be overstated (Moodie et al., 2008).

Mental health and substance use disorders are among the most salient predictors of smoking and tobacco use disorders (Anthony and Echeagaray-Wagner, 2000; Degenhardt and Hall, 2001; Hitsman et al., 2009). For example, individuals who meet diagnostic criteria for a mental health disorder smoke at nearly twice the rate of those who do not (Lawrence et al., 2009). Lawrence and colleagues (2009) also found that among adult smokers, approximately one third have a past year mental health diagnosis and those with greater psychological distress smoke a greater number of cigarettes per day. Furthermore, the prevalence of smoking is approximately three to four times higher among individuals with a substance use disorder (SUD) compared to the general population (Grant et al., 2004; Sobell et al., 2002). Collectively, this literature suggests that understanding the association between specific mental health and substance use disorders and smoking is critical to identifying pathways to smoking cessation treatment (Prochaska, 2011).

Among mental health disorders, posttraumatic stress disorder (PTSD) has been identified as a particularly salient predictor of smoking (Feldner et al., 2007; Fu et al., 2007; Lawrence et al., 2010). Recent analysis of the 2007 National Survey of Mental Health and Wellbeing (NSMHWB) revealed that 7% of the Australian general population met DSM-IV criteria for a lifetime diagnosis of PTSD and 4% met criteria for current (12-month) PTSD (Chapman et

al., 2012). Approximately half of individuals with PTSD have been found to report daily smoking (Feldner et al., 2007), making smoking twice as prevalent among individuals with PTSD compared to the general population (Acierno et al., 2000; Hapke et al., 2005; Lasser et al., 2000). Individuals with PTSD also incur a greatly increased risk of smoking relapse following a quit attempt (Zvolensky et al., 2008). Indeed, this co-occurrence is so common that integrated treatments are being developed and implemented to mitigate PTSD and smoking concurrently (Feldner et al., 2013).

Abundant literature also indicates that alcohol use disorders (AUDs) and smoking are strongly related. Compared to non-smokers, smokers are more than three times as likely to meet diagnostic criteria for an AUD (McKee et al., 2007). Alcohol consumption is known to increase rates of smoking (McKee et al., 2006), and smoking is known to increase alcohol consumption (Barrett et al., 2006). Approximately 35% of individuals with an AUD also meet criteria for tobacco use disorder (Grant et al., 2004). That prevalence rises to approximately 80% among individuals seeking treatment for AUDs (Kalman et al., 2010). The combination of smoking and AUDs is particularly malignant, as morbidity and mortality associated with co-occurrence versus singular use of alcohol and tobacco use disorders is substantially higher (Marrero et al., 2005; Pelucchi et al., 2006).

Of significant concern is the growing literature demonstrating the common co-occurrence of PTSD and AUD, and the increased risk of smoking and other harms associated with this comorbidity. An examination of the Australian general population revealed that individuals with PTSD are 5 times more likely to be suffering from co-occurring AUDs compared to those without PTSD (Mills et al., 2006). The self-medication hypothesis has been used to explain this common co-occurrence, asserting that individuals may use substances to mitigate negative thoughts and emotions typically associated with their PTSD symptoms (Feldner et al., 2007; Khantzian, 1997; Morissette et al., 2007; Sher and Grekin, 2007). Studies illustrate that PTSD typically precedes AUDs among individuals with comorbidity, and that trauma exposure and PTSD typically precede smoking onset (Breslau et al., 2004; Hanna and Grant, 1999; Jamal et al., 2011). In addition, individuals with PTSD commonly self-report using substances to relieve their PTSD symptoms (Leeies et al., 2010). Smoking is prominently noted in the literature as one such substance: studies have documented proximal associations such that trauma cues can elicit smoking withdrawal symptoms (Beckham et al., 1996) and that a reduction in PTSD-related distress follows tobacco use (Beckham et al., 2008).

Given the independent associations between smoking, PTSD, and AUDs, and the common co-occurrence of PTSD and AUDs, it is likely that this comorbidity is associated with an increased risk of smoking and related harms. Indeed, some studies among U.S. samples indicate increased smoking behaviours and smoking onset among individuals with psychiatric disorders such as PTSD and AUDs (Vlahov et al., 2002). However, to our knowledge no study has examined the co-occurrence of smoking, PTSD, and AUDs in a nationally representative Australian sample, or the impact of this co-occurrence on adverse health consequences and impairment. Doing so is critical because comorbidities such as those between mental health and substance use disorders are known to result in more negative health and treatment outcomes compared to single diagnoses (Back et al., 2000;

Mills et al., 2006; Petrakis et al., 2011; Teesson et al., 2010). It remains unknown if more complex comorbidities, particularly among multiple disorders known to have negative health outcomes independently, result in worse health outcomes. The present study aims to address this gap in the literature. Specifically, the aims of this study are to examine: 1) the prevalence and demographic correlates of co-occurring daily smoking, PTSD, and AUD; 2) the order of onset of daily smoking and self-reported problems with alcohol in relation to trauma exposure; and 3) the associations between daily smoking, PTSD, and AUD diagnoses on general mental and physical health status and associated disability.

2. METHODS

2.1 Participants

The 2007 NSMHWB was a national face-to-face survey conducted by the Australian Bureau of Statistics (Australian Bureau of Statistics, 2007) and commissioned by the Australian Government Department of Health and Ageing. As detailed in Slade and colleagues' (2009) summary of the survey, 14,805 participants aged between 16 and 85 years were randomly selected using a stratified, multi-stage probability design to represent the Australian population. The present study includes the full sample of 8,841 respondents, which represented a 60% response rate.

2.2 Assessment

A structured questionnaire was administered to all participants. Selected current (past 12-month) mental disorders were assessed using the World Health Organisation version of the Composite International Diagnostic Interview (CIDI) designed for the World Mental Health (WMH) Survey Initiative (Kessler and Üstün, 2004). The WMH-CIDI assessed diagnostic criteria for common affective, anxiety and substance use disorders. The NSMWHB also assessed the level of impairment, use of health services, physical conditions, social networks and caregiving, as well as demographic and socio-economic characteristics.

Twelve-month diagnoses of PTSD and AUDs (abuse or dependence) were derived using standard WMH-CIDI algorithms accounting for hierarchical diagnostic rules consistent with the Diagnostic and Statistical Manual of Mental Disorders (4th edition, text revision; American Psychiatric Association, 2000). These diagnoses reflect a lifetime diagnosis with symptoms presenting in the past year. Individuals who reported consuming at least 12 standard drinks in any 12-month period and drank a minimum of three standard drinks on at least one occasion during this period were screened into the diagnostic section for AUDs.

Frequency of current tobacco consumption was assessed in a module on health risk factors included in the NSMHWB 2007. In the present study, smoking status was coded dichotomously as either daily smoker or social/non-smoker to operationalise tobacco use disorders. Ages of onset used in the present study were a) age first started smoking daily b) age when first experienced problems with alcohol use, and c) age when first traumatic event was experienced.

Demographic items included as covariates in analyses included age, gender, marital status (married or not), welfare status (currently receiving welfare benefits as primary income or

not), and education level (highly qualified or not). Participants with school qualifications, and with non-school qualifications up to and including a Certificate IV (i.e., Australian Qualifications Framework [AQF] Levels 1–4) were classified as the "not highly qualified" group, and those with qualifications at or above an Advanced Diploma or Diploma (i.e., AQF Levels 5–10) were classified as "highly qualified". This distinction was made based on the AQF, which lists Level 5 as the first level where graduates are deemed to have skills for paraprofessional work (Australian Qualifications Framework Council, 2013).

Self-reported physical health was measured using one item with a five-point Likert scale from Excellent (1) to Poor (5). General mental health was operationalised as: self-reported mental health on a scale from Excellent (1) to Poor (5); the presence of suicidal thoughts, plans, and/or attempts in the past 12 months ('suicidality'; coded as yes/no); and general psychological distress (assessed using the Kessler Psychological Distress Scale [K10; Kessler et al., 2002] with a possible range of 10–50 [Andrews and Slade, 2001]). Disability days were measured as the number of non-disorder specific days out of role in the past 30 days.

2.3 Data Analysis

The data were weighted for age and sex according to the most recent Australian national census. Replicate weights and the jackknife repeated replication technique were utilised to correct the standard errors and significance tests for unequal probability of selection due to the complex sampling design. A series of analyses were conducted to fulfil the aims of the present study: 1) Weighted prevalence estimates and standard errors were calculated to examine the prevalence and demographic characteristics of groups who smoked daily, met criteria for an AUD, and/or met criteria for PTSD. Logistic regressions were also run to examine the odds of co-occurrence of these groups, controlling for age and sex, and group demographic characteristics were compared with non-group members using adjusted Wald and chi-square distribution tests. 2) Weighted proportion estimates were calculated to investigate patterns in the order of onset of daily smoking, self-reported problems with alcohol, and trauma exposure. 3) A series of linear and logistic regressions were performed to examine the associations between daily smoking, AUDs, and PTSD with current mental and physical health and associated disability. After the main effects of these pathologies were tested, interaction effects were also explored. These regressions were controlled for potentially confounding factors, including age, gender, marital status, education level, and welfare status (Mills et al., 2006).

Analyses were conducted using Stata/IC 13.1 for Windows. Responses of "Don't know" were coded as missing and excluded from relevant analyses. A conservative alpha of .01 was used for all analyses, to account for the large sample size. All regression models reported reached significance at $p < .001$.

3. RESULTS

3.1 Prevalence and co-occurrence of PTSD, AUD, and smoking

Table 1 shows weighted prevalence estimates and standard errors of daily smoking, AUDs, and PTSD. Daily smoking was the most prevalent pathology, followed by PTSD and AUDs,

respectively. The rates of co-occurrence were consistently higher than chance. For example, daily smoking, AUDs and PTSD co-occur in .3% of the population (representing an estimated 43,813 Australians), which is ten times higher than chance. Overall, 29.3% of people with PTSD were daily smokers and 11.7% had a concurrent AUD. An overlap between these two groups was also evident: 6.2% of people with PTSD both smoked daily and had an AUD. After adjusting for age and sex in logistic regression, people with PTSD were 2.0 (95% confidence interval [CI] 1.43–2.73) times more likely to smoke daily, 3.9 (95% CI 2.01–7.21) times more likely to have an AUD, and 5.7 (95% CI 2.79–11.60) times more likely to both smoke every day and have an AUD, compared to people without PTSD. Of the people who met criteria for a 12-month AUD, 37.4% were daily smokers and 11.9% had co-occurring PTSD; they were 2.4 (95% CI 1.76–3.20) times more likely to smoke daily, and 3.4 (95% CI 1.84–6.40) times more likely to have a PTSD diagnosis, compared to those without an AUD. Similarly, of the respondents who smoked daily, 8.9% had an AUD and 7.0% had co-occurring PTSD. This made them 2.6 (95% CI 1.93–3.49) times more likely to have an AUD, and —as mentioned above— 2.0 (95% CI 1.43–2.73) times more likely to have a PTSD diagnosis, compared to those who did not smoke daily. These high rates of co-occurrence demonstrate a systematic pattern of comorbidity among daily smoking, PTSD, and AUDs in Australians.

3.2 Demographic correlates of group membership

The demographic correlates of group membership are shown in Table 1. Men were more likely to smoke daily and/or have an AUD, but tended to be less likely to meet diagnostic criteria for PTSD, compared to women. All those who smoked daily, had an AUD, and/or met criteria for PTSD were significantly younger than the rest of the population. Groups that included smokers tended to have lower education levels. People who smoked daily and/or met criteria for PTSD were more likely to have pensions as their primary source of income, whereas people with AUDs were less likely to rely on pensions, compared to the rest of the population.

3.3 Order of onset

An estimated 74.6% (standard error [SE] = 0.69%) of the population (representing 11 950 410 Australians) reported a traumatic experience in their lifetime. The mean age for first trauma exposure was 14.7 years (SE = .46); it was 16.7 years (SE = .15) for starting smoking daily, and 22.5 years (SE = .36) for developing problems with alcohol. Of those who experienced a traumatic event, 18.4% (95% CI 16.80–20.10) were smoking daily before the first traumatic event occurred, and 28.6% (95% CI 26.98–30.17) started smoking daily after first exposure to trauma. In relation to problems with alcohol use, 5.6% (95% CI 4.59–6.57) of those who had experienced a traumatic event had pre-existing problems with alcohol use and 18.6% (95% CI 17.19–19.90) reported the onset of alcohol problems after first trauma exposure. Experience of first trauma coincided with the onset of daily smoking for 2.0% (95% CI 1.55–2.48) of respondents and with the development of problems with alcohol for 1.2% (95% CI 0.84–1.66) of respondents. In short, daily smoking and problems with alcohol use were more likely to develop after first trauma exposure, rather than before exposure, and this pattern was particularly pronounced for problems with alcohol use.

3.4 Effects of PTSD, AUDs, and daily smoking on wellbeing

3.4.1 General Mental Health

3.4.1.1 Self-reported mental health: After adjusting for demographic characteristics in linear regression, daily smoking, PTSD, and AUDs were all independently associated with worse self-reported mental health (see Table 2). Holding other factors equal, PTSD was associated with the largest decrements in self-reported mental health (.71 points, or 17.8%), followed by AUDs (.45 points, or 11.3%), and daily smoking (.24 points, or 6.0%). However, none of the two-way or three-way interactions were significant. Increasing age, being unmarried, and receiving welfare as a primary source of income were also significantly related to poorer self-reported mental health.

3.4.1.2 Suicidal ideation and attempts: After adjusting for demographic characteristics in logistic regression, a 12-month PTSD diagnosis was related to 5.5 times higher odds of suicidality, and a 12-month AUD diagnosis was related to 3.1 times higher odds (see Table 3). Daily smoking was not significantly related to suicidality, and none of the two-way or three-way interactions were significant. Being unmarried and receiving welfare as a primary source of income were also related to higher odds of suicidality in the past 12 months.

3.4.1.3 Psychological Distress: After adjusting for demographic characteristics in linear regression, daily smoking, PTSD, and AUDs were all independently associated with greater psychological distress (see Table 4). Holding the other variables equal, PTSD was associated with the greatest psychological distress (5.06 points, or 12.7% higher), followed by AUDs (2.36 points, or 5.9% higher), and daily smoking (1.29 points, or 3.2% higher). None of the two-way or three-way interactions were significant. Being younger, female, unmarried, and receiving welfare as a primary source of income were also related to higher psychological distress.

3.4.2 Physical Health—After adjusting for demographic characteristics in linear regression, daily smoking, PTSD, and AUDs were all independently associated with poorer self-reported physical health (see Table 5). Holding the other factors equal, PTSD was associated with the poorest physical health (.42 points or 10.5% lower), although daily smoking and AUDs had similar effects (.29 points or 7.3%, and 27 points or 6.8%, respectively). None of the two-way or three-way interactions were significant. Being older, receiving welfare as a primary source of income, and not being highly qualified were also related to poorer physical health.

3.4.3 Disability—After adjusting for demographic characteristics in linear regression, a 12-month PTSD diagnosis was related to 3.2 additional disability days per month, on average; daily smoking was associated with .7 additional days out of role, on average (see Table 6). The effect of a 12-month AUD diagnosis did not reach significance, and none of the two-way or three-way interactions were significant. Receiving welfare as a primary source of income was also related to an increase of 2.2 disability days per month, on average.

4. DISCUSSION

Taken together, the results of the present study show a pattern of systematic comorbidity among daily smoking, PTSD, and AUDs that negatively impacts mental and physical health and functioning. The paired comorbidity rates among smoking, PTSD, and AUDs were consistent with other population studies (Acierno et al., 2000; Grant et al., 2004; McKee et al., 2007; Mills et al., 2006), although groups including smokers tended to be smaller than previous studies have found (e.g., Feldner et al., 2007). This was likely due to the high frequency of smoking (i.e., daily) used to represent group membership in the present study, in combination with the decreasing smoking rates in Australia in recent years (Australian Bureau of Statistics, 2012).

Daily smoking, PTSD, and AUDs were more common in younger adults, and groups that included smokers tended to have lower levels of education. This suggests that substance use prevention programs and tobacco control programs should target young people, as they are most at risk for smoking. Indeed, in the U.S., state-level tobacco control programs were associated with substantial declines in several smoking-related behaviours among youth, including susceptibility, initiation, current smoking, and established smoking (Farrelly et al., 2013). Other effective strategies to reduce smoking among young people include web-based interventions (Simmons et al., 2013), technology-assisted interventions (Newman et al., 2011), and school/university-based interventions (Hutton et al., 2011; Lechner et al., 2012). Collectively, this literature indicates that young people incur different risk factors for smoking and have different levels of access to intervention (e.g. via technological literacy and educational settings) compared to older populations. Thus, different modes of intervention may prove effective in reducing and preventing smoking behaviour. Given that earlier age of onset of smoking results in greater lifetime nicotine dependence (Hu et al., 2006), targeting smoking interventions for Australian youth remains a critical treatment priority.

Trauma exposure preceded the development of daily smoking and alcohol-related problems in a substantial proportion of respondents. One explanation for this finding could be the self-medication hypothesis, particularly for problems with alcohol use, which were three times less likely to develop before versus after trauma exposure. However, it is important to note that the mean age for first trauma exposure was younger than the mean age for daily smoking initiation or developing problems with alcohol use, which has the potential to artificially inflate this effect. A substantial minority of respondents who experienced trauma also had pre-existing problems with alcohol (6%) and/or were smoking daily (18%) before exposure to trauma, which was consistent with studies that have found that substance use can precede exposure to trauma and the development of PTSD (Read et al., 2012; Witkiewitz et al., 2012). It is possible for these individuals that intoxication and high-risk behaviours associated with substance misuse increases the likelihood of exposure to trauma, therefore increasing the risk for developing PTSD (Stewart et al., 1998). In interpreting these findings regarding order of onset, it is also important to note that the large majority of the sample reported experiencing a traumatic event, so we would not necessarily expect to see systematic patterns of substance abuse associated with trauma. Despite this, it was important to examine trauma exposure rather than PTSD diagnosis in the order of onset

analyses because studies have found that SUDs are independently related to trauma (Cottler et al., 2001; Feldner et al., 2007), and a focus on PTSD would ignore this effect.

Daily smoking, PTSD, and AUDs had additive negative effects on mental and physical health, as well as associated disability in this sample: PTSD was independently related to poorer self-reported mental and physical health, greater psychological distress, higher odds of suicidality, and more disability days; AUDs represented an additional burden for all of these domains (with the exception of disability days); and daily smoking further impacted all domains (with the exception of suicidality). Daily smoking, PTSD, and AUDs were all associated with similar reductions in physical health. With regards to mental health, PTSD was consistently associated with the strongest effects — as expected— but AUDs also had substantial impact, and smoking was associated with small but significant additional decrements for self-reported mental health and distress. All of the disorders had independent negative effects, but the present study did not find any significant interaction effects between the disorders. While the absence of interaction effects suggest that the occurrence of multiple disorders does not amplify their individual effects, the high rates of systematic comorbidity and corresponding additive effects of multiple diagnoses highlights the importance of identifying and reducing these patterns of co-occurrence. These relationships should be further examined in future studies using alternative methods, such as longitudinal data —to take into account the order of onset of the disorders — or structural equation modelling— to better understand the structure of the interrelationships between the disorders.

The high rates of co-occurrence and negative associated disability outcomes in this sample have several treatment and policy implications. Screening for each of these problems concurrently in medical and primary care settings is essential to identify and address treatment needs. Research from substance use disorder literature clearly indicates that when PTSD symptoms remain untreated, effective intervention for either problem remains elusive (Back et al., 2006a, 2006b, 2014; Mills et al., 2012). Medical settings already screening for smoking behaviours may also include trauma exposure and alcohol use screenings to more effectively target referrals for patients. Similarly, brief motivational interventions to enhance treatment motivation for smoking and its precipitating causes may be beneficial in medical settings. Individuals already engaging in behavioural interventions for PTSD or AUDs are also prime candidates for smoking cessation treatment, however, existing evidence-supported treatments for these problems, both individually and concurrently, do not typically include smoking cessation components. One recent study documented the efficacy of treating PTSD and smoking concurrently with promising outcomes (Feldner et al., 2013). Modifying such integrated treatments to apply also to those with co-occurring AUDs is an important direction for future treatment development research. Examining and implementing these screening, referral, and treatment policies in social service outlets such as those utilized by individuals incurring disability may also be beneficial.

While examining gender differences in the co-occurrence of PTSD, AUD, and smoking was not a primary goal of this study, existing literature clearly demonstrates that women are more prone to trauma exposure and PTSD compared to men, and that co-occurring substance use disorders tend to present with a more challenging course of treatment and

associated disabilities (e.g. HIV risk, homelessness, suicidality) among women (Back et al., 2015; Cohen and Hien, 2014; Hourani et al., 2015; Meyer et al., 2011). Thus, it is important for future studies to examine in greater detail the possible influence of gender on the onset, course, and treatment for co-occurring PTSD, AUD, and smoking.

4.1 Limitations

The aforementioned findings should be considered in light of some limitations. Firstly, the NSMHWB 2007 was limited to only people residing in private dwellings. Therefore more severe presentations of PTSD and/or substance use within treatment facilities or transient populations, for example, may not have been captured by the survey. Secondly, the present study relies solely on self-report. It is possible that participants' responses may have been subject to recall bias, particularly in relation to age of onset of smoking, trauma, and alcohol problems. Similarly, in relation to AUD, it has been posited that individuals who abuse substances are less likely to report accurately in household surveys due to fear of stigmatisation (Hall et al., 2000; Hitsman et al., 2009). However, other studies have found the self-report of substance use among individuals with SUD to be valid and reliable (Darke, 1998; O'Farrell et al., 2003). Thirdly, as previously mentioned, the use of daily smoking to represent group membership may have contributed to the comparably lower prevalence rates of smoking in the present study. Lastly, the data analysed in the present study is cross-sectional and therefore conclusions regarding causality cannot be reliably determined.

Considering that trauma exposure in the absence of PTSD may not predict smoking risk or behaviours (Breslau et al., 2003), future studies should aim to distinguish between the effects of trauma exposure, PTSD, and AUDs on smoking behaviours. Future examinations using longitudinal data could better tease out order of onset associations and examine the various ways in which smoking, PTSD and AUDs are related over time. For example, prospective longitudinal epidemiological studies could help to explicate the underlying mechanisms of the comorbidity, and studies that include ecological momentary assessment could explore the proximal relationships. Future studies should also examine the role of other illicit substance use disorders in these relationships, such as cannabis use disorder, given that cannabis use is linked with tobacco and alcohol problems (Wagner and Anthony, 2002)

4.2 Conclusions

This is the first epidemiological investigation of the prevalence and correlates of co-occurring smoking, PTSD, and AUDs in the Australian general population. Findings indicated that smoking, PTSD, and AUDs commonly co-occur in this nationally representative sample of Australian men and women. This co-occurrence was associated with greater severity of mental and physical health problems and impairment in several areas of functioning. Given the serious health problems associated with smoking, it is critical to understand the relationships between smoking and mental health and substance use related correlates. Our findings emphasise the need to develop integrated treatments to address smoking, mental health symptoms, and SUDs concurrently. This would enable providers across drug and alcohol and mental health services to implement evidence-based, integrated smoking interventions for their clients.

Acknowledgments

Role of Funding Source: This research was supported in part by The National Institute on Child Health and Human Development and the Office of Research on Women's Health (K12HD055885; PI: Brady).

Macquarie University, Faculty of Human Science Visiting International Research Fellowship for supporting collaboration within this team. The National Survey of Mental Health and Well Being was funded by the National Health Branch of the Commonwealth Department of Health and Aged Care, Under the National Mental Health Strategy. It was conducted by the Australian Bureau of Statistics.

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Highlights

- Daily smoking, PTSD, and alcohol use disorders (AUDs) had high rates of comorbidity
- Trauma exposure tended to precede daily smoking and problems with alcohol
- Smoking, PTSD, and AUDs had additive negative effects on mental and physical health
- Comorbid smoking, PTSD, and AUDs are associated with impairment and poor wellbeing

Drug Alcohol Depend. Author manuscript; available in PMC 2016 November 01.

Table 1

Prevalence and correlates of daily smoking, 12-month DSM-IV AUD, and/or with 12-month DSM-IV PTSD diagnosis (N = 8840).

Group	Proportion of Population	Male	Age in years	Highly Qualified	Pensions as primary source of income
Population (Full NSMHWB)	**-**	**49.7% (.01)**	**44.3 (.04)**	**31.3% (.43)**	**22.5% (.38)**
Daily smoking	18.2% (.65%)	55.5% (1.73)**	41.0 (.50)**	20.7% (1.72)**	27.1% (1.62)**
PTSD	4.4% (.26%)	31.7% (3.52)**	40.8 (.92)**	32.5% (3.10)	35.5% (4.22)**
AUD	4.3% (.31%)	68.3% (3.39)**	31.9 (1.04)**	24.2% (3.46)	16.2% (2.55)*
Smoking and AUD	1.6% (.18%)	68.6% (5.25)**	31.5 (1.13)**	14.6% (3.68)**	23.7% (4.15)
Smoking and PTSD	1.3% (.16%)	35.4% (5.14)*	36.9 (1.43)**	20.4% (4.99)	36.4% (6.37)*
PTSD and AUD	.5% (.13%)	49.7% (12.08)	34.9 (3.20)**	19.7% (15.37)	36.4% (11.89)
Smoking, PTSD and AUD	.3% (.08%)	50.2% (13.11)	29.87 (2.36)**	1.9% (2.12)**	35.5% (11.87)

Note. Weighted estimates using jackknife replicate weights of proportions (SE) or mean (SE). People can be included in more than one group. Highly qualified = Certificate IV or higher.

** $p < .005$,

* $p < .05$ for weighted adjusted Wald and chi-square distribution tests that compare group members (e.g., daily smokers) to non-members (e.g., people who do not smoke daily). “Don’t know” responses were coded as missing and consequently excluded.

Table 2

Linear regression of self-reported mental health (n = 8840)

Variable	*B(SE)*	95% Confidence Interval	*t*	*p*
Constant	**1.72 (.038)**	**1.65 – 1.80**	**45.90**	**<.0005**
Age in years	**.007 (.001)**	**.01 – .01**	**10.00**	**<.0005**
Gender	.001 (.028)	−.05 – .06	0.05	.958
Marital status	**−.096 (.035)**	**−.17 – −.03**	**−2.78**	**.007**
Welfare status	**.32 (.037)**	**.24 – .39**	**8.65**	**<.0005**
Education level	−.06 (.356)	−.14 – .01	−1.78	.080
12-month PTSD	**.71 (.098)**	**.52 – .91**	**7.29**	**<.0005**
12-month AUD	**.45 (.098)**	**.26 – .65**	**4.64**	**<.0005**
Daily smoking	**.24 (.034)**	**.17 – .30**	**7.04**	**<.0005**

	F	*df*	*p*
Model Fit *F*			
	66.29	**8, 52**	**<.0005**

Note. Higher scores indicate worse mental health. Reference category for gender = male, marital status = unmarried, welfare status = primary income source is not welfare, education level = not highly qualified, 12-month PTSD = no diagnosis, 12-month AUD = no diagnosis, daily smoking = not a daily smoker. Bolded where alpha <.01. “Don’t know” responses were coded as missing and consequently excluded.

Table 3

Logistic regression of suicidality in the past 12 months (n = 8841)

Variable	*OR(SE)*	95% Confidence Interval	*t*	*p*
Constant	**.02 (.004)**	**.01 – .03**	**−17.22**	**<.0005**
Age in years	.99 (.005)	.98 – 1.00	−1.73	.089
Gender	1.34 (.297)	.86 – 2.09	1.33	.188
Marital status	**.44 (.109)**	**.27 – .72**	**−3.31**	**.002**
Welfare status	**2.22 (.446)**	**1.48 – 3.32**	**3.96**	**<.0005**
Education level	1.29 (.271)	.85 – 1.97	1.23	.223
12-month PTSD	**5.51 (1.207)**	**3.55 – 8.54**	**7.79**	**<.0005**
12-month AUD	**3.12 (.922)**	**1.73 – 5.64**	**3.85**	**<.0005**
Daily smoking	1.60 (.352)	1.03 – 2.49	2.14	.036

	F	*df*	*p*
Model Fit *F*	**24.51**	**8, 52**	**<.0005**

Note. Reference category for gender = male, marital status = unmarried, welfare status = primary income source is not welfare, education level = not highly qualified, 12-month PTSD = no diagnosis, 12-month AUD = no diagnosis, daily smoking = not a daily smoker. Bolded where alpha <. 01.

Table 4

Linear regression of psychological distress (n = 8839)

Variable	*B(SE)*	95% Confidence Interval	*t*	*p*
Constant	**14.77 (.239)**	**14.29 – 15.25**	**61.84**	**<.0005**
Age in years	**−.03 (.004)**	**−.04 – −.02**	**−7.85**	**<.0005**
Gender	**.80 (.172)**	**.46 – 1.15**	**4.67**	**<.0005**
Marital status	**−.51 (.182)**	**−.87 – −.14**	**−2.79**	**.007**
Welfare status	**1.92 (.194)**	**1.53 – 2.31**	**9.89**	**<.0005**
Education level	.09 (.172)	−.25 – .44	0.55	.586
12-month PTSD	**5.06 (.603)**	**3.86 – 6.27**	**8.39**	**<.0005**
12-month AUD	**2.36 (.578)**	**1.20 – 3.52**	**4.09**	**<.0005**
Daily smoking	**1.29 (.256)**	**.78 – 1.80**	**5.03**	**<.0005**

	F	*df*	*p*
Model Fit *F*	**47.69**	**8, 52**	**<.0005**

Note. Higher scores indicate greater psychological distress. Reference category for gender = male, marital status = unmarried, welfare status = primary income source is not welfare, education level = not highly qualified, 12-month PTSD = no diagnosis, 12-month AUD = no diagnosis, daily smoking = not a daily smoker. Bolded where alpha <.01. “Don’t know” responses were coded as missing and consequently excluded.

Table 5

Linear regression of self-reported physical health (n = 8841)

Variable	*B(SE)*	95% Confidence Interval	*t*	*p*
Constant	**2.03 (.044)**	**1.94 – 2.12**	**46.24**	**<.0005**
Age in years	**.01 (.001)**	**.01 – .01**	**11.10**	**<.0005**
Gender	−.05 (.034)	−.12 – .02	−1.42	.160
Marital status	.02 (.033)	−.05 – .09	0.60	.551
Welfare status	**.34 (.035)**	**.27 – .41**	**9.58**	**<.0005**
Education level	**−.13 (.030)**	**−.19 – −.07**	**−4.33**	**<.0005**
12-month PTSD	**.42 (.066)**	**.29 – .55**	**6.35**	**<.0005**
12-month AUD	**.27 (.074)**	**.12 – .42**	**3.65**	**.001**
Daily smoking	**.29 (.044)**	**.20 – .38**	**6.57**	**<.0005**
Model Fit *F*	*F*	*df*		*p*
	69.73	**8, 52**		**<.0005**

Note. Higher scores indicate poorer physical health. Reference category for gender = male, marital status = unmarried, welfare status = primary income source is not welfare, education level = not highly qualified, 12-month PTSD = no diagnosis, 12-month AUD = no diagnosis, daily smoking = not a daily smoker. Bolded where alpha <.01.

Table 6

Linear regression of days out of role in the past 30 days (n = 8833)

Variable	*B(SE)*	95% Confidence Interval	*t*	*p*
Constant	.59 (.224)	.14 – 1.04	2.64	.011
Age in years	.01 (.004)	.00 – .02	2.50	.015
Gender	.09 (.165)	−.24 – .42	0.55	.586
Marital status	−.04 (.154)	−.35 – .27	−0.25	.801
Welfare status	**2.23 (.249)**	**1.73 – 2.73**	**8.93**	**<.0005**
Education level	.07 (.128)	−.19 – .32	0.52	.606
12-month PTSD	**3.22 (.473)**	**2.28 – 4.17**	**6.82**	**<.0005**
12-month AUD	.90 (.473)	−.04 – 1.85	1.91	.061
Daily smoking	**.72 (.244)**	**.23 – 1.04**	**2.94**	**.005**
Model Fit *F*	*F*	*df*		*p*
	21.44	**8, 52**		**<.0005**

Note. Reference cat for gender = male, marital status = unmarried, welfare status = primary income source is not welfare, education level = not highly qualified, 12-month PTSD = no diagnosis, 12-month AUD = no diagnosis, daily smoking = not a daily smoker. Bolded where alpha <.01. “Don’t know” responses were coded as missing and consequently excluded.