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Characterization of Veterans' Poisoning Events in the State of Florida

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Abstract

Increasing numbers of veterans are returning home with chronic pain and mental health disorders. Pharmacological treatments may be effective, but may also be increasing the incidence of poisonings among younger as well as older veterans, requiring greater resource expenditures at Veterans Administration (VA) facilities. Our objective was to characterize patterns of the poisoning among the veterans in Florida, using data obtained from the Florida Poisoning Control Information Network (FPCIN). We evaluated retrospective cohort data from 2005 to 2009 of 601 poisoning cases treated at Florida VA medical facilities with consultations from FPCIN. Intentional (suspected suicide) was the most common reason. Major adverse clinical outcomes were associated with the use of NSAIDs or alcohol. Antidepressants and anti-anxiolytics had the strongest association with intentional self-poisoning. Since medications are the major substances for the poisoning among the veterans, our study suggests that pharmaceutical treatments of veterans should include stronger prescribing guidelines and consideration of alternative therapies.

Keywords

Poison, Veterans, FPCIN, Suicide, Opioids, Opioid Analgesics, Antidepressants, Chronic Pain, PTSD, TBI, OIF, OEF

1. Introduction

Since October of 2001, United States (U.S.) has seen a substantial increase in our military personnel being de-

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ployed overseas; many of them participate in active combat. By 2008, roughly 1.64 million U.S. soldiers had been deployed to Afghanistan and Iraq under Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF), respectively [1]. Accordingly, the numbers of deployments had, by 2010, increased to over than 2 million soldiers [2]. Although deployments now are expected to decline, remaining squads require replacement and replenishment [3], especially in light of current western and eastern Asian regional instabilities.

Although increases in troop deployment into theaters of active combat or unstable regions may not necessarily involve greater numbers of service personnel as some troops are deployed multiple times, the number of post-traumatic stress disorder (PTSD) and traumatic brain injury (TBI) diagnoses in military personnel have been noticeably increasing by 2010 [2]. Additionally, repeated deployments of troops may actually increase the intensity and duration of both medical and psychological interventions needed for active service personnel as well as veterans. Cohen *et al.* [4] demonstrated that veterans with mental health disorders show greater use of both in-patient and out-patient non-mental health services than those veterans without a mental health diagnosis. Kline *et al.* [5], in their survey of New Jersey National Guard Troops, determined that those with previous deployments under OEF and OIF were "more than 3 times as likely" to indicate alcohol dependence and chronic pain, possibly resulting "in a substantial number of medically impaired soldiers being returned to combat".

For those wounded in combat, improvements in trauma care have increased the survival rate of critically injured soldiers. Unfortunately, the benefits of improved surgical survival rates also increases the number of veterans surviving with chronic physical disabilities coupled with combat-related mental health issues such as PTSD [1] [6]-[8]. Seal *et al.* [8] studied almost 300 thousand veterans treated at a Veterans Administration (VA) hospital during 2005-2008. The researchers found that almost half of the veterans received at least one "pain-related" diagnosis, with almost two-thirds of those receiving at least 2 different pain-related diagnoses, and half receiving a mental health diagnosis. Lew *et al.* [7] found that a preponderance of veterans returning from OIF and OEF deployments suffered from at least one of the "poly-trauma clinical triad", *i.e.*, chronic pain, PTSD, and persistent post-concussive symptoms (PPCS); most suffered from at least 2 comorbidities and slightly less than half suffered all three.

Studies of veterans who served during prior military conflicts support the need for veteran services for those deployed to combat areas and those who were actively engaged in combat. A national survey of veterans, performed from 2004 to 2006, found that roughly 395,000 veterans suffered from both "substance use disorders" (SUDs) and "serious psychological distress" [9]. More telling is an extensive study spanning 30 years of surveys of veterans who had served during the tumultuous Vietnam War era. The study results indicated that veterans who were deployed to Vietnam itself showed increased incidence of PTSD, along with greater mortality from drug-related causes and "unintentional poisoning" than other veterans who served in locations other than Vietnam during the same time period [10] [11].

Government-sponsored reports assessing veteran needs have evaluated the use and abuse of medications for chronic pain control, substance abuse disorders, and intentional poisoning/suicide risks [1] [2] [12]. Morasco and Dobscha [13] compared the misuse of prescription medicines (especially opioid analgesics) between those veterans with a history of substance abuse and those without. Those with prior abuse histories were three to six times more likely to misuse prescription medications than those without. VA guidelines have continually stipulated extreme caution in prescribing opioids to patients with SUD or psychiatric comorbidities [14] [15]. However, Seal *et al.* (2012) found that veterans with mental health disorders such as depression, anxiety, SUDs or PTSD were found more likely to be prescribed opioid analgesics than those without any mental health diagnoses. Long-term benzodiazepine use among veterans with PTSD has also been shown on the increase contrary to VA guidelines [16] and despite suggestion that prior benzodiazepine use may actually increase the likelihood of future excessive opioid use [17].

Evaluating and planning therapeutic service needs for veterans has a particular relevance for the State of Florida, as it is third in the nation for the number of veterans who reside within [18]. Troublesome, in light of the complications of prescription use and abuse among veterans, is that Florida's 2006 age-adjusted mortality rate from opioid analgesics was shown to be "significantly higher than the U.S. rate" [19]. Warner *et al.* [19] also indicated that on a national scale, overall drug-related mortality rates were increasing, with more than half of the opioid analgesic-related deaths associated with the use of at least one other drug, more commonly benzodiazepines, cocaine or heroin. Thus, assessing the incidence of acute adverse health events caused by medications or other substances in the veteran population in Florida has important national as well as statewide implications.

In Florida, a ready source of information about medications and chemicals is the Florida Poisoning Control Information Network (FPCIN), which, as part of their service, provides consultation to medical treatment facilities in cases of poisoning. For operational as well as follow-up purposes, FPCIN records are kept on some of the specifics of the call, such as the poisoning substance(s), the treatment location, and the clinical outcome. Using this information, our objective was to characterize the nature of poisonings by biological and chemical substances among veterans treated in VA Hospitals in Florida as an indication of where general treatment needs may lie.

2. Methods

The study protocol was approved by the University of Florida Institutional Review Board (IRB) Number PRO00002321. Retrospective cohort data was obtained from the Florida Poisoning Control Information Network. FPCIN recorded the location of the initial contact, after which they followed up with the treatment center. Since FPCIN records do not indicate the military status of their cases, treatment at a VA provided classification of veteran status.

Of the 18,804 consulting calls fielded by FPCIN, 601 consultation cases from seven VA Hospitals were accepted for inclusion in this study. These consults showed initial and/or final treatment at a VA facility and had sufficient information for categorization. Only general demographic data was available (e.g., gender, age); specific identifiers (e.g., name, address) were redacted. Information was also provided as to the type and number of poisons the subject had exposure to, as well as the identified (or suspected) cause of exposure. We categorized the substances of exposure according to appropriate recreational or prescription drug class, biological route, or household chemical usage, while the FPCIN categorized the clinical outcome according to their own criteria for "major", "moderate" and "minor" effects.

All statistical analyses were performed using SAS Version 9.1.2. Frequency analyses were used to identify the most common means of poisoning, identified reasons for poisoning, and clinical outcomes of the poisoning event. Stepwise selection was used to identify variables subsequently used in regression models for determining predictors of clinical outcome as well as underlying causes of poisoning events.

3. Results

Of the 601 cases, 530 subjects (88%) were identified as male, 67 (11%) as female, and 4 were not identified. The range in age ran from 20 years to 92 years, with a mean age of 51.5 (s.d.: 13.7). The vast majority of poisoning originated in the home (528 cases, 87.8%), while workplace poisonings were considerable less common (17 cases, 2.8%). 44 cases (7.3%) had an unknown point of origin.

46% of cases were attributed to intentional exposure as suspected suicide, making it by far the most common exposure with greater than 2.5 times the secondary cause of exposure, unintentional-general. No other reason approached this frequency, with the third most common reason given (unintentional-therapeutic error) having 6.8% cases and frequency decreasing steadily after. **Figure 1** provides a graphical breakdown of causes discerned for poisoning events. It is important to note that while intentional act categories are far fewer in number, intentional acts exceed unintentional acts, 58.6% to 31.1% (excluding bite/stings) or 36% (including bites and stings). Deliberate acts by veterans thus make up the majority of veteran poisoning incidents.

The substances used in the poisoning events as grouped into typical drug classes and chemical uses are shown in **Table 1**. It is clear that the top three substances encountered in these poisoning events are medications commonly used for pain control and mental health issues. It is also relevant to note that the top five groups comprise almost as many cases as the remaining 25 groups.

The substance groups in **Table 1** were furthered grouped into smaller categories more dependent upon use (**Figure 2**). Again, the most encountered poisoning substances fall under mood-altering and analgesic substances.

Clinical outcomes of poisoning events were characterized by FPCIN criteria. As a general guide, "major effects" were considered to have life-threatening potential with possibilities of permanent damage, "moderate effects" were considered to have potential to cause temporary organ damage, or minor permanent organ damage, "minor effects" were neither life-threatening nor causing permanent organ damage, and "no effects" required no medical intervention. **Figure 3** shows a graphical representation of the clinical outcomes.

Regression analyses were performed to determine if an association existed between the poisoning substance

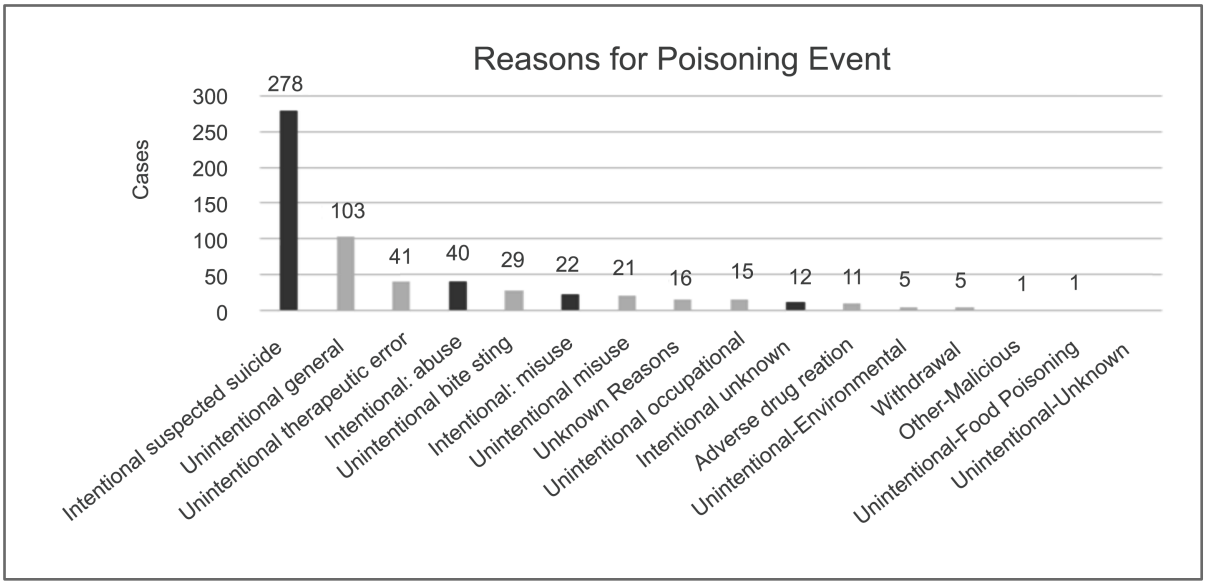

Figure 1. Reasons provided to FPCIN for exposure to poisoning substance. The bolded chart lines are to help indicate the "intentional" acts.

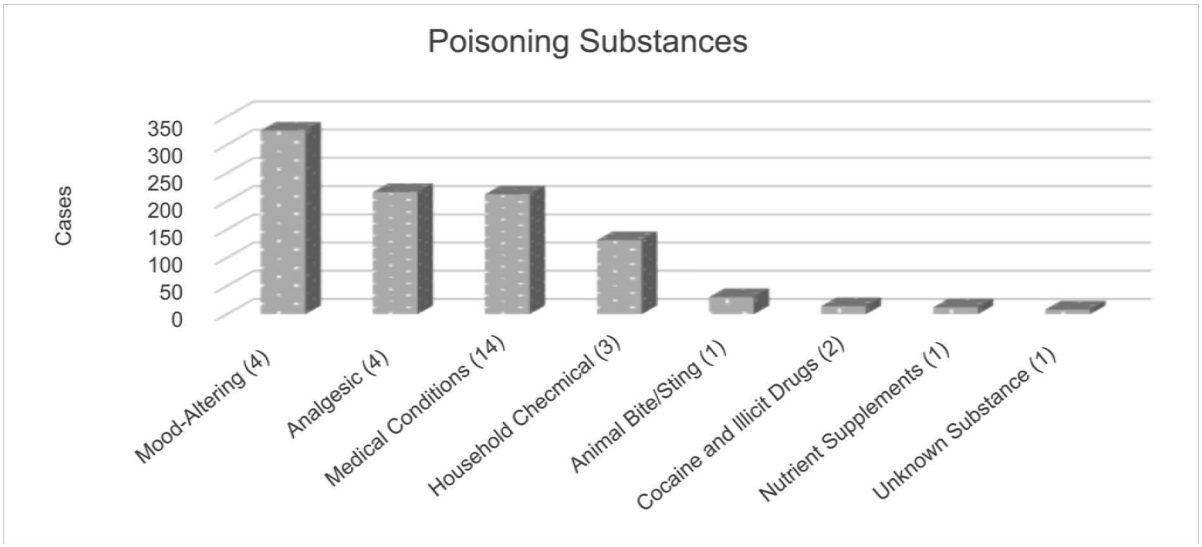

Figure 2. Groupings of substances used in poisoning events. The number in parentheses represent the number of groups from **Table 1** included under the Graph's group heading.

used and the clinical outcome. The use of alcohol was highly associated with a clinical outcome involving a major effect (OR = 3.224, 95%C.I.: 1.141 - 9.112), followed by NSAIDs (OR = 2.175, 95%C.I.: 0.707 - 6.686), though the association for NSAIDs was not statistically significant. When the outcomes of major and moderate effects were combined, several groups demonstrated associations that approached statistical significance including muscle relaxants (OR = 2.042, 95%C.I.: 0.946 - 4.408), followed by cardiovascular agents (OR = 1.786, 95%C.I.: 0.936 - 3.408). NSAIDs were more weakly associated than cardiovascular (OR = 1.726, 95%C.I.: 0.971 - 3.069). The use of four or more substances per poisoning event was associated with clinical outcomes of the combination of major and moderate effects (OR: 3.336; 95%CI: 1.73 - 6.43).

Regression analyses were also performed to see if an association existed between the poisoning substances used and whether the poisoning was an intentional or unintentional event (see **Figure 1**). The use of antidepressants (OR = 6.737) and opioid analgesics (OR = 4.719) showed the strongest association to "intentional-sus-

Table 1. Substance groups identified in the poisoning events. Due to some poisoning cases involved multiple substances, the number of "cases" totaled to 948, despite only 601 actual cases under consideration.

Substance	Cases	%	Substance	Cases	%
Antidepressants	120	12.4	Nutrient supplements	12	1.2
Opioid analgesics	93	9.6	Cocaine	11	1.1
Anti-anxiolytics	89	9.2	Antihistamine	8	0.8
Household chemicals-other	82	8.5	Unknown substance	8	0.8
Anti-psychotic	80	8.3	Cough suppressors	7	0.7
NSAID	64	6.6	Diuretic	7	0.7
Cardiovascular agent	60	6.2	Barbiturate	6	0.6
Anticonvulsants	58	6.0	Antibiotic	6	0.6
Alcohol	53	5.5	Anti-cholesterol	5	0.5
Sedative-hypnotic	36	3.7	Bronchodilators	4	0.4
Muscle relaxants	31	3.2	Antidote	3	0.3
Household chemicals-cleaning	30	3.1	Antiseptic	3	0.3
Animal bite/sting	30	3.1	Other illicit drug	3	0.3
Pesticides	19	2.0	Proton pump inhibitors	3	0.3
Diabetic agents	14	1.4	Thyroid drugs	3	0.3

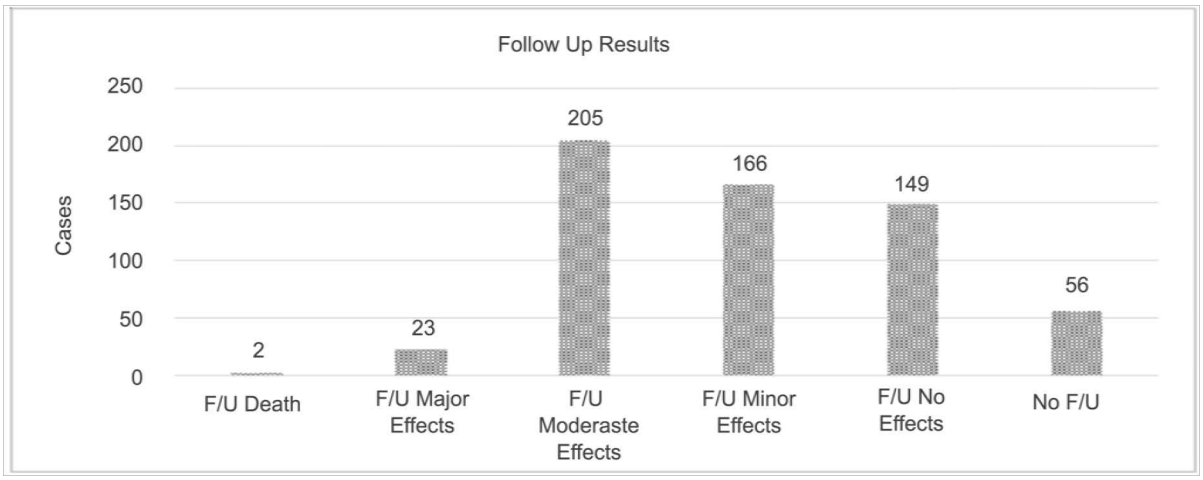

Figure 3. Clinical outcomes as categorized by FPCIN. F/U = Follow-up. "No follow-up" included those where no follow-up was deemed necessary as well as those where follow-up was not possible for some reason.

pected suicide" (95%C.I.: 3.826 - 11.865 and 2.665 - 8.355, respectively), while antidepressants and anti-anxiolytics showed the strongest association to the combined category of all intentional acts (OR = 6.703; 95%C.I.: 3.615 - 12.429 and OR = 8.120; 95%C.I.: 3.945 - 16.175, respectively). However, when the poisoning event cause was categorized as intentional abuse, "other household chemicals" had the strongest association (OR= 4.137; 95%C.I.: 1.922 - 8.907), followed by opioid analgesics (OR = 3.2976; 95%C.I.: 1.449 - 7.5).

4. Discussion

Intentional acts of self-harm were the most prevalent causes of the poisoning events. While household chemicals

(cleaning, other and pesticides) were among the top four categories for poisoning substances, the clear causal agents for poisoning were prescription medications, either for psychological disorders or medical conditions. Of the prescribed medications, opioid analgesics, anti-anxiolytics such as alprazolam and diazepam, and antidepressants had the largest number of associated poisoning cases. Ramchand *et al.* [12] described several measures that the Departments of Defense and Veterans Affairs have instituted to reduce suicide incidence among service personnel and veterans; however, most of the described programs involved limiting access to "lethal means" such firearms and other physical devices. Some isolated military programs now allow the return of unused medications as an attempt to limit the stockpiling of medications, while other spromote the use of alternative (non-pharmaceutical) treatments [20]. Nonetheless, this study demonstrates an increased need for broader and stronger approaches to the prevention of pharmaceutically-based self-harm among veterans.

It may seem surprising that the substances most associated with major adverse outcomes were NSAIDS and alcohol, not opioids or benzodiazepines. However, the NSAID acetaminophen is associated with potential liver damage at dosages in excess of 4 g/day, which is equivalent to 8 "extra-strength" (500 mg) tablets; there are now "black box" warnings for both prescription and over-the-counter products carrying acetaminophen. Alcohol is also associated with hepatotoxicity, and acute alcohol poisoning events are associated with higher blood-alcohol levels than chronic alcohol poisoning mortality [21]. Thus, signs of alcohol poisoning are likely to be more evident at elevated (*i.e.*, life-threatening) doses, resulting in either the veteran or companion to seek medical intervention for the veteran.

What bears significance are the substances most associated with all intentional acts of poisoning. Opioid analgesics, antidepressant and anti-anxiolytics were all associated with veterans intentionally engaging in self-harm. As these are the most common medications prescribed for chronic pain and PTSD, two of the more common disorders suffered by veterans, this study indicates a need for evaluation of more stringent prescribing guidelines. It may well be advantageous to vigorously assess alternative forms of treatment as well.

As with any study, there are limitations to our findings. First and foremost, not all poisoning events involving veterans may have involved the seeking of medical treatment, and of those that did see medical treatment, they may have received treatment from non-VA facilities and thus would not be included within our sample population. Additionally, not all poisoning events that were treated at VA centers may have involved consultations with FPCIN. The data in this study likely greatly underestimates the actual poisoning incidence among veterans. Finally, we had to rely on the consistency and accuracy of data categorization and input by those not integrally involved in the research study, therefore there was no method of data validation.

To see if the results are indeed accurate characterizations of poisoning events involving veterans, the scope of future studies should be expanded to reduce the chance that veterans may have been missed in the data set, and to include more precise information as to the history of substance use of the veteran treated for poisoning. A larger, prospective study would provide higher data resolution and a more specific characterization of these issues. Additionally, while our findings support concerns about prescribing mood-altering and analgesics to veterans, it is unknown based on the information provided as to whether these poisoning substances where obtained legally or were obtained through illicit means. Certainly, if the majority of poisoning substances were obtained through prescriptions, stricter guidelines and follow-up requirements by medical providers would be warranted.

It is important to note that of the 601 cases, only 2 cases (0.33%) ultimately resulted in the death of the veteran. Further study is warranted to determine if there is an association with FPCIN consultations and a reduction of fatal/major outcomes. Access to FPCIN consultation may provide more efficacious treatment of a veteran who is victim of a poisoning event.

References

[1] Schell, T.L. and Marshall, G.N. (2008) Survey of Individuals Previously Deployed for OEF/OIF. In: Tanielian, T. and Jaycox, L.H., Eds., *Invisible Wounds of War*: *Psychological and Cognitive Injuries*, *Their Consequences*, *and Services to Assist Recovery*, Rand Corporation, Santa Monica, 87-115.

[2] Interagency Policy Committee (IPC) (2011) Strengthening Our Military Families: Meeting America's Commitment. Department of Defense, Washington DC. http://www.defense.gov/home/features/2011/0111_initiative/Strengthening_our_Military_January_2011.pdf

[3] Brannen, K. (2010) Combat Brigades in Iraq under a Different Name. *Army Times Online*, August 19, 2010.

[4] Cohen, B.E., Gima, K., Bertenthal, D., Kim, S., Marmar, C.R. and Seal, K.H. (2010) Mental Health Diagnoses and

Utilization of VA Non-Mental Health Medical Services Among Returning Iraq and Afghanistan Veterans. *Journal of General Internal Medicine*, **25**, 18-24. http://dx.doi.org/10.1007/s11606-009-1117-3

[5] Kline, A., Falca-Dodson, M., Sussner, B., Ciccone, D.S., Chandler, H., Callahan, L. and Losonczy, M. (2010) Effects of Repeated Deployment to Iraq and Afghanistan on the Health of New Jersey Army National Guard Troops: Implications for Military Readiness. *American Journal of Public Health*, **100**, 276-283. http://dx.doi.org/10.2105/AJPH.2009.162925

[6] Clark, M.E., Scholten, J.D., Walker, R.L. and Gironda, R.J. (2009) Assessment and Treatment of Pain Associated with Combat-Related Polytrauma. *Pain Medicine*, **10**, 456-469. http://dx.doi.org/10.1111/j.1526-4637.2009.00589.x

[7] Lew, H.L., Otis, J.D., Tun, C., Kerns, R.D., Clark, M.E. and Cifu, D.X. (2009) Prevalence of Chronic Pain, Posttraumatic Stress Disorder, and Persistent Postconcussive Symptoms in OIF/OEF Veterans: Polytrauma Clinical Triad. *Journal of Rehabilitation Research and Development*, **46**, 697-702. http://dx.doi.org/10.1682/JRRD.2009.01.0006

[8] Seal, K.H., Shi, Y., Cohen, G., Cohen, B.E., Maguen, S., Krebs, E.E. and Neylan, T.C. (2012) Association of Mental Health Disorders with Prescription Opioids and High Risk Opioid Use in US Veterans of Ira and Afghanistan. *Journal of the American Medical Association*, **307**, 940-947. http://dx.doi.org/10.1001/jama.2012.234

[9] Substance Abuse and Mental Health Services Administration, Office of Applied Studies (SAMHSA) (2007) The NSDUH Report: Serious Psychological Distress and Substance Use Disorder among Veterans. Rockville.

[10] Boehmer, T.K.C., Flanders, D, McGeehin, M.A., Boyle, C. and Barrett, D.H. (2004) Postservice Mortality in Vietnam Veterans: 30-Year Follow-Up. *Archives of Internal Medicine*, **164**, 1908-1916. http://dx.doi.org/10.1001/archinte.164.17.1908

[11] Boscarino, J.A. (2006) Posttraumatic Stress Disorder and Mortality among U.S. Army Veterans 30 Years after Military Service. *Annals of Epidemiology*, **16**, 248-256. http://dx.doi.org/10.1016/j.annepidem.2005.03.009

[12] Ramchand, R., Acosta, J., Burns, R.M., Jaycox, L.H. and Pernin, C.G. (2011) The War Within: Preventing Suicide in the U.S. Military. Rand Corporation, Santa Monica.

[13] Morasco, B.J. and Dobscha, S.K. (2008) Prescription Medication Misuse and Substance Use Disorder in VA Primary Care Patients with Chronic Pain. *General Hospital Psychiatry*, **30**, 93-99. http://dx.doi.org/10.1016/j.genhosppsych.2007.12.004

[14] Management of Opioid Therapy for Chronic Pain Working Group (CPWG) (2003) VA/DoD Clinical Practice Guideline for Management of Opioid Therapy for Chronic Pain. Department of Veterans Affairs, Washington DC.

[15] Management of Opioid Therapy for Chronic Pain Working Group (CPWG) (2010) VA/DoD Clinical Practice Guideline for Management of Opioid Therapy for Chronic Pain. Department of Veterans Affairs, Washington DC.

[16] Hawkins, E.J., Malte, C.A., Imel, Z.E., Saxon, A.J. and Kivlahan, D.R. (2012) Prevalence and Trends of Benzodiazepine Use among Veterans Affairs Patients with Posttraumatic Stress Disorder, 2003-2010. *Drug and Alcohol Dependence*, **124**, 154-161. http://dx.doi.org/10.1016/j.drugalcdep.2012.01.003

[17] Skurtveit, S., Furu, K., Bramness, J., Selmer, R. and Tverdal, A. (2010) Benzodiazepines Predict Use of Opioids—A Follow-Up Study of 17,074 Men and Women. *Pain Medicine*, **11**, 805-814. http://dx.doi.org/10.1111/j.1526-4637.2010.00870.x

[18] National Center for Veterans Analysis and Statistics (NCVAS) (2014) Veteran Population. U.S. Department of Veterans Affairs. http://www.va.gov/vetdata/Veteran_Population.asp.

[19] Warner, M., Chen, L.H. and Makuc, D.M. (2009) NCHS Data Brief No. 22: Increase in Fatal Poisonings Involving Opioid Analgesics in the United States, 1999-2006. National Center for Health Statistics, Hyattsville.

[20] Dao, H., Carey, B. and Frosch, D. (2011) For Some Troops, Powerful Drugs Have Deadly Results. *New York Times*, **2**, 11.

[21] Jones, A.W. and Holmgren, P. (2003) Urine/Blood Ratios of Ethanol in Deaths Attributed to Acute Alcohol Poisoning and Chronic Alcoholism. *Forensic Science International*, **135**, 206-212. http://dx.doi.org/10.1016/S0379-0738(03)00213-5