Catalogue no. 82-003-X
ISSN 1209-1367

Health Reports

Validation of a brief measure of combat exposure among Canadian Armed Forces personnel

by Kerry A. Sudom, Robert Nesdole and Mark A. Zamorski

Release date: November 20, 2019

Statistics Canada Statistique Canada

Canada

How to obtain more information

For information about this product or the wide range of services and data available from Statistics Canada, visit our website, www.statcan.gc.ca.

You can also contact us by

Email at STATCAN.infostats-infostats.STATCAN@canada.ca

Telephone, from Monday to Friday, 8:30 a.m. to 4:30 p.m., at the following numbers:

- Statistical Information Service 1-800-263-1136
- National telecommunications device for the hearing impaired 1-800-363-7629
- Fax line 1-514-283-9350

Depository Services Program

- Inquiries line 1-800-635-7943
- Fax line 1-800-565-7757

Standards of service to the public

Statistics Canada is committed to serving its clients in a prompt, reliable and courteous manner. To this end, Statistics Canada has developed standards of service that its employees observe. To obtain a copy of these service standards, please contact Statistics Canada toll-free at 1-800-263-1136. The service standards are also published on www.statcan.gc.ca under "Contact us" > "Standards of service to the public."

Note of appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and goodwill.

Published by authority of the Minister responsible for Statistics Canada

An HTML version is also available.

Cette publication est aussi disponible en français.

Validation of a brief measure of combat exposure among Canadian Armed Forces personnel

by Kerry A. Sudom, Robert Nesdole and Mark A. Zamorski

Abstract

Introduction: Exposure to military combat is associated with mental health problems, including posttraumatic stress disorder (PTSD) and depression. To understand the effects of combat on adverse health outcomes, the sound measurement of combat experiences is required; however, many scales used in past research are lengthy. A brief measure of combat exposure benefits militaries by reducing the burden on respondents as well as administration time in post-deployment settings and large population-based health surveys.

Data and methods: The current study sought to describe the psychometric properties of a brief measure of combat exposure among Canadian Armed Forces (CAF) personnel. Data from post-deployment screening were used to compare the psychometric properties of an 8-item scale with the full scale that it was derived from.

Results: The 8-item measure did not fit a one-factor solution well and did not offer a statistically significant improvement in model fit over the full 30-item measure. However, its association with increased odds of a number of health outcomes indicates that it could be useful as a brief measure of combat exposure in settings where using the full scale is not feasible.

Interpretation: Brief measures of combat exposure are valuable for assessing events experienced during deployment among military personnel. Although the 8-item Combat Exposure Scale assessed in the current study represents a potentially useful measure for CAF personnel, further research is necessary to improve its fit.

Keywords: deployment, combat, military, PTSD, stress disorders, Canada, Afghanistan, post-deployment screening

DOI: https://www.doi.org/10.25318/82-003-x201901100002-eng

Research has consistently shown that exposure to military combat is associated with a host of mental health problems, including posttraumatic stress disorder (PTSD), depression and alcohol misuse,[1-3] with PTSD showing the strongest association.[4] In addition, combat exposure has been linked to substance abuse, suicidal ideation, injury and traumatic brain injury.[1,5-9] To understand how combat affects adverse health outcomes, sound measurement of combat experiences is required. Generic trauma measures have items that map conceptually to military experiences (e.g., exposure to combat or peacekeeping), but there are several limitations to using these measures: a lack of clarity as to what precise experiences underlie a respondents' endorsement of an item, an inability to capture the broad range of intensity of combat experiences, and an inability to tie other trauma items from the inventory to military service.

Although different measures of combat exposure exist, many recent Canadian[10,11] and international[12,13] studies have used measures based on the Mental Health Advisory Team's Combat Experiences Scale (MHAT-CES), developed by the Walter Reed Army Institute of Research (WRAIR).[2] The original measure is meant to capture the full range of potentially traumatic combat experiences among individuals deployed to the ongoing conflicts in Southwest Asia. The instrument is lengthy, including up to 37 items in some versions.[14] Advantages of longer instruments include their being exhaustive and, when treated as a count of the different types of combat experiences,[15] precise. However, using longer instruments results in greater respondent burden, which can be problematic in the contexts of routine post-deployment screening and large, population-based mental health surveys. Briefer instruments are therefore needed. Factor analysis and principal components analysis[3,16] of longer scales have demonstrated that many of the items are tightly correlated with one another, providing both a justification and a basis for selecting items to make a briefer scale.

Several shorter scales to assess combat exposure have been developed and validated in other military populations. The Critical Warzone Experiences scale, a 7-item Combat Experiences Scale (CES) measure of combat experiences derived from the MHAT-CES, was found to have favourable psychometric properties and to be strongly predictive of mental health outcomes among Iraq and Afghanistan veterans.[17] In addition, the 7-item CES has been validated with Vietnam veterans.[18] An 8-item measure of combat exposure (CES-8) was recently used in the Canadian Forces Mental Health Survey (CFMHS), a population-based survey of Canadian Armed Forces (CAF) personnel that was administered in 2013. The CFMHS provides a rich source of data on mental health and enables comparison across time points within the CAF and with the civilian general population.[19] The 8 items in the CES-8 were derived from the larger 30-item CES (CES-30) used to capture deployment experiences during post-deployment screening. However, the

Authors: Kerry A. Sudom (kerry.sudom@forces.gc.ca) and Robert Nesdole are with the Director General Military Personnel Research and Analysis, Defence Research and Development Canada. Mark A. Zamorski (deceased August 17, 2018) was with the Directorate of Mental Health, Canadian Forces Health Services Group, and the Department of Family Medicine at the University of Ottawa, Ottawa, Ontario.

What is already known on this subject?

- It is important to be able to reliably and precisely measure events experienced during military deployment in order to understand the effects of combat on health issues including PTSD and depression.
- Past research has often used long lists of combat experiences to measure exposure to events during deployment.
- A more concise scale would have the benefit of being more quickly and easily administered in post-deployment settings, therefore reducing respondent and administrative burden.

What does this study add?

- Similar to longer scales, the brief measure of combat exposure examined in this study was associated with a range of health outcomes, including depression, PTSD, and traumatic brain injury.
- The association of scale scores with increased odds of adverse health outcomes indicates its potential usefulness as a brief measure of combat exposure to be used in settings where administering the full scale is not feasible.

psychometric properties of this reduced scale have not been rigorously explored in association with the parent scale and the outcomes related to mental health that the scale is meant to predict.

Therefore, the current study uses data collected during post-deployment screening to document the psychometric properties of these 8 items as a potential brief measure of combat exposure that could be used for CAF personnel returning from deployment. The goal of this study is to examine the utility of the CES-8 as a potential alternative to the CES-30 in the contexts of both screening and survey research.

Table 1
Sociodemographic and military characteristics of the sample (n = 16,188)

Characteristic	Frequency (%)
Sex	
Male	90.67
Female	9.33
Age (years)	
Younger than 32	53.42
32 and older	46.60
Years of service	
10 or less	60.91
More than 10	39.11
Component	
Regular Force	85.49
Reserve Force	14.51
Rank	
Private or equivalent	8.42
Other junior NCM	58.57
Officer	33.01
Element	
Army	79.57
Air Force	14.48
Navy	5.95

NCM = non-commissioned member.
Source: Enhanced Post-Deployment Screening questionnaire, 2009 to 2012.

Method

Participants

Participants included 16,188 CAF personnel who deployed in support of the mission in Afghanistan between 2009 and 2012. There was significant diversity in the roles and experiences of participants across phases and locations of deployment. Participants located in Kandahar, representing the majority of deployments, had the highest threat level.[15,20] The sociodemographic and military characteristics of the sample are presented in Table 1. The majority of participants were male, Regular Force, non-commissioned members, and from the Army element.

Procedure

Combat exposure data from the Enhanced Post-Deployment Screening (EPDS) process were used for this study. The EPDS involves a confidential, although not anonymous, questionnaire administered between 90 and 180 days following overseas deployments of 60 days or longer.10 Data from the EPDS process are captured electronically for health surveillance purposes. The anonymized use of these administrative health data for the present analysis was approved as part of a larger research project[21] by Veritas Independent Review Board in Montreal, Quebec.

Measures

Combat exposure: Combat exposure was assessed using a modified version of the 34-item CES developed by WRAIR.[14,22] The scale assesses the types of events experienced during the most recent deployment (e.g., "knowing someone seriously injured or killed"). The EPDS uses a 30-item version of the WRAIR combat exposure scale, with four items of the original scale removed because of concerns that endorsing them might require investigation into potential misconduct (e.g., "witnessing mistreatment of a non-combatant"). The items for the CES-8 were derived from these 30 items using considerations such as the prevalence,[3] association with adverse mental health outcomes,[23] ability to map to a range of different subfactors identified in earlier principal components analysis,[3,4] and conceptual considerations of the items (M. Zamorski, personal communication, March 30, 2017). The response options were "yes" or "no" for having experienced each type of event during the most recent deployment.

Mental health problems: Several measures of mental health and well-being were used in this study to establish whether the CES-8 had the expected relationship with PTSD, depression, anxiety disorder, suicidal ideation and high risk drinking. PTSD symptomatology was assessed using the PTSD Checklist–Civilian version (PCL-C).[24] The PCL-C consists of 17 items that encompass the diagnostic symptoms of PTSD. With this test, respondents are asked to indicate how much they were bothered by each symptom in the past month, and scores of 50 or higher indicate the presence of PTSD.[24] Symptoms of depression were measured using the Primary Care Evaluation of Mental Disorders (PRIME-MD) Patient Health Questionnaire (PHQ),[25] which assesses core diagnostic symptoms of depression

and involves asking respondents how often they had been bothered by problems over the last two weeks. Developers of the scale created algorithms to determine diagnoses of major depressive disorder (MDD) and minor depressive disorder (described as "other depressive disorder" by the developers).[25] Symptoms of anxiety were measured using seven items from the PRIME-MD PHQ, assessing how often the respondent had been bothered by the diagnostic symptoms of generalized anxiety disorder (GAD) over the previous four weeks. This was done using the algorithm documented by the developer for "other anxiety syndrome."[25] Suicidal ideation was measured using one item (i.e., "thoughts that you would be better off dead, or of hurting yourself in some way") embedded in the PRIME-MD PHQ.[25] Respondents were asked how often they had been bothered by this over the last two weeks. Symptoms of high risk drinking were measured using the 10-item Alcohol Use Disorders Identification Test,[26] developed to identify individuals whose alcohol consumption has become hazardous or harmful to their health.

Analysis

The reliability coefficients for the full scale (CES-30) and the 8-item scale (CES-8) were calculated. The factor structure of the CES-30 and CES-8 were evaluated for model fit using the following indices: chi-square, the root mean square error of approximation (RMSEA),[26] the comparative fit index (CFI),[27] the Tucker-Lewis Index (TLI),[28] and the standardized root mean square residual (SRMR).[29] Fit index cut-off levels for determining goodness of fit include X*2* *p*-value > 0.05, CFI > 0.95, TLI > 0.95, RMSEA < 0.06, and SRMR < 0.08.[29] Log likelihood estimates obtained from generalized structural equation modelling were used to compare the fit of the CES-8 with the CES-30.

The association between CES-8 scores and CES-30 scores was evaluated using point biserial correlation coefficients for dichotomous mental health outcomes. In addition, the relationship between the CES-8 and measures of health known to be associated with combat exposure from past research was assessed using logistic regression. Finally, the overall predictive value for the outcome of PTSD was compared for the two scales by calculating the area under the curve (AUC) using receiver operating characteristic (ROC) analysis. Stata version 14 was used for all analyses.

Table 2
CES-8 and CES-30 descriptive information

Items	Proportion of respondents experiencing the item at least once
1. Receiving incoming artillery, rocket, or mortar fire	**63.0%**
2. Improvised explosive device (IED)/booby-trap exploded near you	60.1%
3. Having hostile reactions from civilians	57.6%
4. Seeing dead bodies or human remains	45.6%
5. Being attacked or ambushed	42.4%
6. Receiving small arms fire	42.0%
7. Having a member of your own unit become a casualty	38.9%
8. Working in areas that were mined or had IEDs	38.8%
9. Witnessing an accident which resulted in serious injury or death	37.5%
10. Knowing someone seriously injured or killed	**34.8%**
11. Seeing dead or seriously injured Canadians	34.1%
12. Clearing/searching homes or buildings	28.9%
13. Participating in IED/mine clearing	28.6%
14. Shooting or directing fire at the enemy	28.2%
15. Seeing ill/injured women or children who you were unable to help	**24.2%**
16. Having difficulty distinguishing between combatants and non-combatants	**21.2%**
17. Handling or uncovering human remains	19.8%
18. Being in threatening situations where you were unable to respond because of rules of engagement	**19.7%**
19. Calling fire on the enemy	13.6%
20. Seeing a unit member blown up or burned alive	11.9%
21. Clearing/searching caves or bunkers	11.4%
22. Had a buddy shot or hit who was near you	10.5%
23. Had a close call, was shot or hit but protective gear saved you	**10.3%**
24. Feeling directly responsible for the death of an enemy combatant	10.3%
25. Being wounded/injured	**7.7%**
26. Witnessing a friendly fire incident	7.4%
27. Sniper fire	7.0%
28. Feeling responsible for the death of Canadian or ally personnel	**2.6%**
29. Feeling directly responsible for the death of a non-combatant	1.9%
30. Engaging in hand-to-hand combat	1.0%

CES = Combat Experiences Scale.
KR = Kuder-Richardson reliability scale.
M = mean.
SD = standard deviation.
Note: CES-8 items are shown in **bold**.
Source: Enhanced Post-Deployment Screening questionnaire, 2009 to 2012.

Results

Descriptive information and reliability

Table 2 presents the percentage of respondents who reported experiencing each of the events at least once. The most commonly experienced event was receiving incoming artillery, rocket, or mortar fire, reported by 63% of participants, while feeling responsible for the death of Canadian or ally personnel was reported by less than 3% of participants. The Kuder-Richardson reliability coefficient for the CES-30 was high (KR-20 = 0.92), while the coefficient for the CES-8 was moderate (KR-20 = 0.63).

Model fit

Confirmatory factor analysis model fit indices are shown in Table 3. For both scales, four out of five of the indices indicated poor fit. With the exception of a single index (SRMR), fit tended to be better, if anything, for the CES-8 than for the CES-30. However, the log likelihood test suggested that the CES-8 does not

offer a statistically significant improvement in model fit: X^2 (df) = -348,765.96 (22), $p = 0.99$.

Comparison of the CES-8 and the CES-30

The CES-30 and CES-8 were highly correlated, at 0.85 ($p < 0.01$), indicating that both scales are likely measuring the same construct. Both CES-8 and CES-30 total scores were correlated with greater prevalence of PTSD, depression, suicidal ideation, anxiety and high risk drinking (Table 4). For both measures, the strongest associations were evident for PTSD.

Logistic regression was used to assess the associations of the CES-8 and CES-30 with mental health outcomes (Table 5). The CES-8 and CES-30 were both found to be predictive of PTSD, MDD, other depressive disorders, GAD, suicidal ideation and high risk drinking ($p < 0.001$), with PTSD displaying the strongest associations for both versions of the scale.

An ROC curve was developed to determine the relative predictive value of the CES-8 and CES-30 for PTSD symptoms. PTSD was chosen as the outcome variable for this analysis because of its strong association with combat exposure relative to other mental health problems.[4] The results of this analysis suggested that both the CES-8 (AUC = 0.72, $p < 0.001$) and the CES-30 (AUC = 0.70, $p < 0.001$) have similar predictive value for PTSD.

Table 3
Goodness-of-fit indices for the CES-8 and CES-30

		Index value		Fit / No fit	
Fit index	Criterion of fit	CES-8	CES-30	CES-8	CES-30
x^2 (df)	$p \geq 0.05$	3584.319 (20)	175623.74 (405)	No fit	No fit
RMSEA	≤ 0.08	0.11	0.16	No fit	No fit
CFI	≥ 0.95	0.9	0.64	No fit	No fit
TLI	≥ 0.95	0.86	0.61	No fit	No fit
SRMR	≤ 0.08	0.05	0.07	Fit	Fit

CES = Combat Experiences Scale
X2 = chi-square
RMSEA = root mean square error of approximation
CFI = comparative fit index
TLI = Tucker-Lewis index
SRMR = standardized root mean square residual
Source: Enhanced Post-Deployment Screening questionnaire, 2009 to 2012.

Discussion

A brief measure of combat exposure helps militaries to reduce the burden on respondents and the administration time in large population-based health surveys, as well as in post-deployment settings where personnel must also be screened for mental and physical health problems. The present study sought to describe the psychometric properties of a brief version of the CES among CAF members who recently returned from a deployment in support of the mission in Afghanistan and who had completed post-deployment screening. It was found that the 8-item measure did not fit a one-factor solution well, nor did the 30-item scale, indicating that the CES-30 likely works best when used with subscales or on more homogeneous groups, as noted in previous research.[3] In addition, the shorter scale did not offer a statistically significant improvement in model fit over the full 30-item measure. However, the association of the CES-8 with increased odds of a number of mental health outcomes indicates its potential usefulness as a brief measure of combat exposure in settings where using the full scale is not feasible. Moreover, the CES-30 and the CES-8 were found to have similar predictive value for PTSD.

The items used in the reduced CES are similar to those used in a validation study of a 7-item CES, which demonstrated high reliability and a single higher-order factor among a sample of U.S. veterans.[17] However, the 7-item CES validation used only treatment-seeking veterans, unlike the current study, which included all CAF members undergoing post-deployment screening regardless of their health status. Similarly, although Keane and colleagues[18] also found that a 7-item CES had good reliability and factorial validity, the study used only treatment-seeking veterans, and those with mental health conditions were oversampled. Other research using longer scales has also used more homogeneous samples.[14,16] A much larger and more diverse group of personnel returning from deployment was used in the current study.[10] Therefore, it is impossible to attribute the more favourable factor structure of these other brief scales to the scale itself rather than the greater homogeneity of the validation sample.

Similar to past research using brief scales of combat exposure,[17,18] the CES-8 showed strong associations with health conditions. In the present study, the strongest associations were found for PTSD. Past research has shown that, of the mental health conditions assessed following deployment, PTSD generally shows the strongest association with combat exposure.[4]

Limitations

There are a number of limitations to this study. First, post-deployment screening data are collected several months following the end of deployment, which may lead to issues with accurate recall of events, particularly for participants with mental or physical health conditions. In addition to the length of time elapsed, the respondent's current level of mental health and functioning may affect their perceptions of events that occurred during the deployment.

The survey contains self-reported, subjective measures of combat experiences and mental and physical health conditions. Although confidentiality is assured, the EPDS is not anonymous because of its nature as a screening tool to identify individuals requiring help for health conditions following deployment. Therefore, some participants may be reluctant to admit involvement in particular combat experiences, particularly those involving perceived responsibility for the death of Canadian or ally personnel, for fear of

potential career repercussions. Similarly, some respondents may be reluctant to disclose mental health problems because of perceived stigma or potential personal or career impacts. Analysis of combat exposure data from the CFMHS will alleviate this issue since the survey was conducted by a third party as part of a research study with strict confidentiality protections.

Data from post-deployment screening are collected at a single point in time. Therefore, although combat exposure was associated with a number of mental health conditions in this study, it is unclear whether combat experiences led to the development of mental health problems, or whether such experiences exacerbated existing issues among vulnerable individuals. Longitudinal research is needed to determine the temporal relationship between combat experiences and mental health. This study sought to simply examine the structure of the scale and its psychometric properties; no assumptions were made about causality.

Combat experiences were captured in dichotomous response format (i.e., "yes" or "no" to having experienced a particular type of event), which does not reflect the degree of exposure or the level of subjective stress associated with each event. Certain events may be perceived as more traumatic and exhibit greater associations with mental health problems. Indeed, previous research on CAF members following deployment has shown that certain combat experiences are associated with increased odds of PTSD, while other experiences showed no associations.[4] There is also evidence for the importance of cognitive appraisals of deployment stressors for mental health outcomes.[30]

Finally, it is difficult to reliably capture combat experiences using a single scale because of the heterogeneity of experiences of personnel deployed in support of modern military operations. Past research has alleviated this issue by using more homogeneous samples.[17] Moreover, items included in this scale may not apply to future missions, and traumatic experiences may also occur on other types of non-combat missions (e.g., peacekeeping or humanitarian missions). The heterogeneity of experiences and the changing nature of military missions reflect the difficulty in using single measures of exposure to occupational trauma in the military.

Table 4
Point biserial correlations between CES-8 total scores and dichotomous variables of interest

	CES-8 total score	CES-30 total score	PTSD	MDD	MinD	GAD	Suicidal ideation	High risk drinking
CES-8 total score	1	_	_	_	_	_	_	_
CES-30 total score	0.850**	1	_	_	_	_	_	_
PTSD	0.267**	0.218**	1	_	_	_	_	_
MDD	0.125**	0.085**	0.458**	1	_	_	_	_
MinD	0.052**	0.037**	0.217**	-0.034	1	_	_	_
GAD	0.064**	0.040**	0.206**	0.158**	0.114**	1	_	_
Suicidal ideation	0.091**	0.071**	0.328**	0.395**	0.024**	0.142**	1	_
High risk drinking	0.176**	0.186**	0.203**	0.120**	0.072**	0.063**	0.123**	1

** Correlation is significant at the 0.01 level (1-tailed).
CES = Combat Experiences Scale
PTSD = posttraumatic stress disorder
MDD = major depressive disorder
MinD = minor depressive disorder
GAD = generalized anxiety disorder
Notes: Responses for all variables coded as "yes" = 1 and "no" = 0.
Source: Enhanced Post-Deployment Screening questionnaire, 2009 to 2012.

Table 5
Logistic regression of CES-30 and CES-8 (treated as scale variables) as predictors of mental health outcomes

	Odds ratio (95% confidence interval)	
Outcome	CES-8*	CES-30*
PTSD	1.62 (1.58 – 1.67)	1.11 (1.10 – 1.12)
MDD	1.45 (1.38 – 1.52)	1.07 (1.06 – 1.09)
MinD	1.17 (1.12 – 1.23)	1.03 (1.02 – 1.05)
GAD	1.27 (1.20 – 1.36)	1.04 (1.03 – 1.06)
Suicidal ideation	1.37 (1.30 – 1.45)	1.07 (1.06 – 1.08)
High risk drinking behaviour	1.29 (1.22 – 1.38)	1.07 (1.06 – 1.08)

*All odds ratios are statistically significant at the $p < 0.001$ level
CES = Combat Experiences Scale
PTSD = posttraumatic stress disorder
MDD = major depressive disorder
MinD = minor depressive disorder
GAD = generalized anxiety disorder
Source: Enhanced Post-Deployment Screening questionnaire, 2009 to 2012.

Implications

Although the 8-item scale was developed for the CFMHS, a population-based survey of CAF members, its psychometric properties were confirmed using post-deployment screening data to facilitate comparison with the full 30-item scale it was derived from and to determine whether it offered an advantage over the longer scale. However, it will also be important to examine the CES-8 scale using data from the CFMHS itself to determine whether the CES-8 exhibits similar psychometric properties in this group, which experienced a variety of deployments in addition to those in support of the mission in Afghanistan. Moreover, other shorter measures of combat exposure based on the CES-30 should be tested to determine whether a different set of items offers a greater statistical advantage and shows a more robust structure than the full scale.

Conclusions

Brief measures of combat exposure are valuable for assessing events experienced during deployment among military personnel. Such measures would be simple and convenient to administer in

post-deployment settings where military personnel typically undergo screening for health issues, and thereby reduce administrative and respondent burden. Although the CES-8 assessed in the current study represents a potentially useful measure for CAF personnel, further research is necessary to improve its fit as a unidimensional scale of combat exposure. ■

References

1. Bray RM, Pemberton MR, Lane ME, et al. Substance use and mental health trends among U.S. military active duty personnel: key findings from the 2008 DoD Health Behavior Survey. *Military Medicine* 2010; 175(6): 390-9.
2. Hoge CW, Castro CA, Messer SC, et al. Combat duty in Iraq and Afghanistan, mental health problems and barriers to care. *United States Army Medical Department Journal* 2008:7-17.
3. Sudom KA, Watkins K, Born J, Zamorski MA. Stressors experienced during deployment among Canadian Armed Forces personnel: Factor structure of two combat exposure scales. *Military Psychology* 2016; 28(5): 285-95.
4. Watkins K. Deployment stressors: A review of the literature and implications for members of the Canadian Armed Forces. *Res Militaris* 2014; 4(2): 1-29.
5. Brenner AL, Ivins JB, Schwab AK, et al. Traumatic brain injury, posttraumatic stress disorder, and postconcussive symptom reporting among troops returning from Iraq. *Journal of Head Trauma Rehabilitation* 2010; 25(5): 307-12.
6. Jacobson IG, Ryan MAK, Hooper TI, et al. Alcohol use and alcohol-related problems before and after military combat eployment. *JAMA* 2008; 300(6): 663-75.
7. Jakupcak M, Cook J, Imel Z, et al. Posttraumatic stress disorder as a risk factor for suicidal ideation in Iraq and Afghanistan War veterans. *Journal of Traumatic Stress* 2009; 22(4): 303-6.
8. Prigerson HG, Maciejewski PK, Rosenheck RA. Population attributable fractions of psychiatric disorders and behavioral outcomes associated with combat exposure among US men. *The American Journal of Public Health* 2002; 92(1): 59.
9. Schneiderman AI, Braver ER, Kang HK. Understanding sequelae of injury mechanisms and mild traumatic brain injury incurred during the conflicts in Iraq and Afghanistan: persistent postconcussive symptoms and posttraumatic stress disorder. *American journal of epidemiology* 2008; 167(12): 1446-52.
10. Zamorski MA, Rusu C, Garber BG. Prevalence and correlates of mental health problems in Canadian Forces personnel who deployed in support of the mission in Afghanistan: Findings from postdeployment screenings, 2009–2012. *The Canadian Journal of Psychiatry* 2014; 59(6): 319-26.
11. Garber BG, Zamorski MA, Jetly CR. Mental health of Canadian Forces members while on deployment to Afghanistan. *The Canadian Journal of Psychiatry* 2012; 57(12): 736-44.
12. Sundin J, Herrell RK, Hoge CW, et al. Mental health outcomes in US and UK military personnel returning from Iraq. *The British journal of psychiatry : the journal of mental science* 2014; 204(3): 200-7.
13. Hoge CW, Castro CA, Messer SC, et al. Combat Duty in Iraq and Afghanistan, Mental Health Problems, and Barriers to Care. *The New England Journal of Medicine* 2004; 351(1): 13-22.
14. Killgore WDS, Cotting DI, Thomas JL, et al. Post-combat invincibility: Violent combat experiences are associated with increased risk-taking propensity following deployment. *Journal of Psychiatric Research* 2008; 42(13): 1112-21.
15. Zamorski MA, Boulos D. The impact of the military mission in Afghanistan on mental health in the Canadian Armed Forces: a summary of research findings. *European Journal of Psychotraumatology* 2014; 5(1).
16. Guyker WM, Donnelly K, Donnelly JP, et al. Dimensionality, reliability, and validity of the combat experiences scale. *Military medicine* 2013; 178(4): 377-84.
17. Kimbrel NA, Evans LD, Patel AB, et al. The critical warzone experiences (CWE) scale: Initial psychometric properties and association with PTSD, anxiety, and depression. *Psychiatry Research* 2014; 220(3): 1118-24.
18. Keane TM, Fairbank JA, Caddell JM, et al. Clinical evaluation of a measure to assess combat exposure. *Psychological Assessment: A Journal of Consulting and Clinical Psychology* 1989; 1(1): 53-5.
19. Zamorski MA, Bennett RE, Boulos D, et al. The 2013 Canadian Forces Mental Health Survey: Background and methods. *The Canadian Journal of Psychiatry* 2016; 61(1_suppl): 10S-25S.
20. Boulos DL, Zamorski MA. *Cumulative incidence of PTSD and other mental health disorders*. Ottawa: Department of National Defence, 2011.
21. Garber BG, Rusu C, Zamorski MA. Deployment-related mild traumatic brain injury, mental health problems, and post-concussive symptoms in Canadian Armed Forces personnel. *BMC psychiatry* 2014; 14(1): 325.
22. Office of the Surgeon General Mental Health Advisory Team (MHAT) IV: Operation Iraqi Freedom 05-07. Washington, DC: US Army Medical Command, 2006.
23. Watkins K, Sudom KA, Zamorski MA. Association of combat experiences with posttraumatic stress disorder among Canadian Military personnel deployed in support of the mission in *Afghanistan. Military Behavioral Health* 2016; 4(3): 285-292.
24. Weathers FW, Litz BT, Herman DS, et al. *The PTSD Checklist (PCL): Reliability, validity, and diagnostic utility.* Paper presented at the Annual Meeting of the International Society for Traumatic Stress Studies. San Antonio, Texas, 1993.
25. Spitzer RL, Kroenke K, Williams JBW. Validation and utility of a self-report Version of PRIME-MD: The PHQ primary care study. *JAMA* 1999; 282(18): 1737-44.
26. Saunders JB, Aasland OG, Babor TF, et al. Development of the Alcohol Use Disorders Identification Test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption--II. *Addiction* 1993; 88(6): 791-804.
27. Byrne BM. Structural equation modeling with EQS: Basic concepts, applications, and programming. 2006.
28. Bentler PM, Bonett DG. Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin* 1980; 88(3): 588-606.
29. Hu LT, Bentler P. Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal* 1999; 6(1): 1-55.
30. McCuaig Edge HJ, Ivey GW. Mediation of cognitive appraisal on combat exposure and psychological distress. *Military Psychology* 2012; 24(1): 71-85.