

Alcohol use and mental health symptoms in female firefighter recruits

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Background	Limited research suggests that female firefighters report problem drinking at higher rates than the general population.
Aims	To identify longitudinal drinking patterns in female firefighters, make comparisons to male firefighters and examine problem drinking in relation to post-traumatic stress disorder (PTSD) and depression.
Methods	Study participants included 33 female and 289 male firefighter recruits, who were assessed over their first 3 years of fire service.
Results	Female firefighters consumed increasing numbers of drinks per week, with a median of 0.90 drinks per week at baseline, and 1.27 drinks in year 3. Female firefighters reported binge drinking at high rates, with nearly half bingeing at least once per year across all time points (44–74%). The percentage that reported binge drinking three or more times per month doubled over the course of the study (from 9% to 18%). Overall, males reported higher rates of binge drinking and a greater number of drinks per week; however, binge drinking rates among females increased over time and became comparable to rates of binge drinking among males. A greater percentage of female than male firefighters met the criteria for problem drinking by year 1. Problem drinking was associated with screening positive for PTSD at year 1 and depression at year 2, but not with occupational injury.
Conclusions	Over time, female firefighters reported increasing amounts of drinking, more frequent binge drinking and more negative consequences from drinking. These findings along with existing literature indicate female firefighters change their drinking in the direction of their male counterparts.
Key words	Alcohol drinking behaviour; depression; female firefighters; occupational injury; PTSD.

Introduction

The career demands placed on firefighters have consequences both physical and behavioural [1,2]. Depression [3], post-traumatic stress disorder (PTSD) [4] and substance use disorders (SUDs) [5], particularly, alcohol use disorder (AUD), are prevalent behavioural health concerns facing firefighters, due in part to repeated trauma exposure and occupational stress [1].

Haddock *et al.* [6] surveyed alcohol use patterns among career and volunteer firefighters and found that alcohol use and binge drinking occurred at high rates. Using US National Institute of Alcohol Abuse and Addiction (NIAAA) guidelines, 85% of professional firefighters reported alcohol use in the last month and 56% reported engaging in at least one binge drinking episode a month, where binge is defined as greater than four drinks for women and five for men, in about 2 h [6]. This

Key learning points

What is already known about this subject:

- Firefighters' reported binge drinking is over three times that of the general population, and 40–61% of female firefighters reported binge drinking at least once a month.
- Female firefighter problem drinkers are more likely than male firefighter problem drinkers to experience an occupational injury, be diagnosed with depression or have symptoms of PTSD.
- Although cross-sectional literature suggests that female firefighters reported problem drinking at high rates, these drinking patterns have not been studied longitudinally.

What this study adds:

- Overall, males reported higher rates of binge drinking; however, binge drinking rates among females increased over time and became comparable to males by the end of the study.
- Initially, more male firefighters reported problem drinking; however, more female firefighters reported problem drinking at years 1, 2 and 3.

What impact this may have on practice or policy:

- Differences in drinking patterns for male and female firefighters should be considered when developing prevention and intervention programmes for the fire service, as acculturation within the fire service could account for increasing female drinking patterns.

is over three times greater than the estimated 17% of the US adult population that engages in binge drinking [7].

The existing literature is largely based on male firefighters, with female firefighters often being excluded from research due to the small number of females in departments, and the inability to produce meaningful results from a small sample size [8]. However, female firefighters represent 7% of the entire US fire service, and these numbers are increasing [9]. As such, it is critical to address the lack of literature exploring the effects of firefighting among females. Of particular concern within the fire service are rates of binge and problem drinking specifically among female firefighters, where problem drinking is defined as a score of ≥ 2 on the CAGE questionnaire [1,6]. Noor *et al.* [10] reported female US firefighters endorsing similar alcohol abuse symptoms (32%) as their male counterparts (31%). However, within a sample of 31 female career and volunteer firefighters, Jahnke *et al.* [8] found that 89% of US female career firefighters ($n = 18$) reported consuming alcohol, 61% reported at least one binge drinking episode (per NIAAA classifications) and 22% reported three or more binge drinking episodes in the past 30 days. In a larger cross-sectional online survey of 1913 female career firefighters, Haddock *et al.* [11] found that 40% of female firefighters binge drank in the past month. Of those who drank, 17% screened positive for problem drinking as defined by participants scoring ≥ 2 on the CAGE, and problem drinkers were 2.5 times more likely to be diagnosed with depression or have symptoms of PTSD. Importantly, problem drinking female firefighters were 40% more likely to be injured on the job than non-problem drinkers [11].

These limited studies point to the need for further research on patterns of drinking among female firefighters.

The knowledge base so far has come from cross-sectional research. The present study followed a sample of 33 female firefighters with no major mental health or SUDs at the time of the baseline assessment through their first 3 years of fire service, along with their male colleagues. We hypothesized that female firefighter recruits would report binge drinking substantially less than their male counterparts at the baseline assessment but converge over time due to women conforming to the normative drinking levels established by male peers. Finally, we hypothesized that female firefighters endorsing problem drinking would be at elevated risk for PTSD, major depressive disorder and occupational injury.

Methods

As part of a larger National Institute of Health funded longitudinal research project (R01-MH-73808), 322 firefighter recruits from seven urban fire departments across the USA were followed from the academy through their first 3 years of fire service. Participants were excluded if they (i) were pregnant (due to constraints on active duty), (ii) had plans to relocate within 2 months of study initiation, (iii) had a history of psychotic symptoms or suicidal behaviour within the past 30 days, (iv) were currently dependent on substances other than tobacco or caffeine, (v) met criteria for current PTSD or other current mental health disorders or (vi) had previous professional fire service experience. All consented participants completed the academy and went on to be employed. Face-to-face interviews were conducted prior to graduating from the fire training academy (baseline) and at the end of each of the first 3 years of service (year 1, year 2 and year 3). Assessment clinicians included six licensed psychologists and five post-doctoral fellows.

All assessors had extensive training in assessing PTSD and SUDs. The Texas A&M University Institutional Review Board, Baylor Scott & White Research Institute Institutional Review Board, the VA Boston Healthcare System Institutional Review Board and Boston Medical Center and Boston University Medical Campus Institutional Review Board approved all procedures.

Self-reported and clinical interview measures were selected in keeping with the Diagnostic and Statistical Manual for Mental Disorder, 4th Edition, Revised (DSM-IV-R) criteria, as the study began in 2006. The CAGE questionnaire is made up of four yes or no questions that gauge if participants ever (i) feel as though they should cut down on drinking, (ii) feel annoyed by others criticism of their drinking, (iii) feel guilty about their drinking and (iv) require an 'eye-opener' first thing in the morning. If a respondent answers yes to two or more questions they are considered at risk for dependent drinking [12]. Previous cross-sectional analysis of the CAGE assessment has shown it to be a good predictor of hazardous drinking or problem drinking with good sensitivity and specificity [13].

The Beck Depression Inventory—Primary Care (BDI-PC) [14] is a seven-item self-report measure with questions drawn from the BDI-II and is used to assess DSM-IV-Text Revision [15], criteria for major depressive disorder. Each item is rated on a four-point scale that ranges from 0 to 3 (0 = not at all, 3 = all the time) with a possible total of 21. Total scores of ≥ 5 indicate a positive depression screen. The BDI-PC has demonstrated high internal consistency, with Cronbach's alpha values ranging from 0.85 to 0.88 [14,16]. The BDI-PC was administered at baseline and annually. Scores were highly skewed (mean skewness = 3.32; range = 2.56–4.99). Internal consistency in this study ranged from $\alpha = 0.71$ to 0.94.

The PTSD Checklist—Civilian Version (PCL-C) [17] is a 17-item self-report measure that corresponds to DSM-IV-TR PTSD symptoms. Participants answer questions about the extent to which they were bothered by symptoms in the past month from 1 (not at all) to 5 (extremely) with a possible total of 17–85. Total scores of ≥ 33 indicate a positive PTSD screen. The PCL-C has acceptable test-retest reliability ($r = 0.92$) and high internal consistency ($\alpha = 0.92$ – 0.96) [18,19]. The PCL-C was administered at baseline and annually. Scores were highly skewed (mean skewness = 3.32, range = 2.56–4.99). Internal consistency in this study ranged from $\alpha = 0.87$ to 0.96.

The Firefighter Work Environment questionnaire (Gulliver *et al.*, unpublished measure) is an 11-item self-report measure that ascertains whether a firefighter has experienced serious and potentially traumatic life events during their shifts. This measure was modelled after the Trauma History Questionnaire [20] and was administered annually. For the purpose of this study the yes or no question 'Have you been injured yourself in the line of duty?' was used to determine workplace injury.

The Form 90 AIR/ED—Alcohol Intake Revised [21] is a 45-item, clinician-administered measure assessing alcohol use. Good to excellent reliability was demonstrated for alcohol consumption and psychosocial functioning [21]. This measure was administered at baseline for the 90 days preceding fire academy and for the time since the last interview at each annual time point. A standard drink (USA) is defined as 12 fluid ounces of 5% alcohol beer which converts to 8–9 fluid ounces of malt beverage (7% alcohol), 5 fluid ounces of table wine (12% alcohol) and 1.5 fluid ounces of distilled spirits (40% alcohol) [22]. Standard drinks (USA) convert to 1.77 units for beer, 1.86 units for malt beverages, 1.77 units for table wine and 1.77 units for distilled spirits [23].

The Timeline Followback (TLFB) [24] uses a calendar-based format to gather retrospective estimates of daily drinking [25]. The test-retest reliability for the TLFB is strong across multiple populations ($r = 0.88$ – 0.96) [24]. Consistent with NIAAA guidelines, we defined binge drinking as having four or more drinks in one episode for females and five or more drinks in one episode for males [26]. This measure was administered at baseline to assess the 90 days preceding fire academy and annually to assess the time since the last interview.

Data analysis, including frequencies and descriptive statistics, was conducted using SPSS version 23. Odds ratios and Figure 1 data were analysed in R. In Figure 1 median numbers of drinks by sex and time are plotted and a 95% confidence interval was generated using a percentile bootstrap (5000 resamples) around the median for each time point [27].

Results

Table 1 depicts the sample characteristics. Of firefighter recruits, 90% (289) were male and 10% (33) were female. Female recruits were slightly older ($M = 28.36$ years, $SD = 5.37$) than males ($M = 27.15$ years, $SD = 4.16$). Most female and male firefighters were Caucasian (82% and 78%, respectively). Demographics were similar to that of the fire service in the USA [9]. Retention in the sample was as follows: year 1: 24 (73%), year 2: 23 (70%) and year 3: 22 (67%), which was higher than for males: year 1: 180 (62%), year 2: 152 (53%) and year 3: (51%). If a participant missed an assessment time point, every effort was made to re-establish contact at the remaining time points. Thus, some participants remained in the study, even if not all measures were completed at each assessment time point.

Within the female sample, firefighters reported an increasing number of drinks per week, with a median of 0.90 drinks per week at baseline and a median of 1.27 drinks per week in year 3 (see Figure 1). Most female firefighters reported monthly alcohol use throughout the first 3 years of fire service (62–68%). Nearly half of female firefighters reported binge drinking at least once per

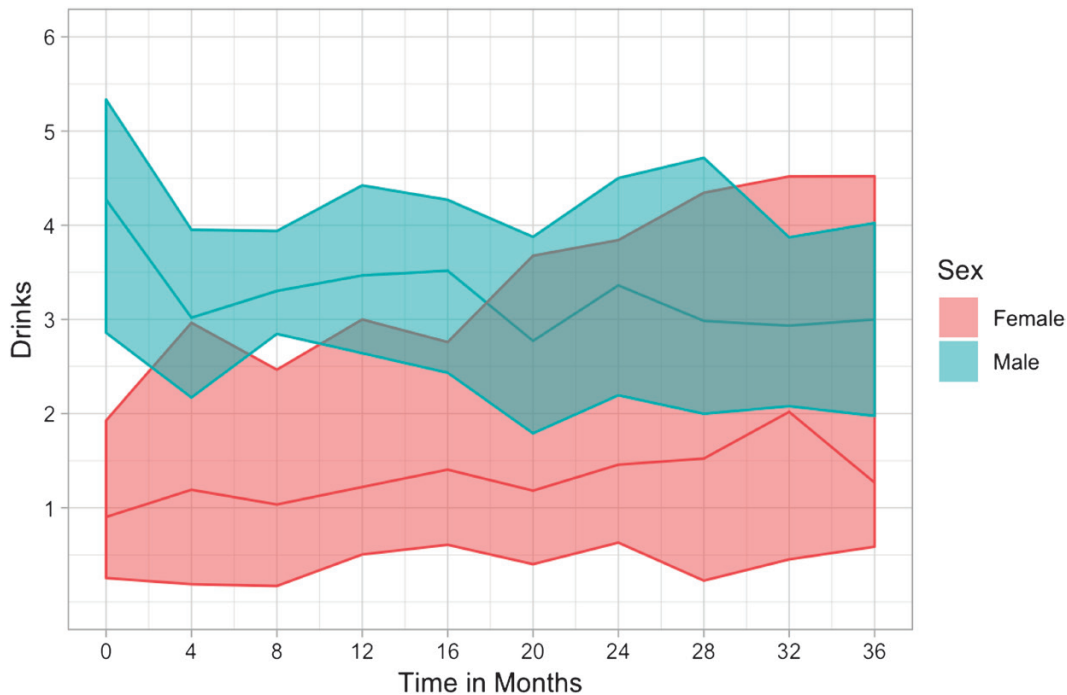


Figure 1. Median drinks per week for male and female firefighters, surrounded by a 95% percentile-bootstrapped CI (5000 resamples).

year across all time points (44–74%) and an increasing percentage also reported binge drinking three or more times per month (baseline: 9%; year 3: 18%). See [Table 2](#) for detailed rates of drinking and binge drinking.

Overall, a larger percentage of males engaged in at least one binge drinking episode in the past year (72–79%) and engaged in three or more binge drinking episodes in the past month (25–34%) when compared to female firefighters. However, while the percentage of male firefighters engaging in three or more binge drinking episodes in the past month decreased slightly over time in fire service, an increasing percentage of females reported binge drinking three or more times per month over the same time period, see [Table 2](#). Male firefighters initially met criteria for problem drinking, defined as screening positive on the CAGE, at higher numbers than female firefighters (14% versus 3%); however, a greater percentage of female firefighters reported meeting criteria for problem drinking at year 1 (25% versus 7%), year 2 (13% versus 7%) and year 3 (9% versus 4%), see [Table 2](#). [Figure 1](#) shows median drinks per week for the first 3 years of fire service. In general, male drinking levels began higher but converged with females' drinking levels over time (3.00 drinks per week for males at year 3; 1.27 drinks per week for females at year 3).

[Table 3](#) presents associations between problem drinking and screening positive for depression, PTSD and occupational injury among female firefighters. As hypothesized, problem drinking was associated with a positive PTSD screen at year 1 ($P < 0.05$) and a positive depression screen at year 2 ($P < 0.05$), though not at the other years. These associations were consistent

with the entire sample of firefighters, including males [1]. Contrary to our hypothesis, occupational injury and problem drinking were not related at any time point.

Discussion

Our hypothesis that female firefighter recruits would differ meaningfully from their male counterparts on binge drinking at the baseline assessment but converge over time was supported. Female firefighters' drinks per week increased over time, as did the percentage of females who binge drank per year, and the percentage of females who binged three or more times per month. Male drinking rates stayed constant. Rates of problem drinking among female firefighters surpassed that of male firefighters by the end of year 1. Our second hypothesis that female firefighters endorsing problem drinking would be more likely to screen positive for PTSD, depression or occupational injury was partially supported. We observed an association between problem drinking and positive PTSD screen at year 1 and depression at year 2. Such associations are found in prior studies with a range of populations. There are few data on such associations in female firefighters. No association was observed between binge drinking and occupational injury, contrary to prior literature [11].

Rates of binge drinking three or more times per month doubled among female firefighters during the first 3 years of fire service (9–18%), whereas rates among males decreased (34–25%). Rates of binge drinking at least once per year increased among females (44–65%) to rates comparable to that of males beginning fire service (72%).

Table 1. Baseline demographic characteristics

Characteristic	Female (<i>n</i> = 33) <i>n</i> (%)	Male (<i>n</i> = 289) <i>n</i> (%)	All participants (<i>n</i> = 322) <i>n</i> (%)
Age (mean, years ± SD)	28.36 ± 5.37	27.15 ± 4.16	27.26 ± 4.31
White/Caucasian	25 (76)	216 (75)	241 (75)
Hispanic or Latino	4 (12)	47 (16)	51 (16)
Marital status			
Never married	23 (70)	187 (65)	210 (65)
Separated	2 (6)	4 (1)	6 (2)
Divorced	3 (9)	11 (4)	14 (4)
Married	5 (15)	84 (29)	89 (28)
Years of education (mean, years ± SD)	15.09 ± 1.94	14.37 ± 1.92	14.45 ± 1.93
Military veteran	2 (6)	70 (24)	72 (22)

SD, standard deviation. Data presented as *n* (%), except where otherwise noted. Percentages may not add up to 100 due to rounding.

Table 2. Patterns of alcohol consumption among firefighters

	Form 90/TLFB			CAGE		
	<i>n</i>	Mean % drank alcohol in past month ^a	% binge drank in past year	Mean % binge drank ≥3 times in past month ^a	<i>n</i>	Problem drinking <i>n</i> (%)
Female						
Baseline	32	65	44	9	33	1 (3)
Year 1	24	62	58	8	24	6 (25)
Year 2	23	62	74	20	23	3 (13)
Year 3	17	68	65	18	22	2 (9)
Male						
Baseline	283	80	72	34	287	41 (14)
Year 1	190	75	78	26	180	14 (8)
Year 2	158	75	78	28	153	11 (7)
Year 3	145	75	79	25	148	6 (4)

^aMean percent for past month presented for each year because past month drinking was assessed for every month over the past year at each annual assessment. Baseline mean percent is the average of the percent per month during the 3 months preceding fire academy.

Acculturation within the fire service could account for differing drinking patterns between male and female firefighters. Firefighters may use alcohol to cope with the strenuousness of work [8]. Female firefighters, possibly already facing discrimination, may partake in binge drinking to conform to the fire service culture [25]. In a preliminary survey of female firefighters, garnering the acceptance of male colleagues was a considerable obstacle female firefighters faced [25]. Since then, females have joined the fire service at a steady rate [9]. While the International Association of Fire Fighters, the International Association of Fire Chiefs and other organizations have worked to address gender disparity, 34% of female firefighters still report gender discrimination [28].

Drinking rates in this sample of female firefighters were lower than those found in prior cross-sectional surveys, but higher than that of the general population [7]. Across all time points, lower percentages of

females reported alcohol consumption within the past month compared to Jahnke *et al.*'s sample (62–68% versus 89%) [8]. However, in years 2 and 3 the percentage of females reporting binge drinking episodes increased to levels near those found in Jahnke *et al.*'s [8] sample (18–20% versus 22%) and in years 1 and 2 the percentage of females screening positive for problem drinking exceeded that of firefighters in Haddock *et al.*'s [11] sample (13–25% versus 17%). Firefighters in Haddock *et al.*'s [11] sample had an average of 13.7 years of fire service experience. It is possible that the trends seen in this study would continue, leading to rates comparable to those observed in prior research with more seasoned firefighters. Firefighters were excluded from this study if they screened positive for any Axis I disorder at baseline, whereas prior studies used unselected samples. This likely contributed to the lower rates of drinking that we observed relative to prior studies.

Table 3. Problem drinking, depressive symptoms, PTSD symptoms and occupational injury among female firefighters

	Year 1				Year 2				Year 3			
	CAGE screen		Odds ratio	95% CI	CAGE screen		Odds ratio	95% CI	CAGE screen		Odds ratio	95% CI
	Positive (%) <i>n</i> = 6	Negative (%) <i>n</i> = 18			Positive (%) <i>n</i> = 3	Negative (%) <i>n</i> = 20			Positive (%) <i>n</i> = 2	Negative (%) <i>n</i> = 20		
Depression screen	16.67	5.56	3.40	0.18–64.69	66.67	0.00 ^b	65.00*	2.04–2069.99	0.00	10.00	1.48	0.05–40.58
PSTD screen	50.00	5.56	17.00*	1.30–223.15	33.33	15.00	2.83	0.19–41.99	0.00	20.00	0.73	0.03–18.18
Occupational injury	20.0 ^a	16.67	1.25	0.10–15.50	33.33	20.00	8.00	0.57–111.96	0.00	30.00	0.45	0.02–10.67

CI, confidence interval. The Haldane–Anscombe correction was used to calculate odds ratios and CIs for cells containing zero observations as recommended by Lawson (2004).

^aFive firefighters screened positive on CAGE screen and completed occupational injury questions at year 1.

^bNineteen firefighters screened positive on CAGE screen and completed depression symptoms questionnaire at year 2.

**P* < 0.05.

Although our sample did not consistently show that problem drinkers were more likely to screen positive for PTSD or depression across all time points, as was the case in a previous study [11], female firefighters in our sample still reported problem drinking and psychiatric concerns. While problem drinking was only statistically significantly associated with screening positive for PTSD at year 1 and depression at year 2, relationships at other time points trended the expected direction. However, the small sample size led to a low level of precision of the odds ratios.

To our knowledge, this is the first longitudinal study of alcohol use among female firefighters. Methodological strengths included the use of a prospective longitudinal design, a clinician-administered measure of alcohol use and psychometrically strong self-report measures. We also enrolled a sample of psychopathology-free firefighters at baseline in order to conduct an examination of the effects of entry into a high-risk occupation on negative mental health and substance-related outcomes independent of the effects of pre-existing psychiatric problems.

The study also had limitations. The small sample, although it was comparable to prior cross-sectional studies of female firefighters and was larger, percentage-wise, than the proportion of female firefighters [8,9]. Attrition further decreased power. Given that firefighter recruits with Axis I diagnoses at the time of fire academy were ineligible, the sample is representative of female firefighters without diagnosable levels of psychopathology at entry into the profession. Additionally, it is possible that our data produced a biased retention effect as opposed to a differential rate of alcohol misuse since dropout rates in our study are associated with the reduced rate of binge drinking episodes in male firefighters.

This study's results demonstrate the importance of considering gender when addressing drinking within the

fire service. This is important for clinicians to consider when developing a treatment plan for women in fire service. The possibility of acculturation presents implications for drinking interventions within this population where social factors appear to exert powerful buffering and potential risks [29]. For example, lower levels of perceived social support were found to predict risk for mental health and AUD symptoms in firefighters [29]. The extent to which the perceived availability of social support in fire service is intertwined with environments in which problematic alcohol use occurs and expectations to engage in drinking appear to warrant investigation. Further research should aim to determine the implications of these findings in terms of fire service policy.

Further work on time-in-service and the relationship between trauma exposure and drinking over time is needed for clarity regarding substance use and behavioural health in firefighter recruits. Future longitudinal studies of female firefighters should attend to problematic alcohol use over time, the bi-directional nature of alcohol use and symptoms of distress, as well as mechanisms that may account for longitudinal changes.

Funding

National Institute of Mental Health (R01-MH-73808 to S.B.G.).

Acknowledgements

The authors would like to thank the International Association of Fire Fighters and the leadership of the participating Fire Departments for their support of this project. This work was supported by and used the facilities at VA Boston Healthcare System, VA VISN 17 Center of Excellence for Research on Returning War Veterans, Boston University, Texas A&M University Health Science Center and Baylor Scott & White

Health. Special thanks to research assistants Jessica Dupree and Jordan Strack for their help in finalizing the manuscript.

Competing interests

None declared.

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