



## Predictors of posttraumatic stress disorder, depression, and suicidal ideation among Canadian Forces personnel in a National Canadian Military Health Survey

Charles Nelson<sup>a</sup>, Kate St. Cyr<sup>a,\*</sup>, Bradley Corbett<sup>b</sup>, Elisa Hurley<sup>c</sup>, Shannon Gifford<sup>a</sup>, Jon D. Elhai<sup>d</sup>, J. Donald Richardson<sup>a</sup>

<sup>a</sup> Parkwood Hospital Operational Stress Injury Clinic, St. Joseph's Health Care London, London, ON, Canada

<sup>b</sup> Microdata Access Division, University of Western Ontario, London, ON, Canada

<sup>c</sup> Public Responsibility in Medicine and Research, Boston, MA, USA

<sup>d</sup> Department of Psychology, University of Toledo, Toledo, OH, USA

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### ABSTRACT

Despite efforts to elucidate the relationship between traumatic event exposure and adverse mental health outcomes, our ability to understand why only some trauma-exposed individuals become emotionally affected remains challenged. The aim of the current study is to determine the relations between social support, religiosity, and number of lifetime traumatic events experienced on past-12 month posttraumatic stress disorder (PTSD), depression, and suicidal ideation (SI) in a nationally representative sample of Canadian Forces personnel. The current study used data from the Canadian Community Health Survey Cycle 1.2 – Canadian Forces Supplement. The impact of a number of predictive and mediating factors was assessed using structural equation modeling. Social support and number of lifetime traumatic events experienced were significant predictors of past-year PTSD, depression, and SI; however PTSD did not mediate the relationship between number of traumatic events and SI nor between social support and SI. Conversely, depression mediated the relationship between number of traumatic events and SI. Possible mechanisms for these findings and their implications are discussed.

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### 1. Introduction

The impact of peacekeeping or combat in theaters of conflict on mental disorders such as Posttraumatic Stress Disorder (PTSD) is well-documented. Recent events in Iraq and Afghanistan have led to a considerable number of studies finding that military personnel are indeed at increased risk of developing PTSD as a result of their service (Hankin et al., 1999; Hoge et al., 2004, 2007; Hotopf et al., 2006; Iversen et al., 2008; Seal et al., 2007); and although Canadian military operations prior to 2002 consisted mainly of peacekeeping and the provision of humanitarian assistance (Department of National Defence, 2011), previous research shows that military personnel deployed on peacekeeping missions may be at increased risk for PTSD (Litz et al., 1997). However, substantial controversy about whether military personnel are also at greater risk of suicidal behaviors continues to exist, despite evidence that suicide is one of the most common causes of death among military personnel

(Hendin and Haas, 1991; Tien et al., 2010) and that the rate of death by suicide in military members is increasing (Kuehn, 2009; Lorge, 2008).

A number of studies have found that military veterans are more likely to attempt or complete suicide than civilians (Hendin and Haas, 1991; Kang and Bullman, 2008; Kaplan et al., 2007; McCarthy et al., 2009; Thoresen et al., 2003), while others, including one recent study of Canadian Forces (CF) members, have found that military personnel were less likely to attempt suicide than their civilian counterparts (Belik et al., 2010; Desjeux et al., 2004; Michel et al., 2007; Scoville et al., 2007). It is likely that part of the controversy can be attributed to important methodological artifacts, including differences in study populations (i.e. age distribution; military veterans vs. still-serving armed forces members; differences in psychological characteristics of civilians and military personnel; etc.), the sample sizes and time frames of comparative studies, and differences in the way suicide attempts and completed suicides are recorded across nations (Michel et al., 2007).

Little information is available regarding the possible role of predictor and mediating factors that inhibit or lend to suicidal ideation (SI) in military populations. The impact of contributing

\* Corresponding author. Tel.: +1 519 685 4292x45037; fax: +1 519 685 4585.

E-mail address: [katherine.stcyr@sjhc.london.on.ca](mailto:katherine.stcyr@sjhc.london.on.ca) (K.St. Cyr).

factors such as sex (Boscarino and Adams, 2009; Kessler et al., 1999; Taylor et al., 2003), positive and negative social supports (Seal et al., 2007; Pietrzak et al., 2009, 2010; Vogt and Tanner, 2007), religiosity (Kendler et al., 1999; Koenig et al., 1998), and exposure to multiple traumatic experiences (Seal et al., 2007; Belik et al., 2007; Tanskanen et al., 2004) on adverse mental health outcomes such as PTSD and major depressive disorder (MDD) in both military and civilian populations has been well-documented. However, the authors of the current study are not aware of any study to date that has attempted to fully investigate a set of interrelated relationships predicting PTSD, MDD, and suicidal ideation in a military population. The authors of the current study hypothesize that a lack of positive social support and exposure to multiple traumatic events will predict past-year PTSD, MDD, and SI; and that past-year PTSD and MDD will mediate the relationship between social support and SI, and number of lifetime traumatic events experienced and SI. Therefore, this study aims to: 1) determine how number of lifetime traumatic events experienced, sex, self-perceived religiosity, social support, and years of military service impact past-year PTSD, MDD, and SI in the CF; and 2) assess whether past-year PTSD and MDD mediate the relationship between social support and past-year SI, and number of lifetime traumatic events experienced and past-year SI.

## 2. Materials and methods

### 2.1. Sample

The Canadian Community Health Survey – Canadian Forces Supplement (CCHS-CFS) is a nationally representative sample of 8441 active Canadian Forces (CF) members between the ages of 16 and 64 years belonging to either the Regular ( $N = 5155$ ) or Reserve ( $N = 3286$ ) Forces. Data for this survey were collected on a monthly basis between May and December of 2002 in face-to-face interviews conducted by trained professional Statistics Canada interviewers. The response rate for the survey was 79.5% for Regular Force members and 83.5% for Reserve Force members (Statistics Canada). A multistage sampling framework was used to ensure the representativeness of the sample to the CF. The details of this sampling methodology have been thoroughly described in a number of previous studies (Belik et al., 2009; Fikretoglu et al., 2009; Sareen et al., 2007) and are available at [http://www.statcan.gc.ca/imdbbmdi/document/5084\\_D1\\_T1\\_V1-eng.pdf](http://www.statcan.gc.ca/imdbbmdi/document/5084_D1_T1_V1-eng.pdf).

### 2.2. Measures

Self-perceived religiosity and social support were explored as possible predictors of adverse mental health outcomes. Self-perceived religiosity was assessed by asking “In general, would you say that you are very religious, religious, not very religious, or not religious at all?” Similarly worded questions (“to what extent do you consider yourself a religious person?”) have been used to evaluate the role of religiosity in the development of depression in a number previously published studies (Dew et al., 2008, 2010).

The CCHS-CFS assessed social support using 19 functional social support items, adapted from the Medical Outcomes Survey (MOS) Support Survey. Frequency of various kinds of social support was assessed using a 5-point Likert-type scale, with 1 = none of the time and 5 = all of the time. Items are summed to create four subscales of social support: affection (range = 0–12), emotional or informational support (range = 0–32), positive social interaction (range = 16), and tangible support (range = 0–16), with higher scores indicating greater levels of support. These scales have been demonstrated to have excellent internal consistency and reliability, with Cronbach’s alphas ranging from 0.91 to 0.96 (Sherbourne and Stewart, 1991). In order to assess overall social support, we created

a higher-order social support factor (using confirmatory factor analysis) which consisted of the four subscales of social support assessed by the survey; we termed this variable “perceived social support”. Higher scores on this variable indicated greater positive social support.

Number of lifetime traumatic events experienced, past-year PTSD, MDD, and SI were assessed using the World Mental Health version of the Composite International Diagnostic Interview (WMH-CIDI) 2.1 (World Health Organization, 1997). The WMH-CIDI is a structured diagnostic interview that can be used to assess a number of mental disorders, including anxiety disorders, mood disorders and substance disorders. Disorders are assessed using the definitions and criteria set out in the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV) and the ICD-10 Classification of Mental and Behavioral Disorders (ICD-10). Methodological evidence collected in the WHO-CIDI Field Trials and clinical calibration studies have demonstrated that the WMH-CIDI has good to excellent reliability and validity (Haro et al., 2006; Wittchen, 1994), and that diagnoses made using the WMH-CIDI are consistent with those made in a clinical face-to-face interview (Kessler et al., 2004).

Number of lifetime traumatic events experienced was based on the sum count of 28 possible types of traumatic events the respondent has experienced over the course of his or her lifetime. Respondents were provided with a list of traumatic events adapted from the WMH-CIDI and asked if they had experienced any of the events listed, and if so, how many different events they had been exposed to (range = 1 to 28). Traumatic events assessed by the WHMCIDI include such experiences as experiencing combat, acting as a relief worker in a combat zone, witnessing death or seeing dead bodies, having been sexually assaulted or raped, having been physically assaulted, having a loved one pass away unexpectedly, or having been in an automobile accident.

Past-year alcohol dependence was assessed using the Alcohol Dependence Scale (Short Form Score) (Kessler et al., 1998), a subset of the WMH-CIDI, and is based on the Diagnostic and Statistical Manual of Mental Disorders, Third Edition Revised (DSM-III-R) criteria for psychoactive substance use disorder. Respondents were asked a number of questions about their use of alcohol over the past twelve months; responses were coded as yes = 1/no = 0. Seven key items were used to form the Short Form Score. Scores ranged from 0 to 7; a score of three or higher on this index indicated alcohol dependence.

Past-year MDD and PTSD were assessed using the following criteria, from the 1.2/WMH-CIDI derived variable document (Statistics Canada). Respondents met criteria for past-year MDD if they: 1) met criteria for a lifetime major depressive episode; 2) had a major depressive episode in the 12 months prior to the interview; and 3) reported clinically significant distress or impairment in social, occupational or other important areas of functioning. In order to assess past-year PTSD, respondents were asked which traumatic experience, if they had been exposed to more than one, caused the most adverse reactions; this “worst event” was identified as the index trauma used to determine whether a respondent met criteria for past-year PTSD. A diagnosis of past-year PTSD was given to individuals who: 1) met CCHS 1.2/WMH-CIDI criteria for lifetime PTSD; 2) reported having reactions in the 12 months prior to the interview; 3) reported re-experiencing the event through recurrent distressing recollections, dreams, flashbacks, or physiological reactivity on exposure to reminders of the event in the 12 months prior to the interview; 4) reported persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness in the 12 months prior to the interview; and 5) reported persistent symptoms of increased arousal in the 12 months prior to the interview.

Past-year suicide ideation (SI) was assessed by asking “In the past 12 months, did you seriously think about committing suicide or taking your own life?” SI has been assessed using the same question in a number of other nationally representative studies (Ratcliffe et al., 2008; Sareen et al., 2005).

Past-year SI, past-year MDD, past-year PTSD, alcohol dependence, and perceived social support (PSS) were our outcome variables of interest; however past-year PTSD, past-year MDD, alcohol dependence, and PSS were also tested as predictors of past-year SI.

### 2.3. Statistical analyses

We used the final sample weights included in the Statistics Canada data file to ensure that the data used were representative of the CF as a whole. A confirmatory factor analysis (CFA) of social support items was tested using a second-order CFA, with the measures' items mapping onto the four social support subscales as latent factors (affection, emotional or informational support, positive social interaction, and tangible social support), subsumed by a second-order latent PSS factor.

Mplus 5 software (Muthén and Muthén, 2007) was used for CFA and the structural equation modeling (SEM). Because the model included binary variables, weighted least squares estimation with a mean-and variance-adjusted chi-square test was used (Flora and Curran, 2004; Wirth and Edwards, 2007). Missing data for variables were estimated using full information maximum likelihood procedures (Muthén, 1998–2004); however 60 participants were excluded from the analysis because of missing data on predictor variables. All residual covariances were fixed to zero.

The SEM analyses were based on a covariance matrix that included Pearson correlations for continuous variable pairs, tetrachoric correlations for binary variable pairs, and polychoric correlations for binary-continuous variable pairs. Linear regression coefficients were estimated for paths leading to continuous variables (i.e. alcohol dependence) and probit regression coefficients were used for paths leading to binary variables (i.e. past-year SI). Standardized path coefficients for direct and specifically hypothesized indirect effects were also calculated; Sobel's test was used to compute indirect/mediation effects. Lastly, both comparative fit and Tucker–Lewis indices (CFI and TLI, respectively) and root mean square error of approximation (RMSEA) were computed using the standard cut-offs for an excellent fit (CFI  $\geq$  0.95; TLI  $\geq$  0.95; RMSEA  $\leq$  0.06) (Hu and Bentler, 1998, 1999). Two alternate models were also tested to ensure that a better fit couldn't be achieved. One of these models excluded number of lifetime traumatic events experienced as a predictor variable, and the other examined the additive impact of PTSD and MDD diagnoses on alcohol abuse. None of these models improved the fit indices; therefore, only the original model was used for the remainder of the analyses.

## 3. Results

2.33% ( $N = 197$ ) met criteria for past-year PTSD diagnosis, while 6.86% ( $N = 574$ ) met criteria for past-year MDD. 3.84% of participants ( $N = 324$ ) reported having suicidal thoughts in the past twelve months.

### 3.1. Confirmatory factor analysis

The results of the social support CFA show that the newly-constructed second-order PSS variable captured the covariance between all social support items very well and met criteria for an excellent fit of the data [robust  $X^2(3, N = 8407) = 9.91, P = 0.02, CFI = 0.96, TLI = 0.98, RMSEA = 0.02$ ].

### 3.2. Structural equation modeling

The results of the SEM show that our structural model also fit the data well [robust  $X^2(4, N = 8347) = 29.49, P < 0.001, CFI = 0.95, TLI = 0.95, RMSEA = 0.03$ ].

A number of structural paths between predictor and outcome variables were statistically significant at the  $P < 0.001$  level, and several other structural paths were found to be statistically significant at the  $P < 0.05$  level (see Fig. 1). Neither sex nor years of military service were significantly associated with the social support variable. Past-year PTSD was significantly predicted by both number of lifetime traumatic events ( $\beta = 0.39, P < 0.001$ ) and PSS ( $\beta = -0.56, P < 0.001$ ), as was past-year MDD ( $\beta = 0.008, P < 0.001$  and  $\beta = -0.13, P < 0.05$ , respectively), and alcohol dependence ( $\beta = 0.008, P < 0.001$  and  $\beta = -0.47, P < 0.001$ ). PSS also predicted past-year SI at the  $P < 0.05$  level ( $\beta = 0.11$ ). Lastly, self-perceived religiosity predicted past-year MDD ( $\beta = 0.39, P < 0.05$ ) but not past-year SI ( $\beta = 0.22, P > 0.05$ ).

We also tested several mediation hypotheses in this model: 1) that past-year PTSD would mediate the relationship between PSS and past-year SI; 2) that past-year PTSD would mediate the relationship between number of lifetime traumatic events experienced and past-year SI; and 3) that past-year MDD would mediate the relationship between number of lifetime traumatic events experienced and past-year SI. Somewhat unexpectedly, past-year PTSD did not mediate the relationship between either PSS and past-year SI [ $\beta = 0.01, B = 0.02$  (SE = 0.06),  $P > 0.05$ ] or between number of lifetime traumatic events experienced and past-year SI [ $\beta = -0.01, B = 0.02$  (SE = 0.06),  $P > 0.05$ ]. However, we found that past-year MDD did mediate the relationship between number of lifetime traumatic events experienced and past-year SI [ $\beta = 0.04, B = 0.07$  (SE = 0.02),  $P < 0.001$ ].

## 4. Discussion

To the best of our knowledge, this was the first study to explore PTSD and MDD as covariates of SI among CF members in a mediation analysis. The results of the current study add to the ever-increasing body of literature demonstrating the impact of military-specific traumatic experiences on adverse mental health outcomes including SI in military personnel. As expected, and similar to a number of other studies (Asmundson et al., 2002; Belik et al., 2007, 2010; Cabrera et al., 2007; Dohrenwend et al., 2006; Pitman, 2006; Sareen et al., 2007; Vasterling et al., 2006), social support and number of lifetime traumatic experiences, including exposure to combat, were significantly associated with past-year PTSD, past-year MDD, and past-year SI. The results of the current study indicate that there is a significant role for both pre-deployment and post-deployment social support. Previous studies (Seal et al., 2007; Pietrzak et al., 2010) have indicated that unit social support is significantly associated with PTSD and depressive symptoms, and increasing the amount of time spent with one's unit both prior to and following deployment may influence the rates of PTSD and MDD in the CF.

These findings also provide evidence that there is a dose–response reaction relating to number of traumatic events experienced and likelihood of adverse mental health outcomes in military personnel. It may be of benefit to the CF, and other national armies, to screen recruits for traumatic experiences upon intake to the armed forces and/or closely monitor members post-deployment for increased symptoms of distress which may be sub-clinical yet, according to our findings, increase vulnerability to developing PTSD through added exposure.

The statistically significant association between self-perceived religiosity and MDD is an interesting one. Evidence about the

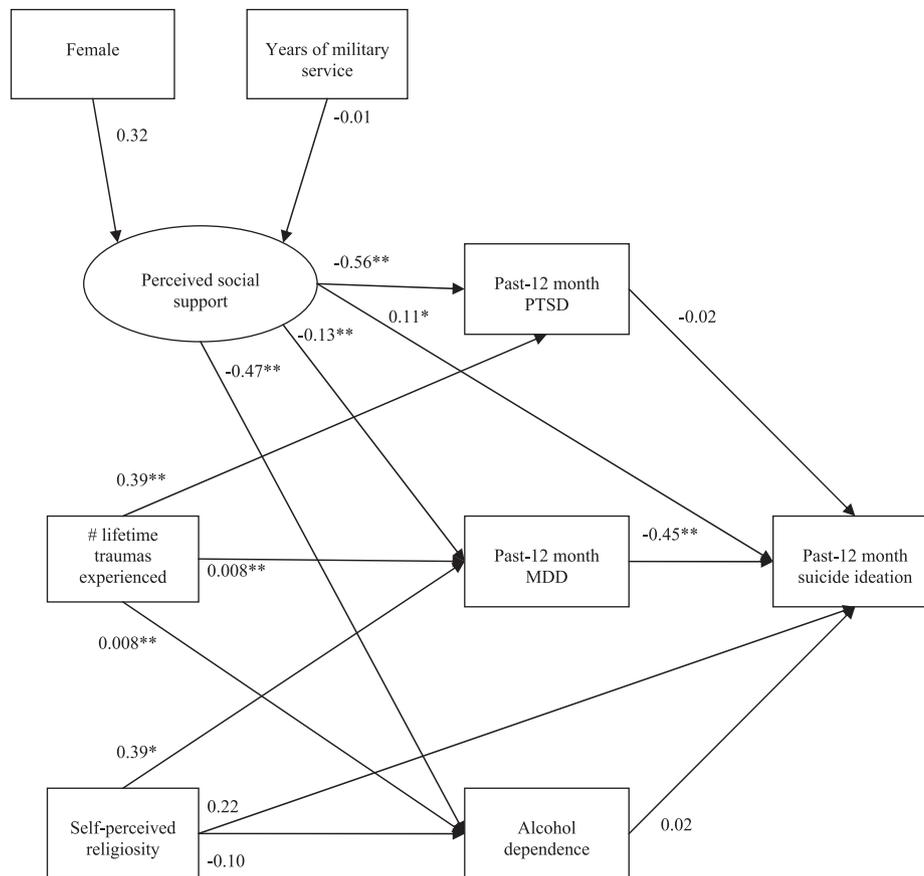


Fig. 1. Results of the structural equation model – standardized path estimates. Note: \* $p < 0.05$ ; \*\* $p < 0.01$ .

effects of religiosity and spirituality are contradictory, with some studies indicating that intrinsic religiosity has a greater influence on health outcomes than extrinsic religiosity while others demonstrate the opposite (Kendler et al., 1999; Koenig et al., 1998). It is worth noting that this finding may reflect the idiopathic nature of defining one's religiosity, rather than religion actually moderating the effects of anxiety and despair; this curious relationship warrants further investigation.

Lastly, the significant association between past-year MDD and past-year SI is a noteworthy finding that warrants substantial attention. To reiterate, this highlights the need for comprehensive post-deployment screening for mental disorders, and the importance of early identification of at-risk individuals who may only be showing minimal to moderate symptoms of anxiety or depression. Because SI is one of the strongest predictors of suicide attempts, it is imperative that individuals who screen positively for symptoms of PTSD or MDD following deployment are referred for psychotherapy, pharmacotherapy, or a combination of both in order to mitigate the possibility of future suicidal behaviors.

#### 4.1. Limitations

There were a number of limitations to the current study. First, the CCHS-CFS is a cross-sectional survey, which means that causality cannot be inferred. Second, although all respondents participated in a structured interview, the self-report nature of this study lends itself to the potential for reporting and social desirability biases. Military culture has traditionally placed a great deal of emphasis on strength and resilience, and some participants may have not been comfortable reporting any outcomes that could be seen as weakness, such as depressive symptoms, despite the

strict confidentiality limits of the health survey. Third, the CCHS-CFS data was collected in 2002, prior to the combat mission in Afghanistan. It is likely that the inclusion of individuals deployed to recent missions in Afghanistan would alter the results of this study. Fourth, the CCHS-CFS only captures data of actively-serving members, who are more likely to be physically and mentally fit because of the demands of their job (the "healthy soldier effect") (Kang and Bullman, 1996, 2001; McLaughlin et al., 2008). Therefore, the prevalence of adverse mental health outcomes in CF members may actually be higher than what was reported in this study, as individuals with more severe PTSD and MDD are likely to have been discharged from the military and were therefore not included in the survey. Additionally, the authors acknowledge the possibility that the mediating variables tested in this model (PTSD, MDD, and alcohol dependence) may in fact influence one another; however, this hypothesis was not tested in its entirety. Future research examining the interrelationships of these variables would provide further insight into their respective impacts on suicidal behaviors.

#### 5. Conclusion

Despite these limitations, the current study suggests that past-year diagnosis of PTSD or MDD is a significant predictor of SI and lends support to the theory that multiple traumatic experiences increase risk of mental disorders, while perceived social support decreases this risk. This study has clinical implications; namely that individuals who screen positively for PTSD or MDD are at increased risk for SI and potentially suicide attempt and that early identification and treatment of these individuals may lead to a decline in the rates of suicidal behaviors among CF members.

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## Contributors

Drs. Charles Nelson, Elisa Hurley, Shannon Gifford, J. Donald Richardson, and Kate St. Cyr conceptualized the design of the study, while Dr. Elisa Hurley and Kate St. Cyr conducted the literature review. Drs. Nelson, Corbett and Elhai, along with Kate St. Cyr, designed the study's analytic strategy and prepared the data for analysis, while Drs. Corbett and Elhai conducted the statistical analysis and interpretation. Dr. Jon Elhai prepared the Statistical Analyses presented in the Methods and Materials section of manuscript. Kate St. Cyr wrote the first draft of the manuscript, and all other authors contributed to the preparation of the manuscript draft by reviewing it. All authors have provided their final approval of the version submitted.

## Conflict of interest

None of the authors report any conflicts of interest.

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## References

- Asmundson GJG, Stein MB, McCreary DR. Posttraumatic stress disorder symptoms influence health status of deployed peacekeepers and nondeployed military personnel. *Journal of Nervous and Mental Disease* 2002;190(12):807–15.
- Belik SL, Cox BJ, Stein MB, Asmundson GJG, Sareen J. Traumatic events and suicidal behaviours: results from a national mental health study. *Journal of Nervous and Mental Disease* 2007;195(4):342–9.
- Belik SL, Stein MB, Asmundson GJG, Sareen J. Relation between traumatic events and suicide attempts in Canadian military personnel. *Canadian Journal of Psychiatry* 2009;54(2):93–104.
- Belik SL, Stein MB, Asmundson GJG, Sareen J. Are Canadian soldiers more likely to have suicidal ideation and suicide attempts than Canadian civilians? *American Journal of Epidemiology* 2010;172(11):1250–8.
- Boscarino JA, Adams RE. PTSD onset and course following the World Trade Center disaster: findings and implications for future research. *Social Psychiatry and Psychiatric Epidemiology* 2009;44(10):887–98.
- Cabrera OA, Hoge CW, Bliese PD, Castro CA, Messer SC. Childhood adversity and combat as predictors of depression and post-traumatic stress in deployed troops. *American Journal of Preventive Medicine* 2007;33:77–82.
- Department of National Defence. Past operations, <http://www.comfec-cefcom.forces.gc.ca/pa-ap/ops/pastops-eng.asp>; 2011 [accessed 17.11.10].
- Desjeux G, Labarère K, Galoisy-Guibal L, Ecochard R. Suicide in the French armed forces. *European Journal of Epidemiology* 2004;19(9):823–9.
- Dew RE, Daniel SS, Goldston DB, Koenig HG. Religion, spirituality, and depression in adolescent psychiatric outpatients. *Journal of Nervous and Mental Disease* 2008;196:247–51.
- Dew RE, Daniel SS, Goldston DB, McCall WV, Kuchibhatla M, Schleifer C, et al. A prospective study of religion/spirituality and depressive symptoms among adolescent psychiatric patients. *Journal of Affective Disorders* 2010;120:149–57.
- Dohrenwend BP, Turner JB, Turse NA, Adams BG, Koenen KC, Marshall R. The psychological risks of Vietnam for US veterans: a revisit with new data and methods. *Science* 2006;313:979–82.
- Fikretoglu D, Elhai JD, Liu A, Richardson JD, Pedlar DJ. Predictors of likelihood and intensity of past-year mental health service use in an active Canadian military sample. *Psychiatric Services* 2009;60(3):358–66.
- Flora DB, Curran PJ. An empirical evaluation of alternative methods of estimation for confirmatory factor analysis with ordinal data. *Psychological Methods* 2004;9:466–91.
- Hankin CS, Spiro 3rd A, Miller DR, Kazis L. Mental disorders and mental health treatment among U.S. Department of Veterans Affairs outpatients: the veterans health study. *American Journal of Psychiatry* 1999;156(12):1924–30.
- Haro JM, Arbabzadeh-Bouchez S, Brugha TS, de Girolamo G, Guyer ME, Jin R, et al. Concordance of the composite international diagnostic interview version 3.0 (CIDI 3.0) with standardized clinical assessments in the WHO World mental health surveys. *International Journal of Methods in Psychiatric Research* 2006;15:167–80.
- Hendin H, Haas AP. Suicide and guilt as manifestations of PTSD in Vietnam combat veterans. *American Journal of Psychiatry* 1991;148:586–91.
- Hoge CW, Castro CA, Messer SC, McGurk D, Cotting DI, Koffman RL. Combat duty in Iraq and Afghanistan, mental health problems, and barriers to care. *New England Journal of Medicine* 2004;351:13–22.
- Hoge CW, Terhakopian A, Castro CA, Messer SC, Engel CC. Association of post-traumatic stress disorder with somatic symptoms, health care visits, and absenteeism among Iraq war veterans. *American Journal of Psychiatry* 2007;164:150–3.
- Hotopf M, Hull L, Fear NT, Browne T, Horn O, Iversen A, et al. The health of UK military personnel who deployed to the 2003 Iraq war: a cohort study. *Lancet* 2006;367:1731–41.
- Hu L, Bentler PM. Fit indices in covariance structural modeling: sensitivity to underparameterized model misspecification. *Psychological Methods* 1998;3:424–53.
- Hu L, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Structural Equation Modeling* 1999;6:1–55.
- Iversen AC, Fear NT, Ehlers A, Hacker Hughes J, Hull L, Earnshaw M, et al. Risk factors for post-traumatic stress disorder among UK armed forces personnel. *Psychological Medicine* 2008;38(4):511–22.
- Kang HK, Bullman TA. Mortality among U.S. veterans of the Persian Gulf War. *New England Journal of Medicine* 1996;335(2):1498–504.
- Kang HK, Bullman TA. Mortality among US veterans of the Persian Gulf War: 7-year follow-up. *American Journal of Epidemiology* 2001;154(5):399–405.
- Kang HK, Bullman TA. Risk of suicide among US veterans after returning from the Iraq and Afghanistan War zones. *Journal of the American Medical Association* 2008;300:652–3.
- Kaplan MS, Huguot N, McFarland BH, Newsome JT. Suicide among male veterans: a prospective population-based study. *Journal of Epidemiology and Community Health* 2007;61:619–24.
- Kendler KS, Gardner CO, Prescott CA. Clarifying the relationship between religiosity and psychiatric illness: the impact of covariates and the specificity of buffering effects. *Twin Research* 1999;2(2):137–44.
- Kessler RC, Abelson J, Demler O, Escobar JI, Gibbon M, Guyer ME, et al. Clinical calibration of DSM-IV diagnoses in the World mental health (WMH) version of the World Health Organization (WHO) composite international diagnostic interview (WMH-CIDI). *International Journal of Methods in Psychiatric Research* 2004;13(2):122–39.
- Kessler RC, Andrews G, Mroczek D, Ustun B, Wittchen HU. The World Health Organization composite international diagnostic interview short-form (CIDI-SF). *International Journal of Methods in Psychiatric Research* 1998;7(4):171–85.
- Kessler RC, Borges G, Walters EE. Prevalence of and risk factors for lifetime suicide attempts in the National Comorbidity Survey. *Archives of General Psychiatry* 1999;56(7):418–22.
- Koenig HG, George LK, Peterson BL. Religiosity and remission of depression in medically ill older patients. *American Journal of Psychiatry* 1998;155(4):536–42.
- Kuehn BM. Soldier suicide rates continue to rise: military, scientists work to stem the tide. *Journal of the American Medical Association* 2009;301(11):1111–3.
- Litz BT, Orsillo SM, Friedman M, Ehlich P, Batres A. Post-traumatic stress disorder associated with peacekeeping duty in Somalia for U.S. military personnel. *American Journal of Psychiatry* 1997;154(2):178–84.
- Lorge E. Army responds to rising suicide rates, <http://www.army.mil/news/2008/01/31/7222-army-responds-to-rising-suicide-rates/>; 2008 [accessed 23.11.10].
- McCarthy JF, Valenstein M, Kim HM, Ilgen M, Zivin K, Blow FC. Suicide mortality among patients receiving care in the veterans health administration health system. *American Journal of Epidemiology* 2009;169(8):1033–8.
- Mclaughlin R, Nielsen L, Waller M. An evaluation of the effect of military service on mortality: quantifying the health soldier effect. *Annals of Epidemiology* 2008;18(12):928–36.
- Michel PO, Lundin T, Larsson G. Suicide rate among former Swedish peacekeeping personnel. *Military Medicine* 2007;172(3):278–82.
- Muthén BO. Mplus technical appendices. Los Angeles, CA: Muthén & Muthén; 1998–2004.
- Muthén LK, Muthén BO. Mplus statistical software. 5th ed. Los Angeles, California: Muthén & Muthén; 2007.
- Pietrzak RH, Johnson DC, Goldstein MB, Malley JC, Southwick SM. Psychological resilience and postdeployment social support protect against traumatic stress and depressive symptoms in soldiers returning from operations enduring freedom and Iraqi freedom. *Depression and Anxiety* 2009;26(8):745–51.
- Pietrzak RH, Johnson DC, Goldstein MB, Malley JC, Rivers AJ, Morgan CA, Southwick SM. Psychosocial buffers of traumatic stress, depressive symptoms, and psychosocial difficulties in veterans of operations enduring freedom and Iraqi freedom: the role of resilience, unit support, and postdeployment social support. *Journal of Affective Disorders* 2010;120(1–3):188–92.
- Pitman RK. Combat effects on mental health: the more things change, the more they remain the same. *Archives of General Psychiatry* 2006;63(2):127–8.
- Ratcliffe GE, Enns MW, Belik SL, Sareen J. Chronic pain conditions and suicidal ideation and suicide attempts: an epidemiologic perspective. *Clinical Journal of Pain* 2008;24(3):204–10.
- Sareen J, Cox BJ, Afifi TO, Stein MB, Belik SL, Meadows G, Asmundson GJ. Combat and peacekeeping operations in relation to prevalence of mental disorders and perceived need for mental health care. *Archives of General Psychiatry* 2007;64(7):843–52.

- Sareen J, Houlihan T, Cox BJ, Asmundson GJ. Anxiety disorders associated with suicidal ideation and suicide attempts in the National Comorbidity Survey. *Journal of Nervous and Mental Disease* 2005;193(7):450–4.
- Scoville SL, Gubata ME, Potter RN, White MJ, Pearse LA. Deaths attributed to suicide among enlisted U.S. armed forces recruits, 1980–2004. *Military Medicine* 2007;172(10):1024–31.
- Seal KH, Bertenthal D, Miner CR, Sen S, Marmar C. Bringing the war back home: mental health disorders among 103,788 US veterans returning from Iraq and Afghanistan seen at the Department of Veterans Affairs facilities. *Archives of Internal Medicine* 2007;167:476–82.
- Sherbourne CD, Stewart AL. The MOS support survey. *Social Science Medicine* 1991;32(6):705–14.
- Statistics Canada. Canadian community health survey (CCHS) cycle 1.2 – Canadian forces derived variable (DV) specifications. [http://www.statcan.gc.ca/imdb-bmdi/document/5084\\_D3\\_T9\\_V1-eng.pdf](http://www.statcan.gc.ca/imdb-bmdi/document/5084_D3_T9_V1-eng.pdf) [accessed 01.12.10].
- Statistics Canada. Response rates by stratum for CCHS 1.2 – Canadian Forces. [http://www.statcan.gc.ca/imdb-bmdi/document/5084\\_d4\\_t9\\_V1\\_B.pdf](http://www.statcan.gc.ca/imdb-bmdi/document/5084_d4_t9_V1_B.pdf) [accessed 23.09.10].
- Tanskanen A, Hintikka A, Honkalampi K, Haatainen K, Koivumaa-Honkanen H, Viinamaki H. Impact of multiple traumatic experiences on the persistence of depressive symptoms – a population based study. *Nordic Journal of Psychiatry* 2004;58(6):459–64.
- Taylor RR, Jason LA, Jahn SC. Chronic fatigue and sociodemographic characteristics as predictors of psychiatric disorders in a community-based sample. *Psychosomatic Medicine* 2003;65(5):896–901.
- Thoresen S, Mehlum L, Moller B. Suicide in peacekeepers: a cohort study of mortality from suicide in 22,275 Norwegian veterans from international peacekeeping operations. *Social Psychiatry and Psychiatric Epidemiology* 2003;38(11):605–10.
- Tien HC, Acharya S, Redelmeier DA. Preventing deaths in the Canadian military. *American Journal of Preventive Medicine* 2010;38(3):331–9.
- Vasterling JJ, Proctor SP, Amoroso P, Kane R, Heeren T, White RF. Neuropsychological outcomes of army personnel following deployment to the Iraq war. *Journal of the American Medical Association* 2006;296(5):519–29.
- Vogt DS, Tanner L. Risk and resilience factors for posttraumatic stress symptomatology in Gulf War veterans. *Journal of Traumatic Stress* 2007;20(1):27–38.
- Wittchen HU. Reliability and validity studies of the WHO-composite international diagnostic interview (CIDI): a critical review. *Journal of Psychiatric Research* 1994;28:57–84.
- Wirth RJ, Edwards MC. Item factor analysis: current approaches and future directions. *Psychological Methods* 2007;12:58–79.
- World Health Organization. Composite international diagnostic interview. Version 2.1. Geneva (CH): World Health Organization; 1997.