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Lower levels of bodily pain increase risk for non-medical use of prescription drugs among current US reserve soldiers

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HIGHLIGHTS

- Pain is associated with non-medical use of prescription drugs among reserve soldiers over time.
- Pain is an important risk factor, even if it is not significantly interfering with individuals' work.
- Addressing pain, even at lower levels, is important for prevention of misuse.

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ABSTRACT

Background: Military populations have a higher prevalence of pain compared to their civilian counterparts and are also at increased risk for substance use. The link between clinically significant pain and substance use has been established, but it is unclear if lower levels of pain relate to risk. The goal of this inquiry was to determine if level of bodily pain was associated with increased risk of current substance use over time among a community sample of U.S. Army Reserve/National Guard (USAR/NG) soldiers.

Methods: Data were drawn from an ongoing study of USAR/NG soldiers. We used generalized estimating equations to examine the longitudinal impact of baseline bodily pain level (modeled in standard deviations from the mean pain score) on current drug use (illicit and non-medical use of prescription drugs [NMUPD]) among soldiers ($n = 387$) over two-years. Final models controlled for baseline post-traumatic stress disorder (PTSD), anxiety, and depression symptomatology, history of deployment (yes/no), years of military service, and substance use norms.

Results: Bodily pain was longitudinally associated with increased odds of current NMUPD (AOR: 1.49, $p < .05$), but not with the current use of illicit drugs (AOR: 1.18, $p > .05$), controlling for symptoms of PTSD, anxiety, depression, deployment, years of service, and substance use norms.

Conclusions: Overall, our findings indicate that bodily pain is longitudinally associated with NMUPD among male soldiers, but not with illicit drugs. Significantly, our results stem from a non-clinical sample of soldiers with overall lower levels of pain. This indicates that pain may be important, even at lower levels, and underscores the importance of early non-pharmacologic interventions for pain.

1. Introduction

Research has established a linkage between clinically significant pain and substance use, particularly the treatment of pain with opioids and related risk for non-medical use or abuse of prescription pain medications (Becker et al., 2009; Compton and Volkow, 2006; Fishbain et al., 2008; Morasco et al., 2011; Novak et al., 2009). However, most of this work has been done among samples of chronic pain patients or patients already prescribed opioids for pain; often within the context of specialty treatment clinics, or among special populations (i.e., those already diagnosed with substance use disorders) (e.g., Becker et al., 2009; Manchikanti et al., 2006, 2013). Limited work has examined general pain among community samples and how it may relate to increased risk for substance use (Becker et al., 2009; Zvolensky et al., 2011). Cross-sectional data from a nationally-representative sample of adults demonstrated that pain is a risk factor for the non-medical use of

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prescription analgesics (Novak, Herman-Stahl, Flannery, & Zimmerman, 2009). There is also evidence for a link between chronic pain and lifetime marijuana use among civilian adults in the United States, but the relationship to current use was not demonstrated (Zvolensky, Cougle, & Bonn-Miller, 2011).

Military populations are at greater risk for both pain and substance use compared to their civilian counterparts (Seal et al., 2011; Nahin, 2017). Chronic pain and low back pain are highly prevalent among active duty service members (Clark & Hu, 2015; Clark & Taubman, 2015). Nationally representative data indicate that veterans overall have more pain and veterans under 40 are three times as likely as their civilian counterparts to have severe pain (Nahin, 2017).

Studies of prescription opioid misuse among veterans have shown an association between pain and misuse, primarily in the context of treatment-seeking, or exposure to prescription opiates. In a sample of veterans returning to low-income minority neighborhoods in New York City, receiving prescription opioids during deployments and continuing use after leaving the military predicted opioid misuse (Golub & Bennett, 2013). Cross-sectional data from a VA clinic-based sample also demonstrated an association between pain and lifetime use of alcohol and street drugs specifically to manage pain (Goebel, Compton, & Zubkoff, 2011). However, cross-sectional data collected from veterans seeking treatment for comorbid PTSD and substance use disorders demonstrated no reliable associations between pain and addiction severity or days of use (Gros, Szafranski, Brady, & Back, 2015). This may be an artefact of the sample, consisting of individuals who already had substance use disorders, limiting the ability to detect an additional effect of pain (Gros et al., 2015).

There has been limited examination of pain in Reserve and National Guard soldiers. However, reserve populations are at higher risk for substance use compared to active duty populations (Cohen, Fink, Sampson, & Galea, 2015; Jacobson, Ryan, & Hooper, 2008; Office of the Under Secretary of Defense for Personnel and Readiness, 2012). The unique stressors of part-time military service and differential access to military resources/services may be a contributing factor to this increased risk (Griffith, 2010, 2015; Castaneda et al., 2008). Thus, it is important to explore the associations between pain and substance use in this high risk subset of military personnel and in a community (i.e., non-clinic-based) sample.

The goal of this work was to explore the association between level of bodily pain and current use of illicit drugs and non-medical use of prescription drugs [NMUPD], separately, over time among a community-based sample of male U.S. Army Reserve and National Guard (USAR/NG) soldiers. We hypothesized that bodily pain levels would predict use of both illicit drugs and NMUPD over time, after accounting for possible confounders known to be related to or highly comorbid with pain in military populations, including PTSD (Buttner et al., 2017; Gros et al., 2015), anxiety, and depression symptomatology (Buttner et al., 2017; Naylor et al., 2017; Phillips et al., 2016), military service history variables (deployment and years of service) (Buttner et al., 2017; Phillips et al., 2016; Toblin et al., 2014; Vallerand et al., 2015) and substance use norms.

2. Material and methods

2.1. Recruitment and data collection

Detailed methods have been published elsewhere (Devonish et al., 2017; Heavey et al., 2017; Vest et al., 2017), but are described briefly here. Data were drawn from Operation: SAFETY (Soldiers and Families Excelling Through the Years) an ongoing, survey-based study of US Army Reserve and National Guard soldiers and their spouses (N = 418 couples). The study sample was recruited in 2014–2015, in person, during drill and training weekends across New York State. Interested participants and their partners were screened for eligibility and enrolled in the study.

Table 1
Participant baseline characteristics and key variables over time (N = 387 male soldiers).

Characteristic	Baseline % (n) or M (SD)	Year 1 % (n) or M (SD)	Year 2 % (n) or M (SD)
Age	31.7 (6.6)		
Race/ Ethnicity			
Non-Hispanic White	79.3% (307)		
Non-Hispanic Black	5.9% (23)		
Hispanic	9.0% (35)		
Other	4.1% (16)		
Education			
High School	15.0% (58)		
Some College	56.6% (219)		
College Degree or Higher	28.4% (110)		
Median Household Income	$60,000–79,999		
Years of Military Service	9.7 (6.1)		
Previously Deployed	64.1% (248)		
Probable PTSD Diagnosis	5.9% (23)		
PTSD Score	9.4 (12.1)		
Anxiety Score	4.3 (5.5)		
Depression Score	3.3 (4.4)		
Pain Score	20.6 (20.0)	27.3 (29.8)	29.5 (32.2)
Illicit Drug Use	4.1% (16)	5.7% (22)	5.7% (22)
NMUPD	4.7% (18)	3.9% (15)	4.1% (16)

NMUPD = non-medical use of prescription drugs.

Participants complete an annual electronic survey covering a wide variety of topics, including: military service, health, social support, substance use, mental health, relationship information, and life experiences. Participants either come to the university or complete the survey remotely via secure log-in. Three time points have been collected on participants to date. Participants each received a $60 check for baseline and a $70 check for each of the two follow-ups.

Study procedures were approved by the University at Buffalo Institutional Review Board, the Adjutant General of the National Guard, the Office of the Chief Army Reserve, and the Army Human Research Protections Office. All participants provided informed consent to participate in the study.

2.2. Participants

Current analyses utilized a subset of data from 387 male soldiers at three time points (baseline, year 1, and year 2). Analyses were restricted to males due to the small number of female soldiers who reported current illicit drug use or NMUPD, which would have resulted in underpowering of the regression models. Participant characteristics are reported in Table 1.

2.3. Measures

Bodily pain level (a composite score of pain intensity and interference) was assessed at each time point (baseline, year 1, year 2) using items from the RAND SF-36 (Ware, 1993; Ware and Sherbourne, 1992). Per the scoring instructions, a total pain score was calculated based on the sum of two questions: “How much bodily pain have you had during the past 4 weeks?” and “During the past 4 weeks, how much did pain interfere with your normal work?” Each item was scored on a Likert scale with higher scores indicating less pain (alpha: 0.81; range 0–100). For ease of interpretation, we re-coded the scale such that higher scores indicate more bodily pain, and pain was modeled in standard deviations as a time-varying predictor for the regression analyses.

To assess current use of illicit drugs and NMUPD, the NIDA Modified ASSIST 2.0 (Alcohol, Smoking, and Substance Involvement Screening Test) was used at each time point (WHO Assist Working Group, 2002). The ASSIST asks about past 3 months use of illicit drugs (marijuana, cocaine, methamphetamine, hallucinogens, illicit opioids, and

Table 2
Generalized estimating equation results - longitudinal association between level of bodily pain and drug use.

	Illicit Drug Use		Non-Medical Use of Prescription Drugs	
	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Pain Score (standard deviations)	1.01 (0.99, 1.02)	1.18 (0.81, 1.71)	1.02** (1.01, 1.03)	1.49* (1.05, 2.13)
PTSD Score		1.06 (1.00, 1.13)		1.05 (1.00, 1.10)
Anxiety Score		1.02 (0.90, 1.14)		0.98 (0.89, 1.08)
Depression Score		0.90 (0.74, 1.10)		0.99 (0.85, 1.14)
Deployment (Yes/No)		1.54 (0.48, 4.96)		0.39* (0.15, 0.99)
Years of Military Service		0.88 (0.76, 1.02)		1.00 (0.92, 1.09)
Illicit Drug Use Norm Score		1.16* (1.01, 1.32)		
Non-Medical use of Prescription Drugs Norm Score				1.01 (0.88, 1.16)
Time	1.23 (0.98, 1.56)	1.27 (0.98, 1.66)	1.06 (0.74, 1.53)	1.08 (0.73, 1.60)

*p < 0.05, **p < 0.01, ***p < 0.001.

inhalants) and past 3 months use of prescription medications (sedatives, stimulants, and pain medications) used "on your own, either without a doctor's prescription, in greater amounts, more often or longer than prescribed, or for a reason other than a doctor said you should use them." If participants indicated use of any of the included substances in the past three months, the response was recorded as a "yes" for current illicit drug use or NMUPD. The ASSIST does not contain information on whether the substances used were prescribed to the individual or obtained in some other way.

All covariates were modeled using the baseline time point. PTSD symptomatology was assessed using the PTSD Checklist for DSM-5 (PCL5) (Blevins et al., 2015; Bovin et al., 2016; Weathers et al., 2013), a 20-item measure of past month PTSD symptoms. Greater scores indicate greater PTSD symptomatology. Each response is rated on a 5-point Likert scale ranging from 0 (Not at all) to 4 (Extremely), with an overall score range of 0–80 (alpha: 0.95). Depression was assessed with the PHQ-8 (Kroenke et al., 2009), an 8- item measure of the frequency of depression symptoms over the past two weeks (range: 0–24; alpha: 0.90). Anxiety was assessed with the Severity Measure for Generalized Anxiety Disorder; (Craske, Wittchen, Bogels, Stein, Andrews, & Lebeu, 2013) a 10-item measure which assesses frequency of anxiety symptoms over the past seven days (range: 0–40; alpha: 0.91). To assess substance use norms, participants were asked three questions on a 7-point Likert scale concerning the acceptability of NMUPD and illicit drugs, adapted from a similar study of alcohol and marijuana use (Armitage, Conner, Loach, & Willetts, 1999). Participants rated their level of agreement with statements about each substance: "People who are important to me think I [should not-should use] [substance]"; "People who are important to me would [disapprove-approve] of my using [substance]"; "People who are important to me want me to use [substance]". Items were summed for each substance (range: 3–21, alphas: 0.46, NMUPD; 0.52, illicit). Higher scores indicate greater approval of substance use. Finally, participants self-reported whether they had ever been deployed and their total years of military service at baseline.

2.4. Data analysis

To examine the association between level of bodily pain and substance use over time, we used generalized estimating equations with a logit link function and included pain as a time-varying predictor. Separate models were constructed for each outcome (illicit drug use, NMUPD) over a two-year follow up period. Final models controlled for history of deployment (yes/no) and years of military service, as military service history may be related to greater likelihood of pain (Toblin et al., 2014; Vallerand et al., 2015). Models also controlled for perceived approval of (i.e., norms for) substance use (reported at baseline; matched to outcome), and PTSD, anxiety, and depression symptomatology given the relationship of mental health to both pain and substance use (Gros et al., 2015; Novak et al., 2009). Time (baseline, year 1, year 2) was also included in each model. To enhance the accuracy of inferences made with these data, all models were bootstrapped with 1000 replications.

3. Results

3.1. Descriptive results

Prevalence estimates of current illicit drug use and NMUPD were 5.7% (n = 22) and 4.1% (n = 16), respectively at Year 2 follow-up. Of those, marijuana (81.8%, n = 18) and prescription opioids (43.8%, n = 7) were the most prevalent illicit drug and NMUPD reported, respectively. Mean pain scores at baseline were 20.6 (SD = 20.0; range 0–90), indicating low overall levels of bodily pain in the sample. Mean PTSD scores at baseline were 9.4 (SD = 12.1) and 5.9% of the sample met criteria for a probable diagnosis of PTSD. Mean anxiety and depression scores were 4.3 (SD = 5.5) and 3.3 (SD = 4.4) at baseline, respectively. Among these soldiers, 12.9% had scores indicative of moderate or worse anxiety and 8.3% had moderate or worse depression. Mean illicit drug use and NMUPD norms were 4.4 (SD = 2.8; range 3–17) and 4.2 (SD = 2.6; range 3–15), respectively, indicating overall low levels of approval of the use of these substances.

3.2. GEE model results

In unadjusted models (Table 2), pain was associated with current NMUPD (OR: 1.02; 95% CI: 1.01–1.03, $p < .01$), but not with use of illicit drugs (OR: 1.01; 95% CI: 0.99–1.02, $p > .05$).

In adjusted models, controlling for symptoms of PTSD, anxiety, and depression, deployment, years of military service, and drug use norms, pain was likewise associated with NMUPD (OR: 1.49; 95% CI: 1.05–2.13, $p < .05$), but not with illicit drug use.

4. Discussion

Overall, our findings indicate that level of bodily pain is longitudinally associated with current NMUPD among male USAR/NG soldiers, but not with illicit drugs. This is important, as it demonstrates the contributing risk of pain in general, outside of the context of specialty treatment for clinically significant pain. Our results stem from a non-clinical sample of USAR/NG soldiers who were currently serving at the time of recruitment and baseline assessment, and who we may therefore assume are generally healthy overall. The pain in our sample is not significantly interfering with individuals' work in or outside of the home, which indicates that pain may be an important risk factor for substance use, even if pain is not reaching clinically significant levels. Promotion of non-pharmacologic methods for addressing low-levels of pain may be an important strategy for preventing pain progression, thereby reducing risk for potential substance misuse (Meerwijk, Larson, & Schmidt, 2019).

Most of the illicit drug use reported in our sample was marijuana. While previous studies have found a linkage between chronic pain and marijuana use in the general population (Zvolensky et al., 2011), pain was not associated with illicit drug use in our sample. Cross-sectional data from a veteran sample found an association between pain and illicit drugs, particularly in the context of co-occurring mental health disorders and previous history of substance use (Goebel et al., 2011). Currently serving USAR/NG soldiers are subject to random drug testing, which may limit the use of illicit drugs to manage pain during military service. However, there is evidence to suggest this risk may increase after individuals leave the military (Hoopsick, Fillo, Vest, Homish, & Homish, 2017), when drug testing is no longer enforced.

Our data are likely reflective of potential substance misuse, prior to the development of a diagnosable substance use disorder. This is important from a prevention standpoint as careful attention to misuse, as well as factors such as low-level pain, may help identify at-risk individuals. It is important to appropriately address pain before it becomes severe, imposes lifestyle limitations, and leads to potential greater risk of substance use. However, further study is needed to examine the life course trajectory of pain in military populations and how it relates to drug use outcomes over time, especially at periods of greater risk, such as post-deployment or transitioning out of the military (Golub and Bennett, 2014; Hoopsick et al., 2017; Sayer et al., 2010).

4.1. Limitations

These findings should be interpreted in the context of some limitations. First, participants consisted of reserve and National Guard soldiers from one region of the US and as part of the larger study all participants needed to be married/partnered. Study results may not reflect all military populations, although approximately half of service members nationally are married (Office of the Deputy Assistant Secretary of Defense, 2016). Second, we were unable to examine the relationship between pain and drug use among women due to limited numbers of female soldiers who endorsed current drug use. This is important for future studies, given gender differences in pain and substance use (Cichowski et al., 2017; Higgins et al., 2014; Naylor et al., 2017). Finally, we were unable to explore whether the NMUPD in our sample (primarily prescription opioid misuse) was misuse of medications prescribed to participants or use of medications acquired from elsewhere. Further studies should examine this nuance.

4.2. Conclusion

Given the high risk in military populations for experiencing pain and substance use, there is urgency to understand in more detail how pain impacts substance use over time, and especially how lower pain levels that may not impose significant limitations may contribute to misuse. Our data indicate that this type of pain may be an important risk factor to consider, and may also simultaneously represent an opportunity for early non-pharmacologic intervention. Further, risk for both NMUPD and illicit drug use may increase at the point of separation from the military (Hoopsick et al., 2017), when individuals are no longer subject to drug testing; how pain may contribute to this is unclear. There is need for additional research on how to best address pain resulting from military service. Understanding how military experiences and the transition out of the military affect this association is important for effectively targeting prevention, screening, and treatment interventions to reduce the risk of misuse associated with bodily pain.

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Contributors: Dr. Homish and Ms. Homish conceived of, designed, and implemented the study. Dr. Vest conducted the literature review and wrote the first draft of the manuscript with sections contributed by Dr. Hoopsick and Ms. Homish. Dr. Hoopsick and Ms. Homish conducted the statistical analysis. All authors critically reviewed the manuscript for content. All authors contributed to and approve the final manuscript.

CRediT authorship contribution statement

Bonnie M. Vest: Conceptualization, Writing - original draft. **Rachel A. Hoopsick:** Methodology, Formal analysis, Writing - original draft. **D. Lynn Homish:** Project administration, Data curation, Writing - review & editing. **Gregory G. Homish:** Conceptualization, Methodology, Resources, Writing - review & editing, Supervision, Funding acquisition.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.addbeh.2020.106443.

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