



# HHS Public Access

Author manuscript

*Subst Abus.* Author manuscript; available in PMC 2021 January 01.

Published in final edited form as:

*Subst Abus.* 2020 ; 41(4): 456–462. doi:10.1080/08897077.2019.1671944.

## Exploration of the Association of Selected Pain Diagnoses with Risky Alcohol Use among Active Duty Soldiers

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### Abstract

**Background:** Pain and its consequences remain of concern, particularly in high-risk occupations such as the military. Alcohol is a legal and accessible means of self-medication, and risky alcohol use is associated with potentially serious consequences. This exploratory analysis aimed to better understand the association of selected pain diagnoses with risky alcohol use among soldiers returning from deployment.

**Methods:** Analysis of data from active duty soldiers returning from Afghanistan or Iraq deployments in fiscal years 2008–2011 who completed Department of Defense health questionnaires after deployment (n= 267,100). Each questionnaire included self-reported alcohol consumption and items yielding AUDIT-C screening scores. Military Health System data were used to identify diagnoses of pain-related conditions.

**Results:** About 70% of soldiers had none of the selected pain diagnoses either pre- or post-deployment. 10% had incident pain diagnoses (only post-deployment), 7% had persistent pain diagnoses (both pre- and post-deployment), and 13% had remitted pain diagnoses (only pre-deployment). On the AUDIT-C, 39% screened positive for at-risk drinking and 6% were likely to have severe alcohol problems. Half of the respondents reported any binge drinking; 20% at least monthly binge drinking. Logistic regression analyses found reduced odds of risky alcohol use post-deployment in association with incident and persistent pain diagnoses, compared to no pain diagnoses pre- or post-deployment.

**Conclusions:** Pain diagnoses, binge drinking, and risky alcohol use were prevalent among this sample of Army soldiers. An inverse relationship was found between pain diagnosis (incident, persistent) and risky alcohol use post-deployment. Attention should continue to be paid to risky alcohol use in this population, yet these exploratory findings do not suggest that soldiers with the pain diagnoses used in this study are at greater risk. Combat exposure, traumatic brain injury, and psychological health were more important predictors, and should continue to warrant enhanced alcohol screening.

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**Author Contributions:** SR developed the research questions and plan for this paper, and led analyses, interpretation, and writing of the manuscript. RSA participated in development, analysis, interpretation and writing. GAR oversaw the analyses, participated in interpretation, and reviewed the manuscript. MJL led the overall study from which these data were drawn, and participated in development, analysis, interpretation and writing for these analyses.

**Declarations of Interest:** The authors declare no conflicts of interest.

## Keywords

military personnel; pain; alcohol drinking; alcohol-related disorders

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## INTRODUCTION

The presence of pain and its consequences remains a great concern. People in occupations such as the military or construction are at higher risk for painful injuries and conditions.<sup>1-3</sup> Persistent pain that limits a military member's ability to function in their job, or requires opioids, can be career-ending. To ensure force readiness, the Department of Defense (DoD) issued an instruction that military members who are non-deployable for 12 consecutive months because of pain or opioid prescriptions will be processed for military separation.<sup>4</sup>

People with pain have heightened use of alcohol and other substances; recent reviews consider causal mechanisms that include self-medication/negative reinforcement, stress responses, and analgesic properties of alcohol.<sup>5,6</sup> The relationship between alcohol and pain may depend on prior levels of drinking or pain severity and/or interference.<sup>6,7</sup> Further, pain and substance use disorders commonly co-occur.<sup>5,6,8</sup> People with pain who have substance use disorders are at higher risk for relapse,<sup>9,10</sup> and people with reduced pain after substance use treatment are less likely to relapse.<sup>8</sup>

To date, studies about alcohol and pain have focused on populations that have low levels of baseline drinking, are in treatment for substance use disorders, or do not have chronic pain; little is known about whether pain drives alcohol use – risky or otherwise – in other populations.<sup>5,6,11</sup> Earlier identification of potential alcohol problems that are related to pain would enable more effective interventions before the alcohol problems become severe.

Risky alcohol use is prevalent among military members.<sup>12,13</sup> Since mandatory drug tests discourage the misuse of prescription pain relievers or illicit drug use, alcohol may be used to self-medicate for pain.<sup>14</sup> It remains unknown whether risky alcohol use and alcohol-related problems, such as binge drinking, are more common among soldiers with pain than those without pain. If this proves true for military members, enhanced screening for alcohol problems and earlier interventions would be beneficial to reduce consequences of alcohol misuse for military members and military readiness.

This paper explored the following questions in a population of post-deployment soldiers: What is the association of pain-related diagnoses with 1) alcohol consumption, and 2) with binge drinking and risky drinking? These findings are intended to offer guidance regarding the risk for alcohol problems and the need for enhanced alcohol screening among soldiers with pain-related conditions.

## METHODS

The Substance Use Psychological Injury Combat (SUPIC) study is a population-based, observational study of U.S. Army soldiers who returned from an Afghanistan or Iraq

deployment. Data used for this study is from the cohort returning during fiscal years 2008-2011. The rationale, methods and sample are described elsewhere.<sup>15</sup>

### Data Sources

Analyses relied on existing self-reported screening data (e.g., combat exposure, alcohol use) from the DoD's post-deployment health surveillance program: (1) the Post-Deployment Health Assessment (PDHA) completed within 60 days of the end of deployment, and (2) the Post-Deployment Health Re-Assessment (PDHRA) completed on average 4.5 months post-deployment. Medical record diagnoses for pain-related conditions, pre-deployment alcohol use disorder, and filled opioid prescription medications were from the Military Health System Data Repository.

### Sample

From the SUPIC active duty cohort (n=434,986), we selected soldiers who completed the PDHA questionnaire that was matched to the index deployment and completed a follow-up PDHRA questionnaire (n=267,100). Description of this sample is available elsewhere.<sup>16</sup>

### Variables

**Alcohol Outcome Measures.**—The PDHRA includes self-reported alcohol quantity and frequency questions: “How many drinks containing alcohol do you have on a typical day when you are drinking?” (1-2, 3-4, 5-6, 7-9, 10 or more), and, “How often do you have a drink containing alcohol?” (never, monthly or less, 2-4 times a month, 2-3 times a week, 4 or more times a week). The time frame for these items is not specified.

We adapted quantity-frequency (QF) measures from military and civilian literature,<sup>17-19</sup> and created a self-reported alcohol consumption variable with 5 drinking categories: abstainer (no drinking days per month), light alcohol use (1-2 drinks per day, regardless of drinking frequency), moderate alcohol use (3-4 drinks per day, regardless of drinking frequency, or 5-6 drinks per day no more than 2-3 times per week), heavy-infrequent alcohol use (7 or more drinks per day, monthly or less), and heavy-frequent alcohol use (5-6 drinks per day, 4 or more times per week, or 7 or more drinks per day at least 2-4 times per month).

From the self-reported item, “How often do you have 6 or more drinks on one occasion?” (never, less than monthly, monthly, weekly, daily; not gender-specific), we created two dichotomous variables: any binge drinking and binge drinking at least monthly, each coded as 0=no (binge drinking or monthly binge drinking, respectively) and 1=yes.

Alcohol risk was measured from the AUDIT-C score items in the PDHRA.<sup>20-23</sup> Two dichotomous measures were created, one for a positive screen for at-risk drinking (AUDIT-C 4 for men, 3 for women), and the other indicating a high likelihood for severe alcohol problems (AUDIT-C 8 for men or women).<sup>24</sup> Each was coded as 0=no (not at-risk or severe) and 1=yes. By definition, “severe” on the AUDIT-C is a subset of “at-risk”.

**Pain Measures.**—We used a previously constructed pain-related diagnosis variable based on ICD-9 diagnostic codes from soldiers' inpatient and outpatient claims for selected pain-

related conditions (e.g., chronic pain, headache/migraine, back pain, nerve pain, unspecified joint pain, generalized pain, and cancer-related pain). Arthritis and some musculoskeletal pain-related diagnoses (e.g., shoulder) were excluded from this existing variable. A four-category variable was then created to indicate presence of pain diagnoses in the 1 year before and 90 days following deployment: no pain diagnosis (neither time period), remitted pain (presence of pain diagnoses before deployment, but not post-deployment), incident pain (presence of pain diagnoses post-deployment, but not before), and persistent pain (both before and post-deployment).

**Covariates.**—Demographic data (gender, race/ethnicity, marital status, age, education, and whether the soldier has dependent children) and military characteristics (rank/paygrade, any prior deployments, and length of the index deployment) were included.

Covariates from the PDHA included self-report about the index deployment (ever restricted to quarters or assigned light duty due to painful conditions; count (0 to 3) of combat exposures that were included on the PDHA [encountered dead bodies or seen people killed or wounded, engaged in direct combat where discharged a weapon, felt were in great danger of being killed]); positive screen for traumatic brain injury (TBI);<sup>16,25</sup> poor physical health in the past 4 weeks; and positive screens for mental health problems in the past month (PTSD<sup>26-28</sup> and depression<sup>29</sup>). We also included covariates indicating if a soldier had filled an opioid prescription in the 90 days post-deployment, or received an alcohol use disorder (AUD) diagnosis in the year prior to deployment. All covariates, with the exception of combat exposure, are dichotomous where 0=no (e.g., no positive PTSD screen) and 1=yes (e.g., positive PTSD screen).

## Analyses

Analyses examined alcohol use measures from the PDHRA.<sup>16</sup> We present univariate analyses to describe the sample overall, and bivariate analyses to examine the associations between the constructed pain variables and the alcohol measures. Logistic regression models examined the association of the pain variable on at-risk drinking, binge drinking at least monthly, severe alcohol problems, and heavy-frequent alcohol use, adjusting for covariates listed above. Analyses used SAS 9.3 (SAS Institute, Cary, NC). This study was approved by the Human Research Protection Programs at Brandeis University and the Office of the Assistant Secretary of Defense Health Affairs.

## RESULTS

### Sample Characteristics

The sample was mostly male (90.1%), approximately half were white (53.3%), with a mean age of 26.9 years old. About two-thirds (62.5%) were married and 44.7% had at least one dependent child. Over 12% reported being restricted to quarters or light duty due to pain during the index deployment, 59% had no combat exposure during the index deployment, just over 7% screened positive for a TBI, and almost 11% filled an opioid prescription in the 90 days post-deployment (Table 1).

## Pain Diagnoses and Alcohol Consumption

Overall, 70.3% of the sample had none of the selected pain diagnoses during the pre- or post-deployment time periods (Table 2). Nearly 7% had persistent pain diagnoses, 10.2% had incident pain diagnoses, and 12.9% had remitted pre-deployment pain diagnoses.

Most soldiers were light (41.3%) or moderate (34.0%) drinkers (Table 2). The minority were abstainers (18.9%), and the remainder were heavy drinkers (5.3% heavy-frequent and 0.6% heavy-infrequent). Half of soldiers reported any binge drinking at the level of 6+ drinks on one occasion, and about 20% reported binge drinking at least monthly. The AUDIT-C score indicated that 38.8% of soldiers screened positive for at-risk drinking, and 6.0% were likely to have severe alcohol problems.

Figure 1 illustrates how the AUDIT-C variables relate to the created alcohol consumption variable. As shown, they do not fully coincide. Moderate drinkers are also at-risk on the AUDIT-C nearly 80% of the time, but rarely considered severe on the AUDIT-C. In particular, the heavy-infrequent drinkers were always at-risk on the AUDIT-C but rarely at a severe level, whereas the heavy-frequent drinkers were always at-risk on the AUDIT-C and 80% screened positive at the severe level.

Bivariate analyses indicated significant differences in the alcohol measures by pain category (Table 2). Soldiers with no pain diagnosis in either time period and soldiers with post-deployment incident pain diagnoses had the highest rates of heavy-frequent drinking, binge or monthly binge drinking, and at-risk or severe AUDIT-C scores. Soldiers with persistent pain diagnoses were most likely to abstain from alcohol or be light drinkers, and least likely to be heavy drinkers, have any binge or monthly binge drinking, or have at-risk or severe AUDIT-C scores.

## Likelihood of Risky Alcohol Use

Logistic regression results show that, controlling for other variables, soldiers with incident or persistent pain diagnoses had lower odds of risky alcohol use indicators at the post-deployment re-assessment than soldiers with no pain diagnosis at either time period (Table 3). More specifically, soldiers with persistent pain diagnoses were less likely to have an at-risk AUDIT-C score (adjusted odds ratio [AOR] 0.92, 95% confidence interval [CI] 0.89-0.95,  $p < .0001$ ), binge monthly (AOR 0.91, 95% CI 0.87-0.95,  $p < .0001$ ), have a severe AUDIT-C score (AOR 0.89, 95% CI 0.83-0.96,  $p = .002$ ), or be heavy-frequent drinkers (AOR 0.89, 95% CI 0.82-0.96,  $p = .002$ ) than soldiers with no pain diagnosis at either time period.

Soldiers with incident pain diagnoses were less likely to have at-risk AUDIT-C scores (AOR 0.97, 95% CI 0.94-0.99,  $p = .010$ ), binge monthly (AOR 0.94, 95% CI 0.91-0.98,  $p < .0001$ ), or be heavy-frequent drinkers (AOR 0.93, 95% CI 0.88-0.99,  $p = .021$ ) than soldiers with no pain diagnoses at either time period. Severe AUDIT-C scores (AOR 0.95, 95% CI 0.90-1.00,  $p = .061$ ) trended in the same direction.

Soldiers with remitted pain were not significantly different than soldiers with no pain on any of the problem alcohol indicators.

Soldiers who had a prior AUD diagnosis were significantly more likely to report problem alcohol indicators than soldiers without a prior AUD diagnosis. Soldiers who were assigned to quarters for pain were more likely to have an at-risk AUDIT-C score than soldiers who were not (AOR 1.08, 95% CI 1.05-1.10,  $p < .0001$ ), but otherwise were not significantly different on the other alcohol measures. The more combat exposures reported, the greater the likelihood of each risky alcohol indicator, and the same was true for the presence of positive screens for PTSD, depression, TBI, or poor physical health in the past month. Having filled an opioid prescription in the 90 days post-deployment was associated with lower at-risk AUDIT-C scores but was not significantly associated with other alcohol indicators.

## DISCUSSION

The association between pain and risky alcohol use is essential to understand, particularly in a military population where there is a high prevalence of each. One concern is that people with pain might be self-medicating by using alcohol at higher rates, with the concomitant problems that often accompany excessive alcohol use. In contrast to that hypothesis, this study found that, when controlling for deployment experiences and comorbidities, the presence of incident or persistent pain diagnoses was associated with lower likelihood of alcohol problems as indicated by significantly reduced rates of heavy-frequent alcohol use or monthly binge drinking and of at-risk or severe AUDIT-C scores. Soldiers with remitted pain diagnoses were very similar to soldiers with no pain diagnoses regarding drinking patterns, suggesting that the relationships we found only hold while painful conditions are temporally close to the drinking behaviors being measured.

The negative effect of incident or persistent pain diagnoses on risky drinking was unexpected. Since we were able to control for opioid pain medications in the 90 days post-deployment, it is unlikely that this is due to an intentional decision to drink less because of pain medication. Some studies have suggested that pain could be increased in people who drink at higher levels.<sup>6</sup> If so, those individuals might reduce their drinking to reduce their pain. Since our findings hold while controlling for alcohol use diagnoses, this may be a viable explanation. An alternative is that drinking is often a normative or recreational activity in military populations – serving as recreation, stress relief, and a way to build camaraderie<sup>13</sup> – whereas people experiencing painful conditions may withdraw from activities.<sup>30</sup> Future studies should examine our finding that suggests some level of protective effect regarding risky drinking among people with diagnoses of painful conditions.

Although the differences across groups were quite small, these findings do not suggest a need for enhanced alcohol screening or targeted alcohol interventions among soldiers with pain-related diagnoses. As discussed in the literature,<sup>13,24,31,32</sup> risky alcohol use and indicators of alcohol problems are common in Army populations. Since unadjusted rates of risky alcohol use are similar among all four pain groups, while adjusted rates are significant for the incident and persistent groups, the significance must be largely attributable to these soldiers' covariate values which would otherwise predict higher rates of risky alcohol use.

Similar to other studies, important predictors of problem alcohol indicators were related to combat and TBI exposure, and psychological health.<sup>16,33,34</sup> Further, these comorbidities

had a stronger association with alcohol consumption than the presence or absence of pain-related diagnoses. It is unsurprising that these covariates might have stronger effects in soldiers with ongoing pain. These findings highlight the importance of universal screening and interventions to address risky drinking in Army soldiers, in particular in the context of psychological health.

This study has several limitations. The existing pain variable did not include all painful conditions, such as osteoarthritis and some musculoskeletal conditions, which were fairly rare in other analyses with this population. Cancer pain was included but is extremely rare in this sample. We could not include a measure of pain severity or functional limitations. With a large sample size, significant differences are not altogether surprising. However, except for the 3% difference in at-risk AUDIT-C scores among soldier with incident pain, all other significant effects are 5% or more. Effects of this size are commonly considered large enough to be worth noting.

Alcohol frequency and quantity were self-reported. The DoD binge drinking measure is 6 or more drinks regardless of gender, thus we underestimate binge drinking as commonly defined by the National Institute on Alcohol Abuse and Alcoholism and in the literature. This is particularly true for women, although they represent under 10% of the sample. Information on other drug use, another potential self-medication approach, was not available although illicit drug use is very low in the military.<sup>35</sup> Study results may not be generalizable to military members from other U.S. military Services, National Guard or Reserve, or civilians.

With high rates of risky drinking across this sample, there could be a threshold effect, where we would not see any differences due to pain since the risky drinking rates are already more than we might expect. If our findings were not significant, the threshold effect might be of concern. However, we found a decreased likelihood of risky drinking, suggesting that a threshold does not play a role.

High levels of risky alcohol use remain of concern in populations such as the military, where pain is common. Yet, we did not find evidence of increased alcohol problems among soldiers with pain diagnoses, and pain may in fact be associated with fewer problems. We echo the call for increased attention to risky alcohol use among soldiers, but these findings do not indicate need for enhanced focus on soldiers with pain. Future studies should examine a broader range of painful conditions<sup>36</sup> and other populations, both military and civilian. Further, the current context of the opioid epidemic and resulting reductions in use of prescription opioid medications suggest that replication of these findings in more recent populations would be valuable.

## Acknowledgements:

We thank Beth Mohr Dana and Sue Lee for statistical programming. We acknowledge Kennell and Associates, Inc. for compiling the data files used in these analyses. Chester Buckenmaier, III, M.D., of the Uniformed Services University is the Department of Defense (DoD) data sponsor. Thomas V. Williams, Ph.D., formerly of the Defense Health Agency, was the data sponsor at the time these analyses were conducted. The Defense Health Agency's Privacy and Civil Liberties Office provided access to DoD data. The opinions and assertions herein are those of the authors and do not necessarily reflect the official views of the DoD or the National Institutes of Health. Preliminary

versions of these results were presented at the American Pain Society annual conference May 2016 and the Research Society on Alcoholism annual meeting May 2016.

**Funding Details:** This study was funded by the National Center for Complementary and Integrative Health (NCCIH; R01 AT008404), with support to develop the study cohort from the National Institute on Drug Abuse (NIDA; R01 DA030150). The funding agencies had no role in study design, data collection, analysis or interpretation of data, writing or review of the manuscript, or decision to submit the manuscript for publication.

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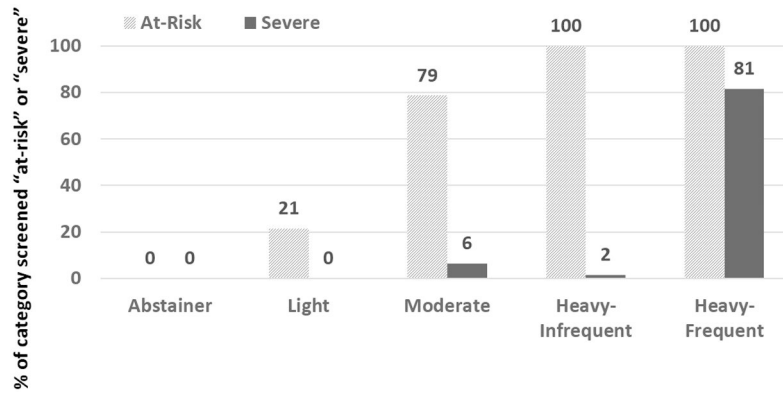
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**Figure 1. % with Positive Screens on the AUDIT-C (“at-risk” or “severe”) for each Alcohol Consumption Category, Active Duty Soldiers, FY2008-2011**

Hatched columns represent the proportion of soldiers in each alcohol consumption category who screened positive for at-risk drinking (e.g., 79% of moderate drinkers screened as at-risk). Solid columns represent the proportion of soldiers in each alcohol consumption category who screened positive for severe alcohol problems (e.g., 6% of moderate drinkers screened as severe).

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**Table 1.**

Military, Deployment and Post-Deployment Characteristics, Active Duty Soldiers, FY2008-2011

	N	%
<b>TOTAL</b>	267,100	100.0
<b>Military</b>		
Rank/paygrade		
Junior enlisted	149,185	55.9
Senior enlisted	83,041	31.1
Officer	34,874	13.1
Any prior deployment	120,790	45.2
Length of index deployment (months)	267,100	12.0 (mean)
<b>Deployment variables*</b>		
Restricted to quarters or light duty for pain	33,481	12.5
Combat exposure (count)		
None	156,901	58.7
One	58,048	21.7
Two	32,284	12.1
Three	19,867	7.4
TBI during deployment, positive screen	19,240	7.2
<b>Post-deployment variables*</b>		
Poor physical health past month	29,832	11.2
PTSD past month, positive screen	14,295	5.4
Depression past month, positive PHQ-2 screen	20,103	7.5
Filled opioid prescription 0-90 days post-deployment**	28,839	10.8

\* Self-reported, from Post-Deployment Health Assessment, conducted within 60 days of the end of deployment

\*\* From pharmacy claims data

**Table 2:**

Post-Deployment Alcohol Use and Risky Use by Pain Category, Active Duty Soldiers, FY 2008-2011

			% of All Soldiers				
			Pain Category				
	N	Total	No Pain	Remitted	Incident	Persistent	p
<b>N</b>	267,100	267,100	187,693	34,389	27,242	17,776	
<b>%</b>	100.0	100.0	70.3	12.9	10.2	6.7	
			% of Soldiers by Pain Category				
<b>%</b>		100.0	100.0	100.0	100.0	100.0	
<b>Drinking category</b> *	250,032						
Abstainer		18.9	18.7	19.2	19.0	20.8	<.0001
Light		41.3	40.9	42.1	41.6	43.2	
Moderate		34.0	34.6	33.2	33.2	30.6	
Heavy-Infrequent		0.6	0.5	0.5	0.7	0.7	
Heavy-Frequent		5.3	5.3	5.0	5.5	4.7	
<b>Binge drinking</b> **	267,100						
Any binge		49.8	50.4	48.2	50.1	45.9	<.0001
At least monthly		19.8	20.1	18.7	20.1	17.8	<.0001
<b>AUDIT-C</b> ***	267,100						
At-risk		38.8	39.1	38.2	39.2	36.5	<.0001
Severe		6.0	6.1	5.8	6.5	5.6	<.0001

Data are self-reported from Post-Deployment Health Reassessment (PDHRA), conducted on average 5 months following end of deployment.

\* Drinking category based on typical alcohol quantity and frequency;

\*\* Binge drinking defined as 6 or more drinks on one occasion;

\*\*\* "At risk" = AUDIT-C score of 4 or higher for males, 3 or higher for females; "Severe" = AUDIT-C score of 8 or higher regardless of gender.

**Table 3.**

Likelihood of Risky Alcohol Use, Active Duty Soldiers, FY2008-2011

	Alcohol Outcomes, Post-Deployment*															
	At Risk (AUDIT-C)				Binge (6+) monthly				Severe (AUDIT-C)				Heavy-Frequent Drinking			
	AOR	Lower CI	Upper CI	p	AOR	Lower CI	Upper CI	p	AOR	Lower CI	Upper CI	p	AOR	Lower CI	Upper CI	p
<i>N</i>																
<i>Pain Category</i> [ref=none]																
Remitted	1.00	0.98	1.03	0.852	0.98	0.95	1.01	0.167	1.01	0.96	1.06	0.786	0.99	0.94	1.05	0.713
Incident	0.97	0.94	0.99	0.010	0.94	0.91	0.98	0.001	0.95	0.90	1.00	0.061	0.93	0.88	0.99	0.021
Persistent	0.92	0.89	0.95	<0.001	0.91	0.87	0.95	<0.001	0.89	0.83	0.96	0.002	0.89	0.82	0.96	0.002
<i>Year before Deployment</i>																
Any alcohol diagnosis**	1.46	1.39	1.53	<0.001	1.54	1.45	1.62	<0.001	1.65	1.53	1.79	<0.001	1.70	1.57	1.85	<0.001
<i>Deployment**</i>																
Assigned to quarters for pain	1.08	1.05	1.10	<0.001	1.02	0.99	1.06	0.132	1.02	0.97	1.07	0.520	1.01	0.95	1.06	0.856
Combat exposure [ref=none]																
One	1.16	1.13	1.18	<0.001	1.18	1.15	1.21	<0.001	1.20	1.16	1.25	<0.001	1.19	1.13	1.24	<0.001
Two	1.25	1.22	1.29	<0.001	1.28	1.24	1.32	<0.001	1.41	1.35	1.48	<0.001	1.37	1.30	1.45	<0.001
Three	1.38	1.34	1.42	<0.001	1.42	1.37	1.47	<0.001	1.52	1.43	1.61	<0.001	1.54	1.45	1.64	<0.001
<i>Post-Deployment***</i>																
PTSD past mo, positive screen	1.11	1.07	1.15	<0.001	1.19	1.14	1.25	<0.001	1.29	1.21	1.37	<0.001	1.27	1.18	1.36	<0.001
Depression (PHQ-2) past mo, pos screen	1.29	1.25	1.33	<0.001	1.39	1.34	1.44	<0.001	1.67	1.59	1.76	<0.001	1.59	1.50	1.68	<0.001
Poor physical health past mo	1.09	1.06	1.12	<0.001	1.20	1.16	1.24	<0.001	1.40	1.33	1.46	<0.001	1.37	1.30	1.45	<0.001
TBI, positive screen	1.11	1.07	1.14	<0.001	1.15	1.11	1.20	<0.001	1.16	1.10	1.23	<0.001	1.15	1.08	1.22	<0.001
<i>0-90 Days Post-Deployment</i>																
Any opioid prescription fill	0.97	0.95	1.00	0.049	1.01	0.98	1.04	0.575	1.05	0.99	1.10	0.086	1.04	0.98	1.10	0.185

AOR = Adjusted Odds Ratio CI = 95% Confidence Interval, upper and lower limits

\* Alcohol outcomes from Post-Deployment Health Re-Assessment, conducted on average 5 months post-deployment. All models control for gender, race/ethnicity, marital status, dependent children, military rank/paygrade, length of index deployment, and days since deployment;

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From pharmacy claims data;

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Self reported from the Post Deployment Health Assessment, conducted within 60 days of the end of deployment