

# Comorbidity Patterns of Psychiatric Conditions in Canadian Armed Forces Personnel

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## Modèles de comorbidité des affections psychiatriques chez les membres des Forces armées canadiennes

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### Abstract

**Objective:** Posttraumatic stress disorder (PTSD) is often accompanied by other mental health conditions, including major depressive disorder (MDD), substance misuse disorders, and anxiety disorders. The objective of the current study is to delineate classes of comorbidity and investigate predictors of comorbidity classes amongst a sample of Canadian Armed Forces (CAF) Regular Force personnel.

**Methods:** Latent class analyses (LCAs) were applied to cross-sectional data obtained between April and August 2013 from a nationally representative random sample of 6700 CAF Regular Force personnel who deployed to the mission in Afghanistan.

**Results:** MDD was the most common diagnosis (8.0%), followed by PTSD (5.3%) and generalized anxiety disorder (4.7%). Of those with a mental health condition, LCA revealed 3 classes of comorbidity: a highly comorbid class (8.3%), a depressed-only class (4.6%), and an alcohol use-only class (3.1%). Multinomial logit regression showed that women (adjusted relative risk ratio [ARRR] = 2.77; 95% CI, 2.13 to 3.60;  $P < 0.01$ ) and personnel reporting higher trauma exposure (ARRR = 4.18; 95% CI, 3.13 to 5.57;  $P < 0.01$ ) were at increased risk of membership in the comorbid class compared to those without a mental health condition. When compared to those with no mental health condition, experiencing childhood abuse increased the risk of being in any comorbidity class.

**Conclusions:** Results provide further evidence to support screening for and treatment of comorbid mental health conditions. The role of sex, childhood abuse, and combat deployment in determining class membership may also prove valuable for clinicians treating military-related mental health conditions.

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## Abrégé

**Objectif :** Le trouble de stress post-traumatique (TSPT) s'accompagne souvent d'autres affections de santé mentale, notamment le trouble dépressif majeur (TDM), les troubles d'abus de substances, et les troubles anxieux. L'objectif de la présente étude est de délimiter les catégories de morbidité dans un échantillon de membres de la Force régulière des Forces armées canadiennes (FAC).

**Méthodes :** Des analyses des classes latentes (ACL) ont été employées sur des données transversales obtenues entre avril et août 2013 d'un échantillon aléatoire représentatif à l'échelle nationale de 6 700 membres de la Force régulière des FAC déployés en mission en Afghanistan.

**Résultats :** Le TDM était le diagnostic le plus commun (8,0%), suivi du TSPT (5,3%) et du trouble anxieux généralisé (4,7%). Chez ceux qui avaient une affection de santé mentale, les ACL ont révélé 3 catégories de comorbidité: une catégorie très comorbide (8,3%), une catégorie de dépression seulement (4,6%); et une catégorie de consommation d'alcool seulement (3,1%). La régression logistique multinomiale a révélé que les femmes (réduction du risque relatif ajusté [RRRA]: 2,77; IC à 95% 2,13 à 3,60;  $P < 0,01$ ) et les militaires qui déclaraient une forte exposition à un traumatisme (RRRA: 4,18; IC à 95% 3,13 à 5,57,  $P < 0,01$ ) étaient à risque accru d'appartenir à la catégorie comorbide comparativement à ceux qui n'avaient pas d'affection de santé mentale. En comparaison avec ceux sans affection de santé mentale, le fait d'avoir vécu de l'abus dans l'enfance augmentait le risque de se classer dans une catégorie de comorbidité.

**Conclusions :** Les résultats offrent d'autres preuves en faveur du soutien du dépistage et du traitement des affections de santé mentale comorbides. Le rôle du sexe, de l'abus dans l'enfance, et du déploiement au combat dans la détermination de l'appartenance à une catégorie peut aussi se révéler valable pour les cliniciens qui traitent des affections de santé mentale liées aux militaires.

## Keywords

alcohol use, comorbidity, generalized anxiety disorder, major depressive disorder, posttraumatic stress disorder

Of the roughly 40,000 Canadian Armed Forces (CAF) members deployed to the combat mission in Afghanistan, approximately 13.5% have since been diagnosed with a mental disorder.<sup>1,2</sup> Rates of past-year posttraumatic stress disorder (PTSD), generalized anxiety disorder (GAD), and panic disorder (PD) among CAF members have risen, as have rates of comorbidity. In 2002, 27.4% of CAF members with mood or anxiety disorders reported multiple mental health conditions; by 2013, this had increased to 41.0%.<sup>3</sup> Increases in the prevalence and co-occurrence of mental health symptoms and disorders have been reported within other national militaries; for example, higher rates of alcohol misuse are described in UK military populations,<sup>4</sup> while an increase in PTSD and psychiatric comorbidities has been reported within US military populations.<sup>5</sup> Comorbidity is associated with poorer health outcomes, increased health care costs,<sup>6</sup> and treatment complexity<sup>7</sup> and may contribute to lower health-related quality of life.<sup>8-10</sup> As such, a better understanding of the nature of comorbidity is a topic of increasing importance.

Within military populations, major depressive disorder (MDD) is often reported alongside PTSD.<sup>11,12</sup> However, PTSD also commonly presents with anxiety disorders such as GAD and substance misuse problems such as alcohol use disorder (AUD).<sup>13,14</sup> Estimates of PTSD comorbidities within military samples have ranged as high as 50% to 80%,<sup>15,16</sup> but symptom overlap between mood and anxiety disorders exists,<sup>17-19</sup> and shared vulnerability of risk factors may help explain high rates of comorbidity.<sup>20,21</sup>

Existing research demonstrates that having one mental health condition increases the risk of developing

subsequent mental health conditions.<sup>22</sup> Sociodemographic and historical factors have also been associated with comorbidity. For example, female sex, younger age, childhood physical and sexual abuse, lower education, and unemployment have been associated with comorbid mood and anxiety disorders in civilians.<sup>23,24</sup> In military samples, a recent study<sup>25</sup> of 1551 US military personnel who served in Iraq or Afghanistan found that female members with MDD experienced comorbid anxiety disorders more frequently than their male counterparts, while comorbid alcohol and nicotine use disorders were seen more frequently among male participants.

Data reduction techniques such as latent class analysis (LCA) have been widely used to study comorbidity in military cohorts. Such work has largely focused on symptom overlap between PTSD and other conditions such as depression,<sup>12,26,27</sup> anxiety,<sup>28</sup> and AUD.<sup>29</sup> A substantial number of studies have identified a 3-class solution, composed of a high symptom severity class, a moderate symptom severity class, and a low symptom severity class,<sup>30-32</sup> although 1 study examining the absence or presence of mental health conditions, as opposed to symptoms, found only high and low comorbidity classes.<sup>33</sup> Lippa and colleagues<sup>34</sup> recently investigated factors of comorbidity in a small sample ( $N = 255$ ) of service members deployed to Iraq or Afghanistan. The results of this study revealed 4 factors: a trauma factor characterized by mild traumatic brain injury, depression, and PTSD; a somatic factor characterized by pain and sleep disturbances; a factor comprising only anxiety; and a factor comprising only substance use.

Despite evidence of mental health comorbidity among military personnel and veterans, factors that may put CAF members at risk for developing psychiatric comorbidities have been largely unexplored. Therefore, using data from the 2013 Canadian Forces Mental Health Survey (CFMHS), the aim of the current study was to describe patterns of psychiatric comorbidity using latent class analysis within a nationally representative sample of CAF members deployed in support of the mission in Afghanistan.

## Methods

### Participants and Procedure

Data for this study were obtained from the 2013 CFMHS, a survey assessing the mental health status and health service use of 8165 currently serving Regular Force (RegF) and 1867 Reserve Force (ResF) personnel. Data were collected by Statistics Canada using computer-assisted personal interviews between April and August 2013; response rates for the survey were 79.8% for RegF personnel ( $N = 6700$ ) and 78.7% ( $N = 1500$ ) for ResF personnel. The current study included data from the 6700 RegF members only, as data for ResF members were not stratified by deployment to Afghanistan. Additional details on the CFMHS, including sampling methodology, are available elsewhere.<sup>3</sup>

### Measures

**Mental health conditions.** Respondents were assessed for probable past 12-month PTSD, MDD, PD, GAD, alcohol abuse disorder (AAD), and alcohol dependence disorder (ADD) using the World Health Organization Composite International Diagnostic Interview (WHO-CIDI) version 3.0, which uses criteria from the fourth edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM-IV)*.<sup>35</sup> Previous studies show the WHO-CIDI demonstrates acceptable concordance with clinical diagnostic instruments.<sup>36,37</sup>

### Covariates of Mental Health

**Sociodemographic characteristics.** Demographic variables measured included sex (male, female), age group (18-29, 30-44, 45-60 years), and marital status (married/common law, divorced/separated/widowed, single/never married).

**Military characteristics.** Military variables measured included rank (junior noncommissioned members, senior noncommissioned members, officers) and branch (Army, Navy, Air Force).

**Deployment-related traumatic experiences.** History of deployment-related potentially traumatic experiences was assessed using the 8-item version of a combat experiences scale.<sup>38</sup> Respondents indicated whether they had experienced (yes/no) the following events: being in a threatening situation; having been injured; seeing ill or injured women or

children who you were unable to help; feeling responsible for the death of a Canadian or ally; having a close call; knowing someone who was seriously injured or killed; receiving incoming artillery, rocket, or mortar fire; and having difficulty distinguishing between combatants and non-combatants. These items are meant to capture a wide array of potentially traumatic deployment-specific experiences. Responses were categorized as never deployed, deployed without endorsing potentially traumatic experiences, endorsing 1 to 2 types of potentially traumatic experiences while deployed, and endorsing 3 to 8 types of potentially traumatic experiences while deployed.

**History of child abuse.** History of childhood physical and/or sexual abuse and exposure to intimate partner violence were assessed using the Childhood Experiences of Violence Questionnaire.<sup>39</sup> Respondents reported whether they had experienced 6 specific childhood abuse events (witnessing interpersonal violence in the home; being slapped or spanked; being pushed, grabbed, or shoved; being kicked, punched, bitten, choked, or burned; unwanted sexual activity; being touched or fondled sexually) before 16 years of age using a 5-point ordinal scale (*never, 1-2 times, 3-5 times, 6-10 times, and 10 or more times*). A count of the number of types of child abuse was classified as none, 1 type, and 2 or more types.

**Disability.** Past-month disability was assessed using the short version of the WHO Disability Assessment Schedule 2.0 (WHODAS). Respondents indicated the degree of difficulty experienced while performing 12 common activities over the past 30 days, using a 5-point response scale from ranging from *none* to *extreme/cannot do*. Disability scores ranging from 0 (*no disability*) to 100 (*full disability*) were calculated using the scoring method outlined in the WHODAS 2.0.<sup>40</sup>

**Self-rated mental health.** Respondents rated their own mental health on a single item using a 5-point response scale, ranging from poor to excellent.

**Mental health service use.** Respondents indicated if problems with emotions, mental health, or alcohol or drug use within the past 12 months had caused them to see or speak to a health care provider. Interactions with a general practitioner, mental health nurse, or social worker were categorized as primary service use, while interactions with a psychiatrist or psychologist were categorized as specialty service use. Responses were classified as follows: no mental health service use, primary service use only, and specialty service use.

### Statistical Analysis

All estimates were weighted to be representative of the 2013 RegF population. To account for the complex design of the 2013 CFMHS, variance estimates were calculated using the bootstrap weights generated by Statistics Canada. In

accordance with Statistics Canada's confidentiality guidelines for this survey, only weighted estimates were reported and weighted sample estimates were rounded to the nearest 20; prevalence rates were calculated from these rounded estimates. Estimates with a coefficient of variation between 16.6% and 33.3% were flagged (E) as potentially unreliable while estimates with a coefficient of variation greater than 33.3% were flagged (F) and suppressed as unreliable.

LCA was selected as the analytic strategy for the current study for its ability to develop parsimonious and person-centred pictures of patterns of comorbidity. Moreover, LCA identifies a small set of latent classes that vary from each other in a number of ways, including, potentially, the way members of a class respond to treatment or types of treatment. By identifying these classes through LCA, we may open the door to future evaluation of differential treatment response by latent class. This, in turn, may generate information about treatment optimization (e.g., the treatments that are mostly likely to work for an individual in a high-morbidity class) and inform treatment guidelines.<sup>41</sup> The current study used Mplus version 7.31<sup>42</sup> for all analyses. Listwise deletion was used to remove respondents with missing mental health condition data (approximately 3% of the sample). After listwise deletion, only 16% of RegF members met criteria for any mental health condition. LCA was used to classify individual responses across multivariate data measuring mental health conditions from the heterogeneous RegF population into smaller, more homogeneous latent classes. For a given model, posterior probabilities were calculated, and respondents were assigned membership to the class corresponding with their maximum posterior probability. Following assignment, the average posterior probabilities for each latent class were estimated, representing the probability of each mental health condition across respondents assigned to a given class.

Models were fit to the data, each progressively adding mental health comorbidity classes. Selection of the best-fitting model was guided by model fit indices and conceptual perspective. The Lo-Mendell-Rubin adjusted likelihood ratio test (LMR-LRT) was used to compare neighbouring class models differing by the inclusion of 1 latent class. Akaike's information criterion (AIC) and sample-size adjusted Bayesian information criteria (SSA-BIC) were compared for each model. The entropy statistic, a standardized measure of the precision of classification of assigning participants class membership based on the estimated posterior probabilities, was also used.

Multinomial logit regression was used to estimate the associations between mental health covariates and latent class membership using Stata 14.0.<sup>43</sup> Unadjusted and adjusted relative risk ratios (RRRs/ARRRs) with 95% confidence intervals (CIs) estimated the relative probability that a covariate was associated with a class membership. Mean WHODAS scores and prevalence rates for 12-month mental health service use and self-rated mental health were calculated for respondents in each latent class. Significant

differences in scores between latent classes were identified by nonoverlapping 95% CIs.

## Results

The average age of respondents was 35.4 years, and 86.1% of respondents were male; a more detailed description of respondents is reported elsewhere.<sup>3</sup> Each disorder showed distinct and complex patterns of comorbidity (see Table 1). In total, 9.9% of respondents met criteria for 1 mental health condition, 3.7% met criteria for 2 conditions, and 2.4% met criteria for 3 or more conditions. MDD was the most commonly reported past-year mental health diagnosis (8.0%), followed by PTSD (5.3%), GAD (4.7%), PD (3.4%), AAD (2.5%), and ADD (2.0%). Respondents reporting only 1 disorder were most likely to report AAD (i.e., 69.3% of those meeting criteria for AAD did not meet criteria for any other conditions), ADD (57.0% did not meet criteria for any other conditions), and MDD (41.3% did not meet criteria for any other conditions). Respondents reporting comorbid disorders were most likely to report GAD (i.e., criteria for GAD were met in 76.6% of cases where comorbid disorders were endorsed), PD (73.0%), and PTSD (67.1%).

### Latent Class Analysis

In the full sample of RegF personnel, a 3-class model best fit the data (LMR-LRT = 32.62,  $P < 0.001$ , AIC = 11,646.89, SSA-BIC = 11,718.77, entropy = 0.94). Based on average posterior probabilities, the classes were characterized as follows: a nondisordered class characterized by low probabilities of all disorders (90.7% of respondents); a comorbid class with moderately high probabilities of PTSD, MDD, GAD, and PD (3.7% of respondents); and a depressed-only class, characterized by a high probability of MDD but low probabilities across the remaining conditions (5.6% of respondents). These results provide a profile of the classes of mental health conditions representative of the 2013 Canadian RegF population and reflect the finding that the overwhelming majority of personnel did not meet the criteria for a mental health condition.

To better understand comorbidity, LCA was performed on the subsample of respondents reporting at least 1 disorder. Among the 16% of the RegF personnel with a mental health condition, a 3-class model best fit the data (LMR-LRT = 129.95,  $P < 0.001$ , AIC = 5986.97, SSA-BIC = 6021.52, entropy = 0.81). The 3 classes were characterized based on the average posterior probabilities for each class (see Figure 1). A comorbid class, representing 8.3% of the total RegF sample ( $N = 5140$ ), was characterized by personnel with high to moderate probabilities of PTSD, MDD, GAD, and PD. A depressed-only class, representing 4.6% of the total RegF sample ( $N = 2880$ ), was characterized by high probability of MDD but low probabilities across the remaining conditions. Finally, an alcohol-only class, representing 3.1% of the total RegF sample ( $N = 1900$ ), included personnel

**Table 1.** Past 12-Month Mental Health Conditions and Comorbidity in Regular Force Personnel.

	% (95% CI)						
	Total (%)	PTSD	MDD	GAD	PD	AAD	ADD
<b>Comorbid mental health conditions</b>							
PTSD	5.3	—	29.5 (25.1 to 34.3)	38.4 (32.7 to 44.4)	43.2 (36.0 to 50.7)	15.5 (9.5 to 24.4)	16.4 (10.7 to 24.3)
MDD	8.0	44.0 (38.0 to 50.2)	—	54.4 (48.5 to 60.1)	47.2 (40.0 to 54.5)	19.8 (13.6 to 27.8)	37.3 (28.9 to 47.7)
GAD	4.7	33.7 (28.5 to 39.3)	32.3 (28.1 to 36.8)	—	42.5 (35.7 to 49.5)	12.4 (7.3 to 20.2)	18.4 (12.2 to 26.9)
PD	3.4	26.9 (22.1 to 32.2)	20.0 (16.4 to 24.1)	30.2 (25.0 to 35.9)	—	9.9 (5.7 to 16.7)	14.9 (9.4 to 23.0)
AAD	2.5	7.4 (4.5 to 11.9)	6.2 (4.2 to 9.2)	6.7 (3.9 to 11.2)	7.6 (4.3 to 13.0)	—	—
ADD	2.0	6.0 (4.0 to 9.4)	9.7 (6.9 to 12.4)	7.7 (5.1 to 11.3)	8.7 (5.3 to 13.7)	—	—
<b>Number of comorbid mental health conditions</b>							
1 condition	9.9	32.9 (27.4 to 38.9)	41.3 (36.3 to 46.3)	23.4 (18.9 to 28.5)	27.0 (21.1 to 34.0)	69.3 (60.3 to 77.1)	57.0 (47.2 to 66.2)
2 conditions	3.7	31.2 (26.3 to 36.5)	31.6 (27.5 to 36.0)	36.0 (30.1 to 42.4)	22.5 (17.1 to 28.8)	15.6 (10.4 to 22.7)	19.5 (12.4 to 29.2)
3+ conditions	2.4	35.9 (30.4 to 41.9)	27.1 (23.0 to 31.8)	40.6 (34.7 to 46.9)	50.5 (43.4 to 57.6)	15.1 (9.1 to 23.9)	23.5 (16.6 to 32.3)

AAD, alcohol abuse disorder; ADD, alcohol dependence disorder; CI, confidence interval; GAD, generalized anxiety disorder; MDD, major depressive disorder; PD, panic disorder; PTSD, posttraumatic stress disorder.

Cross-tabulations are interpreted as the percentage of those with the mental health condition in the column who also had the mental health condition in the row (e.g., of those with PTSD, 44.0% had MDD).

with high to moderate probabilities on AAD/ADD but low probabilities across all other mental health conditions.

Table 2 displays the descriptive analyses of differences in the disability scores, self-rated mental health, and past 12-month mental health service use, by each disordered latent class and by respondents with no mental health condition. Average WHODAS disability scores were significantly higher among respondents assigned to disordered latent classes compared to respondents with no mental health condition. Furthermore, a significantly higher proportion of respondents in each disordered latent class reported lower self-rated mental health and greater past 12-month primary and speciality mental health service use compared to respondents with no mental health condition.

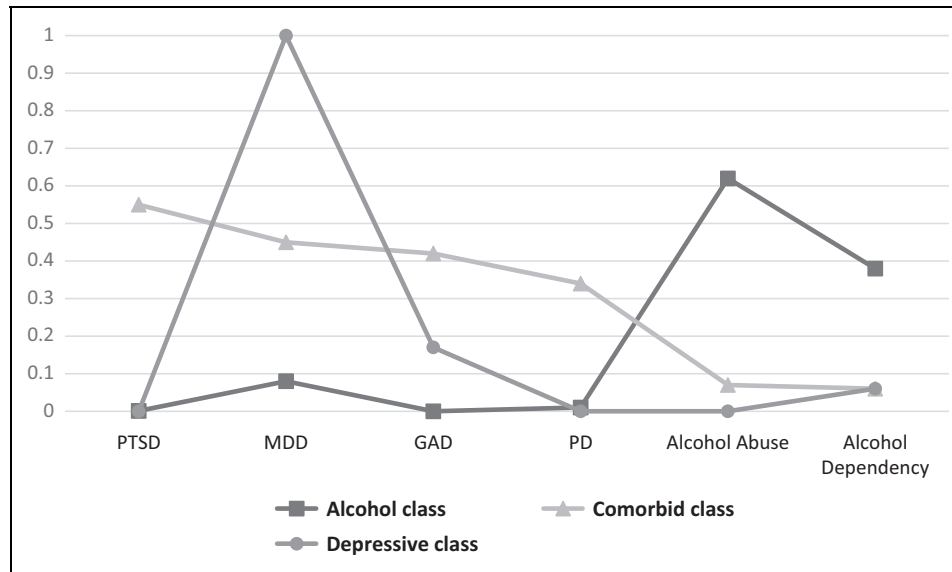
When compared to other disordered latent classes, respondents in the depressed-only class reported significantly higher rates of past 12-month primary mental health service use compared to the alcohol-only and comorbid classes, while those in the comorbid latent class reported higher rates of speciality past 12-month service use compared to the alcohol-only latent class. Average WHODAS disability scores varied significantly between latent classes, with the comorbid class having the highest average score. Finally, respondents belonging to the comorbid and depressed-only classes reported significantly higher rates of poor/fair self-rated mental health in comparison to those in the alcohol-only class.

### Multinomial Regression

Table 3 presents the unadjusted and adjusted associations between mental health covariates and latent class membership. These analyses tested differences in mental health covariates between respondents in each disordered latent class and respondents with no mental health condition. In the multinomial logit regression, factors associated with a higher risk of membership in the alcohol-only class compared to no mental health condition included being single/never married and positive history of childhood abuse. Characteristics associated with a higher risk of comorbid class membership included being female, middle-aged (30-44 years), being separated/divorced/widowed, endorsing 3 to 8 types of potentially traumatic experiences, and a positive history of childhood abuse. Factors associated with a higher risk of membership in the depressed-only class compared to no mental health condition included being separated/divorced/widowed or single/never married and a positive history of childhood abuse. Higher rank—specifically, being an officer—was associated with decreased risk of membership in any of the alcohol-only, comorbid, or depressed-only classes.

### Discussion

Of the mental health conditions included in the current study, MDD was the most commonly reported, and of individuals



**Figure 1.** Probability of past 12-month mental health condition, by class, Regular Force members who meet criteria for any mental health condition. GAD, generalized anxiety disorder; MDD, major depressive disorder; PD, panic disorder; PTSD, posttraumatic stress disorder.

**Table 2.** Descriptive Analyses of 12-Month Service Use, Self-Rated Mental Health, and WHODAS Disability of Regular Force Members by Latent Class Group Membership (N = 62,040).

Characteristic	No Mental Health Condition (N = 52,120; 84.0% of Sample)	Alcohol Class (N = 1900; 3.1% of Sample)	Comorbid Class (N = 5140; 8.3% of Sample)	Depressed Class (N = 2880; 4.6% of Sample)
Type of 12-month mental health service use, % (95% CI)				
No service use	87.2 (86.2 to 88.1)	75.3 (72.4 to 78.5)	29.6 (25.7 to 33.9)	30.9 (25.5 to 37.0)
Primary service use	7.7 (6.9 to 8.5)	13.5 (9.0 to 20.0) <sup>a</sup>	17.8 (14.7 to 21.5) <sup>a</sup>	27.2 (21.8 to 33.3) <sup>a,b,c</sup>
Specialty service use	5.1 (4.6 to 5.8)	11.1 (6.9 to 17.4) <sup>a</sup>	52.6 (48.1 to 57.0) <sup>a,b</sup>	41.9 (36.1 to 47.9) <sup>a,b,c</sup>
Self-reported mental health, % (95% CI)				
Poor/fair	6.5 (5.8 to 7.2)	12.4 (8.1 to 18.4) <sup>a</sup>	57.8 (53.3 to 62.3) <sup>a,b</sup>	49.1 (43.0 to 55.2) <sup>a,b</sup>
Good/very good/excellent	93.5 (92.8 to 94.2)	87.6 (81.6 to 91.9) <sup>a</sup>	42.2 (37.7 to 46.7) <sup>a,b</sup>	50.9 (44.8 to 57.0) <sup>a,b</sup>
WHODAS disability score, mean (95% CI)				
	5.4 (5.2 to 5.7)	8.4 (6.8 to 10.1) <sup>a</sup>	22.8 (21.1 to 24.5) <sup>a,b</sup>	18.6 (16.7 to 20.5) <sup>a,b,c</sup>

CI, confidence interval; WHODAS, WHO Disability Assessment Schedule 2.0.

<sup>a</sup>Significantly different from no mental health condition group;  $P < 0.05$ .

<sup>b</sup>Significantly different from alcohol class;  $P < 0.05$ .

<sup>c</sup>Significantly different from comorbid class;  $P < 0.05$ .

with past-year PTSD, almost half also had past-year MDD. This finding reinforces previous research that indicates PTSD commonly occurs with mood and anxiety disorders.<sup>44-46</sup> Overall, alcohol-related disorders and depression were more likely to occur in isolation, compared to anxiety-related conditions like PTSD, PD, and GAD, which were more likely to present as part of a constellation of comorbid conditions. This is an interesting finding, particularly considering the degree of overlap between PTSD and depressive symptoms.

The 3-class finding of the current study is similar to that reported in a 2013 civilian-based US study<sup>47</sup> but is in contrast to 1 UK civilian study, which identified 4 latent classes.

In the UK study, most participants were assigned to a non-symptomatic class, as was the case in our study when conducting LCA on the full sample; the remainder were classified into 3 symptomatic classes: a psychiatric condition group, a highly comorbid group, and an addiction group.<sup>48</sup> This finding adds to the existing evidence that the constellation of mental health outcomes following exposure to trauma falls into 3 distinct categories.

As expected, and in line with previous research on health care utilization and the economic burden of PTSD,<sup>49</sup> those belonging to the comorbid class had the highest rates of speciality service use in the past year. Interestingly, of the 3 comorbidity classes, the alcohol-only class had the lowest

**Table 3.** Univariate and Multinomial Logistic Regression Testing Associations between Demographic and Military Characteristics and Group Membership Defined by Mental Health Classes and Personnel with No Self-Reported Mental Health Condition(s).

Characteristic	Univariate Association (RRR)			Multivariate Association (ARRR)		
	Alcohol vs. No Mental Health Condition	Comorbid vs. No Mental Health Condition	Depressed vs. No Mental Health Condition	Alcohol vs. No Mental Health Condition	Comorbid vs. No Mental Health Condition	Depressed vs. No Mental Health Condition
Sex						
Male	1.00	1.00	1.00	1.00	1.00	1.00
Female	0.28 (0.05 to 1.56)	2.04** (1.60 to 2.60)	1.43* (1.04 to 1.98)	0.29 (0.05 to 1.88)	2.77** (2.13 to 3.60)	1.38 (0.98 to 1.95)
Age						
18-29	1.00	1.00	1.00	1.00	1.00	1.00
30-44	0.28** (0.20 to 0.41)	1.96** (1.51 to 2.54)	1.13 (0.85 to 1.49)	0.39** (0.25 to 0.60)	1.46* (1.08 to 1.98)	1.20 (0.84 to 1.71)
45-60	0.16** (0.09 to 0.28)	1.39* (1.03 to 1.87)	0.80 (0.57 to 1.12)	0.25** (0.12 to 0.49)	1.12 (0.77 to 1.63)	0.84 (0.55 to 1.30)
Marital status						
Married/common-law	1.00	1.00	1.00	1.00	1.00	1.00
Separated/divorced/widowed	1.46 (0.71 to 3.00)	2.08** (1.52 to 2.85)	2.57** (1.75 to 3.77)	1.85 (0.89 to 3.86)	1.84** (1.30 to 2.60)	2.51** (1.69 to 3.72)
Single/never married	2.84** (2.06 to 3.91)	0.86 (0.67 to 1.09)	1.44* (1.08 to 1.94)	1.50* (1.04 to 2.14)	1.17 (0.89 to 1.54)	1.49* (1.05 to 2.10)
Rank						
Junior NCM	1.00	1.00	1.00	1.00	1.00	1.00
Senior NCM	0.45** (0.29 to 0.69)	1.14 (0.93 to 1.40)	0.97 (0.73 to 1.28)	0.92 (0.57 to 1.47)	0.85 (0.67 to 1.07)	1.04 (0.76 to 1.43)
Officer	0.43** (0.28 to 0.66)	0.51** (0.39 to 0.66)	0.62** (0.46 to 0.83)	0.75 (0.47 to 1.19)	0.47** (0.35 to 0.63)	0.68* (0.50 to 0.92)
Element						
Army	1.00	1.00	1.00	1.00	1.00	1.00
Navy	0.65 (0.42 to 1.01)	0.68** (0.51 to 0.90)	0.80 (0.57 to 1.12)	0.74 (0.47 to 1.18)	1.09 (0.80 to 1.49)	0.82 (0.58 to 1.16)
Air Force	0.37** (0.23 to 0.59)	0.59** (0.47 to 0.75)	0.79 (0.60 to 1.06)	0.48** (0.30 to 0.79)	0.82 (0.63 to 1.07)	0.82 (0.61 to 1.12)
Deployment-related traumatic experiences						
Never been deployed	1.00	1.00	1.00	1.00	1.00	1.00
Deployed no trauma	0.32** (0.15 to 0.66)	0.81 (0.52 to 1.24)	0.85 (0.56 to 1.31)	0.66 (0.31 to 1.44)	0.89 (0.56 to 1.42)	1.04 (0.67 to 1.63)
Deployed with 1-2 traumatic experiences	0.37** (0.22 to 0.62)	1.25 (0.90 to 1.72)	0.85 (0.58 to 1.25)	0.64 (0.37 to 1.11)	1.34 (0.95 to 1.87)	0.96 (0.64 to 1.44)
Deployed with 3-8 traumatic experiences	0.51** (0.36 to 0.73)	3.80** (2.94 to 4.90)	1.05 (0.77 to 1.43)	0.70 (0.46 to 1.09)	4.18** (3.13 to 5.57)	1.07 (0.74 to 1.54)
Childhood abuse experiences						
No abuse	1.00	1.00	1.00	1.00	1.00	1.00
1 type of abuse	2.00** (1.37 to 2.93)	1.61** (1.26 to 2.05)	1.46* (1.09 to 1.96)	2.25** (1.53 to 3.32)	1.54** (1.20 to 1.97)	1.49** (1.11 to 2.01)
2+ types of abuse	1.84* (1.14 to 2.99)	3.82** (3.00 to 4.88)	2.58** (1.87 to 3.57)	2.08** (1.28 to 3.39)	3.36** (2.59 to 4.35)	2.52** (1.82 to 3.51)

ARRR, adjusted relative risk ratio; NCM, noncommissioned member; RRR, unadjusted relative risk ratio.

Data are RRR/ARRR (95% confidence interval).

\* $P < 0.05$ . \*\* $P < 0.01$ .

health service use and disability scores and the highest self-rated mental health scores. This finding may mean that individuals meeting screening criteria for substance use issues perceive themselves as less functionally impaired than individuals with depression and other psychiatric comorbidities. However, further research may help clarify whether the lower rate of service use amongst CAF members with substance misuse is related to higher perceived levels of functioning and therefore less need for services or if specific barriers to accessing health care services for those with alcohol use problems exist.

Sociodemographic and historical variables also influenced membership in disordered latent classes when compared to personnel without mental health conditions. Officers were at decreased risk of membership in any of the disordered latent classes. It is possible that this finding is reflective of a combination of premorbid functioning and current socioeconomic status/psychosocial stress. The finding that a positive history of childhood abuse was associated with belonging in any disordered class supplements a recent and growing body of research investigating the effect of childhood trauma among military members, particularly in light of a recent finding that adverse childhood experiences appear to be more common amongst US military personnel than civilians.<sup>50</sup> Furthermore, being female increased the risk of comorbid group membership compared to CAF members without mental health conditions. Female sex has been implicated previously in the development of mental health comorbidities in both civilian and military cohorts.<sup>23-25,51</sup> These findings add further evidence to support the roles of childhood abuse and female sex in the development of mental health comorbidities.

The current study had a number of limitations. The data are cross-sectional and rely on self-reported results rather than structured clinician-administered tools. Given the self-report nature of the data, we cannot be certain that the results are completely free of underreporting or misclassification bias. While the sample size was large, it was still limited relative to the potential number of permutations one could possibly investigate across co-occurring disorders. As such, there are likely other classes of interest that were not investigated herein, such as a traumatic brain injury class or one that includes psychiatric and physical health conditions. Furthermore, we did not include other potentially comorbid mental health conditions/symptoms, such as illicit drug use, chronic pain, and somatic symptoms. As such, it is possible that the 3-class finding of the current study may not represent the best fit of the data should it be expanded to include other conditions. In addition, the potentially traumatic exposures assessed in the current study were limited to deployment-related exposures and history of childhood abuse, meaning that information about exposure to military sexual trauma was not captured. This is a potentially important variable, particularly in light of the positive association between female sex and PTSD in the current study, that warrants

inclusion in future studies. Last, the role of social support is not explicitly included in the analysis. Existing literature suggests that a lack of social support is a robust predictor of PTSD. Marital status can be seen as a potential proxy for social support, and the current finding that being separated/divorced/never married is associated with membership in the high comorbidity class aligns with existing findings. However, future research may benefit from exploring various types of social support, such as unit support. Nevertheless, this study is one of the first to use LCA among a nationally representative sample of CAF members to determine subclasses of comorbidity. The study also included military personnel who deployed to Afghanistan, a sample that has largely been missing from previously published Canadian studies of this size.

Results from this study have important clinical implications—chiefly, that health care providers should evaluate the presence of comorbidity amongst military members seeking mental health care. Our results also highlight that comorbidity goes beyond the usual diagnoses characterized by only signs and symptoms but that identifying population subgroups might also assist to better develop treatment programs. It is possible that individuals belonging to the comorbid class will require intensive, focused treatment to experience abatement of symptoms and that differential treatment response by latent class may exist. Further research in this emerging field of examining differential treatment response is needed. Mental health clinicians treating these individuals should consult best practice guidelines that focus on evidence-based treatment for mental health comorbidities. For example, existing clinical practice guidelines from the US Veterans Affairs/Department of Defense<sup>52</sup> and the National Center for PTSD<sup>53</sup> recommend collaborative care between medical and mental health professionals, as well as concurrent treatment of PTSD and substance misuse. Similarly worded guidelines from Canadian sources may be of particular benefit for clinicians in Canada who work with CAF members and veterans. These findings and recommendations are similar to existing ones for nonmilitary trauma populations<sup>54</sup>; therefore, in the absence of military-specific guidelines, clinicians could consider consulting guidelines for general trauma populations. Last, the present study emphasizes the pervasive effect of childhood trauma as a risk factor and identifies unique risks for comorbidity, such as sex and traumatic deployment experiences, which should all be considered during the assessment and treatment planning process of military members who present for treatment of operational stress injuries.

#### Data Access

The survey data used in the current study may only be accessed via a Statistics Canada Research Data Centre, following successful completion of an application process. Further information is available from [www.statcan.gc.ca/eng/rdc/process](http://www.statcan.gc.ca/eng/rdc/process).




### Declaration of Conflicting Interests

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