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Composite Measure of Mental Health Problems in Canadian Armed Forces Veterans – 2013 Life After Service Survey

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Composite Measure of Mental Health Problems in Canadian Armed Forces Veterans – 2013 Life After Service Survey

Contents

Plain Language Summary

This paper describes a new way to use the Life After Service Studies (LASS) survey data to better describe the mental health of Canadian Armed Forces (CAF) Veterans. The LASS surveys collected data from former CAF members (Veterans) who were released from service from 1998. The surveys are giving us the first clear look at the well-being of these Canadian Veterans in the areas of mental and physical health, employment, education, finances, life skills and knowledge, social integration and their social environment.

The 2013 LASS survey measured mental health in five ways: (1) chronic mental health conditions diagnosed by a health professional, (2) symptoms of psychological distress, (3) symptoms of PTSD, (4) self-rated mental health and (5) mental health-related quality of life. Until now, our reports about mental health in these Veterans used those measures individually, which did not give us enough information about the extent of mental health problems in CAF Veterans.

This paper reports on a method that we devised to combine the first three of the mental health measures into a single composite measure. The method is an improvement because it combines measures of both diagnosed conditions and symptoms not yet diagnosed. This paper explains how we developed and tested the approach to describing the mental health of these Veterans using this combined measure.

We found that this composite measure provides a much clearer picture of mental health in CAF Veterans than single measures, and that it has good evidence of validity. The new measure is being used in analyses of data collected in the LASS surveys to inform policies, programs and services that support the well-being of Veterans and their families.

Technical Summary

Background: Mental health problems (MHP) are prevalent worldwide in civilian populations and in serving and former (Veteran) military personnel. The design, delivery and monitoring of effective policies, programs and services for Veterans begins with understanding the extent of MHPs across the full range of severity. Methods are required to identify the characteristics and sizes of subgroups with greater and lesser needs both to target limited resources for greatest effect and to monitor outcomes. This study extends the literature on mental health survey analysis by exploring a method for combining brief self-report population survey measures to meet that requirement.

Methodology: Data came from the 2013 Life After Service Survey of Canadian Armed Forces (CAF) Veterans. The composite, three-level ordinal MHP variable was derived by combining self-reported diagnosed mental health conditions, Kessler's measure of psychological distress (K10), and the primary care posttraumatic stress disorder screen (PC-PTSD). The approach to combining these measures was developed through expert consultation and exploratory data analysis. Weighted population estimates, statistical tests and logistic regression were used to assess extent of MHPs and correlations with

outcomes of interest.

Results: The prevalence of any MHP was 38.7%: a fifth (22.3%) had mild-moderate MHP and an eighth (16.4%) had severe. The composite measure was strongly correlated with difficult adjustment to civilian life (odds ratio 10.9) and correlated in expected ways with poor self-rated mental health (225.3), low SF-12 mental component summary (163.1), comorbidity of three or more physical health conditions (3.2), chronic pain (3.9), often having activity restriction (12.8), life stress (5.8), low social support (7.4), suicidal ideation (52.4), Veterans' disability benefits (4.8), counsellor or social work consultation (8.7), psychologist consultation (10.7) and hospitalization (3.1).

Conclusions: This study demonstrates a method for combining individual brief mental health population survey measures to provide the first comprehensive picture of the full spectrum of mental health problems in CAF Veterans. There was evidence of validity of the composite measures. The findings point toward a stepped approach to resourcing services that optimize mental health and well-being in Veterans.

Keywords
Mental health, population statistics, health surveys, Veterans, mental health services.

Mesure composite des problèmes de santé mentale chez les vétérans des Forces armées canadiennes – Enquête sur la vie après le service militaire (2013)

Résumé en langage clair

Dans le présent document, nous définissons une nouvelle façon d'utiliser les données d'enquête tirées des Études sur la vie après le service militaire (EVASM) afin de mieux décrire la santé mentale des vétérans des Forces armées canadiennes (FAC). Les enquêtes des EVASM ont permis de recueillir des données auprès d'anciens membres des FAC (vétérans) libérés du service militaire depuis 1998. Les enquêtes nous permettent de poser un premier regard lucide sur le bien-être de ces vétérans canadiens dans les domaines de la santé mentale et physique, de l'emploi, de l'éducation, des finances, des compétences de vie et des connaissances, de l'intégration sociale et de leur milieu social.

L'EVASM de 2013 a permis d'évaluer la santé mentale de cinq façons : 1) les problèmes de santé mentale chroniques diagnostiqués par un professionnel de la santé; 2) les symptômes de la détresse psychologique; 3) les symptômes de l'état de stress post-traumatique (ESPT); 4) l'auto-évaluation de la santé mentale; et 5) la qualité de vie liée à la santé mentale. Jusqu'à maintenant, nos rapports sur la santé mentale de ces vétérans ont fait appel à ces mesures une par une, ce qui ne nous a pas donné suffisamment de renseignements sur l'étendue des problèmes de santé mentale chez les vétérans des FAC.

Dans cet article, nous faisons état d'une méthode que nous avons mise au point pour combiner les trois premières mesures de la santé mentale en une seule mesure composite. Cette méthode constitue une amélioration, parce qu'elle combine les mesures des problèmes diagnostiqués et des symptômes non encore diagnostiqués. Nous expliquons comment nous avons élaboré et mis à l'essai l'approche visant à décrire la santé mentale de ces vétérans à l'aide de cette mesure combinée.

Nous avons constaté que cette mesure composite donne une idée plus précise de la santé mentale chez les vétérans des FAC que les mesures seules et qu'elle présente des preuves de validité. La nouvelle mesure est utilisée dans les analyses de données recueillies dans les enquêtes des EVASM pour orienter les politiques, les programmes et les services qui soutiennent le bien-être des vétérans et de leur famille.

Résumé technique

Contexte : Les problèmes de santé mentale (PSM) sont répandus dans le monde entier, dans les populations civiles et chez les militaires en service et les ex-militaires (vétérans). La conception, l'exécution et la surveillance de politiques, de programmes et de services efficaces à l'intention des vétérans commencent par la compréhension de l'étendue des PSM dans l'ensemble du spectre de gravité. Des méthodes sont nécessaires pour déterminer les caractéristiques et les tailles des sous-groupes ayant des besoins plus ou moins importants pour à la fois cibler les ressources limitées en vue d'optimiser les efforts et assurer un suivi des résultats. La présente étude s'appuie sur des travaux

d’analyse des enquêtes sur la santé mentale en explorant une méthode qui combine de simples mesures tirées de questionnaires d’autodéclaration administrés dans la population.

Méthodologie : Les données provenaient de l’Enquête sur la vie après le service militaire 2013 des vétérans des Forces armées canadiennes (FAC). La variable PSM ordinale à trois niveaux et composite a été obtenue en combinant les problèmes de santé mentale déclarés volontairement et diagnostiqués, l’échelle de détresse psychologique de Kessler (K10) et l’échelle de dépistage de l’état de stress post-traumatique en soins primaires (PC-PTSD). L’approche visant à combiner ces mesures a été mise au point grâce à des consultations auprès d’experts et à l’analyse exploratoire des données. Les estimations pondérées de la population, les tests statistiques et la régression logistique ont servi à évaluer l’étendue des PSM et les corrélations avec les résultats étudiés.

Résultats : La prévalence des PSM était de 38,7 %; un cinquième (22,3 %) des répondants avaient un PSM léger à modéré et un huitième (16,4 %) présentaient un PSM grave. La mesure composite était fortement corrélée avec la difficulté à s’adapter à la vie civile (rapport de cotes de 10,9) et corrélée de manière prévisible avec divers facteurs : une santé mentale autoévaluée comme étant mauvaise (225,3), un score faible au sommaire de la composante mentale du formulaire SF-12 (163,1), la présence d’au moins trois problèmes de santé physique concomitants (3,2), une douleur chronique (3,9), une restriction fréquente des activités (12,8), une vie stressante (5,8), un faible soutien social (7,4), des pensées suicidaires (52,4), des prestations d’invalidité des anciens combattants (4,8), la consultation d’un conseiller ou d’un travailleur social (8,7), la consultation d’un psychologue (10,7) et l’hospitalisation (3,1).

Conclusions : L’étude montre une méthode utilisée pour combiner chacune des brèves mesures de l’enquête sur la santé mentale menée auprès de la population afin de donner le premier tableau global de l’ensemble du spectre des problèmes de santé mentale chez les vétérans des FAC. L’étude a permis de démontrer la validité des mesures composites. Les conclusions font ressortir une approche progressive visant à offrir des services de ressourcement dans le but d’optimiser la santé mentale et le bien-être des vétérans.

Introduction

Mental health problems (MHP) are prevalent worldwide in civilian populations and in serving and former (Veteran) military personnel [1-3]. The design, delivery and monitoring of effective policies, programs and services begins with understanding the extent of MHPs across the full range of severity. Methods are required to identify the characteristics and sizes of subgroups with greater and lesser needs both to target limited resources for greatest effect and to monitor outcomes. This study explored a method for combining brief self-report population survey measures to meet that requirement.

Three main strategies are used to assess mental health in populations: health services administrative data, clinical assessments by diagnosticians and self-report surveys. Each method has advantages and disadvantages and there is no gold standard [4-11]. Administrative data capture only those in treatment, and clinical assessments are costly and difficult to organize [9,12]. Self-report surveys are an efficient and commonly used important first step in assessing potential need for services [9,11,13,14]. Self-report surveys use either lengthy symptom measures such the Composite International Diagnostic Interview (CIDI) with algorithms identifying those meeting DSM (Diagnostic and Statistical Manual) [15] or WHO ICD (World Health Organization International Classification of Disease) diagnostic criteria [5] or briefer self-report measures [16,17]. The key advantages of brief survey measures include lower cost, lower respondent burden and the opportunity to gather other health and well-being data [5,7,9,12,16,17].

Since mental health is multifaceted, no single mental health survey measure captures the full extent of mental health problems [12,13,18]. For example, measures of DSM-threshold conditions do not capture persons with subthreshold mental health states that cause distress, impair function or lead to service use [13,18-25]; mild cases can resolve with limited intervention; and many with psychiatric disorders function well [13,23,27]. In a survey of Canadian Armed Forces (CAF) personnel deployed to Kandahar in 2010, 8.5% had diagnostic criteria for common psychiatric disorders, but a larger proportion (31%) reported stress, emotional, alcohol or family problems. While almost half meeting diagnostic criteria for disorders perceived occupational impact, two-thirds of those with perceived occupational dysfunction did not meet diagnostic criteria [25]. In the U.S. Millennium Cohort Study, comparisons with clinical records showed that military personnel tended to under report mental and physical health diagnoses and, although prevalences by both methods were similar for depression and PTSD, the two methods captured overlapping subpopulations [7]. These findings imply that composite measures can provide a clearer picture of the extent and impacts of mental health problems for policy and program planners and service providers.

In response to concerns about the mental health of CAF Veterans, the CAF and Veterans Affairs Canada (VAC) conducted several population health surveys of serving and released military populations [2,3]. In initial analyses of the 2013 Life After Service Surveys (LASS) of CAF Veterans (any released CAF member with at least one day of service [28]) who have released since 1998, prevalences of self-rated mental health and self-reported mental health conditions were two or more times higher than in the general

Canadian population [3,29]. These Veterans had enrolled in service from the 1960s to the 2000s and had varied experience in training, domestic disaster response and international peacekeeping, primarily in Cyprus and the Balkans, the first Persian Gulf War in 1990-91 and, more recently, in the combat and peace support mission in Afghanistan.

An understanding of the full extent of MHPs among CAF Veterans remains unclear, since not all with diagnosed conditions had poor self-rated mental health and vice-versa [29]. There is evidence that while mental disorders have a disproportionate impact on disability compared with physical conditions [29,30], many mild MHPs are transient while others can become serious, and more serious problems often are not recognized or treated [23,26,30]. There is some evidence that MHPs are more common in CAF Veterans transitioning to civilian life than the general Canadian population and serving CAF members [3].

Combining brief survey measures to provide a comprehensive picture of population mental health is appealing but has been largely unexplored. We found no established guidelines for developing composites of multiple self-report measures. Of the few published examples, most used lengthy measures rather than the brief instruments used in the 2013 LASS survey [10,12,18,26,31,32]. The objectives of this study were to derive a composite measure from brief mental health measures available in the LASS 2013 for the three most common mental health problems in military populations (depression, anxiety and posttraumatic stress disorder or PTSD); estimate the sizes of population segments with ranges of MHP severity and needs for programs and services; and assess correlations of the composite with measures of mental and physical health, disability, stress, suicidality, and service use. The ultimate goal was to provide policy and program planners with the first easily communicated picture of MHPs in CAF Veterans to better inform development of policies, programs and services intended to optimize the mental health and well-being of CAF members transitioning to life after service.

Methods

The 2013 LASS was a cross-sectional, computer-assisted telephone interview survey of health, disability, and the determinants of health of CAF Veterans conducted by Statistics Canada [29,33,34]. The survey sampled Veterans (former CAF members with at least one day of service) who were released from the Regular Force between 1998 and 2012, or released from the Reserve Force between 2003 and 2012 and had deployed in support of operations in Class C service. The LASS 2013 sample was stratified by service component and rank [33]. The sample size was 5,099 and the response rate was 71%, producing a sample of 3,620 representing 59,500 Veterans [33,34]. The survey sampled Veterans living in the general population including both those who were and were not participating in VAC programs, and excluded those who were still serving or living in institutions, remote areas or outside Canada. Veteran status and sociodemographic and military characteristics were obtained from a Department of National Defence human resources database. Self-reported data were obtained using questions adopted from the Canadian Community Health Survey. Ethical approval was provided by Statistics Canada and participants provided informed consent.

Mental Health Measures

Five brief mental health measures were used in the 2013 LASS survey: the K10 measure of non-specific psychological distress, the PC-PTSD primary care screener for posttraumatic stress disorder, self-reported diagnosed mental health conditions, self-rated mental health and the mental component summary of the SF-12 [29,33,34].

Kessler's K10 was designed to identify non-specific psychological distress in the upper 90-99th percentile range of the general population as a screen for serious mental disorders, mainly depression and anxiety [5,20,34]. The K10 consists of 10 questions that ask about past-month frequency of symptoms, producing scores of 0-40 from low to high distress in the prior month. Higher scores indicate greater degrees of nonspecific psychological distress, greater likelihood of having mental disorders and more severe disability. The K10 and K6 are correlated with mood, anxiety and substance use disorders, functional impairment, work role disability, service utilization and mental health risk factors [5,35-43]. The K10 is widely used in Canada, Australia and the United States to screen for disorders and monitor prevalence and response to treatment change over time [5,6,35] and has demonstrated validity in military personnel in Australia [44]. Cairney et al. [45] evaluated the K10 as a depression screener in the general Canadian population and Blanc et al. [20] validated the K10 as a measure of unspecified psychological distress as a predictor of self-rated occupational impairment for mental health surveillance in CAF serving members in operational settings.

PTSD is a disorder of particular interest in military Veteran populations. Although non-specific psychological distress symptoms captured by the K10 commonly occur in PTSD, the K10 was not specifically designed to measure PTSD [31]. Past-month PTSD was assessed using the primary care posttraumatic disorder (PC-PTSD) screener which starts with the preamble, "Have you ever had any experience that was so frightening, horrible, or upsetting that, in the past month, you…" and then asks four questions about symptoms specific to PTSD including re-experiencing, numbing, avoidance and hyperarousal [46,47]. Responses to the PC-PTSD were validated in U.S. serving and Veteran populations and were not confounded by non-specific psychological distress [46-48].

Checklist questions about chronic mental health conditions were taken from the Canadian Community Health Survey. Following the preamble, "We are interested in conditions diagnosed by a health professional and are expected to last or have already lasted 6 months or more," respondents were asked, "Do you have a mood disorder such as depression, mania, dysthymia or bipolar disorder?", "Do you have an anxiety disorder such as a phobia, obsessive-compulsive disorder or a panic disorder?" and "Do you have post-traumatic stress disorder (PTSD)?". The mood and anxiety disorder questions evolved from half a century of development of chronic physical and mental health condition ascertainment on surveys, evolving from free text to checklists [4]. The PTSD question is new in population surveys, in keeping with the recent recategorization of PTSD out of the anxiety disorder family in the DSM-5 [15]. There is evidence that self-report of chronic physical conditions which, like mental conditions, are characterized by intermittent, nonspecific or mild symptoms or distress, and associated with stigma tends

to underestimate the prevalence ascertained by clinical records [10,12,18,49,50]. We found no studies comparing self-reported diagnosis to CIDI ascertainment. Self-report questions tend not to capture undiagnosed conditions, subthreshold or short-lived episodes of mental illness [32].

Current self-rated mental health was assessed with the question "In general, would you say your mental health is... excellent, very good, good, fair or poor?" This measure is commonly used in population health surveys and correlates to varying degrees with other measures of mental health, morbidity and service use [51,52]. Past-month general mental health was assessed with the mental component summary (MCS) of version 2 of the SF-12 Short Form Health Survey. The SF-12 is comprised of 12 questions assessing past-month quality of life related to physical or mental health status. Mental Component Summary scores (MCS) were computed using QualityMetric's software to measure general mental health [53]. The software computes summary scores for individuals based on normative data for the 1998 U.S. non- institutionalized general population. The PCS and MCS are transformed and standardized to a mean of 50 and a standard deviation of 10, with scores above and below 50 indicating better or poorer than average general mental health, respectively. Lower SF-12 scores indicate lower mental health in a non-linear manner: 98% of the reference population has better mental health than those with scores of 30 or less, and 84% has better mental health than those with scores of 40 or less. Norms for the Canadian population are 2 points higher than the U.S. norms [54]. We used five MCS categories based one-half standard deviation (5 points) to represent meaningful differences in mental health and functioning in this population [55].

Mental Health Problem (MHP) Composite Measure

The first objective of the study was to develop a composite MHP variable from among the five available measures to capture a practical and meaningful range of MHPs, including mental disorders, distressing subthreshold states, and diagnosed and undiagnosed states in this population. The "mental health" construct refers to the capacity of people to have a sense of well-being and good functional ability, regardless of the presence of disorders, while the "mental illness" construct refers to thoughts, feelings or behaviours causing distress and social functioning difficulty that is out of line with cultural norms [11,56]. The "mental disorder" construct describes conditions meeting established diagnostic criteria, such as the DSM or ICD. The "mental health problem" construct encompasses both diagnostic categories and subthreshold symptom states associated with distress and functional difficulties that may warrant intervention [9,25,57-59].

We sought a summary indicator that would comprehensively measure the prevalence of MHPs across a range of impact severity and needs, in a manner easily communicated to policy and program planners. Given the lack of a well-established process for development of the composite, we used consensus among the study team. The team was comprised of senior primary care physicians, psychiatrists and psychologists with many years of clinical and population research experience. The members of the study team have had long careers in clinical practice and research with a focus on mental health in

civilian, serving and Veteran military populations. As described in the following paragraphs, the team derived the composite measure in four steps: selection of the component measures; identification of an optimal number of ordinal levels balancing precision and simplicity; development of an explicit categorization scheme to combine the component measures; and demonstration of convergent, discriminant, concurrent and criterion validity.

The team chose three of the five candidate measures: the K10, the PC-PTSD screener and presence/absence of self-reported diagnosed conditions. These measures represent related but complementary mental health constructs in that they were designed to detect diagnosed states of the three most common disorders in military Veterans (depression, anxiety and PTSD) as well as subthreshold and undiagnosed symptom states [18,29,31,36,46,47,51]. All three component measures capture functional difficulties as well as symptoms, consistent with DSM criteria [15]. The two general mental health measures (self-rated mental health and the SF-12 MCS) are widely used in population health surveys but were not used in the composite because respondents appear to integrate unidentified factors broader than just mental health symptoms and related functioning in responding to those instruments and the instruments do not provide information about the presence/absence of specific mental health conditions [51,52,56,60].

For ease of communication with policy and programming managers, three categories (no/little, mild/moderate and severe) were chosen for the composite measure to reflect ordinal range of severity. Four categories made ordinal regression too complex to interpret, and there appeared to be no clear advantage of four categories over three in communicating findings to policy and program planners. In addition, it was not clear how to assign the presence or absence of self-reported diagnosed conditions and PC-PTSD criteria among more than three categories.

In the absence of published K10 and PC-PTSD cutoffs for the general Canadian or CAF Veteran populations, cutoffs were adopted from studies in other populations. The K10 cutoffs were adopted from Australian guidelines based on studies in general and military populations [36,37,40,42,44,61]: 0-9 for no/little psychological distress, 10-19 for mild/moderate and 20-40 for severe. The lower K10 cutoff for the mild/moderate category is consistent with the point of maximum sum of sensitivity and specificity. This was done to identify individuals likely to need intervention, as identified by inspection of a receiver-operator curve constructed from data published for the Australian general population [36]. The PC-PTSD version used in this survey had four criteria, resulting in a score of 0 (none) to 4 (all four criteria present) [46]. Validation in U.S. Veterans Health Administration patients found that the optimally efficient cutoff for detecting possible PTSD was 3 of the 4 PC-PTSD criteria, which had sensitivity of 0.78, specificity of 0.87, positive predictive value of 0.65 and negative predictive value of 0.92 [46,47]. Both stratified analysis and the finding that subthreshold PTSD can be associated with significant impairment and subsequently can either resolve or develop into full-syndrome PTSD [62-63] supported including respondents with 1-2 PC-PTSD criteria in the mild/moderate MHP category rather than in the no/little category [64]. PC-PTSD criteria

of 3 or 4 were considered severe.

Based on the foregoing, we developed categorization rules for a composite, 3-category ordinal MHP variable (**Table 1**). First, respondents with either K10 scores of 20-40 or 3-4 PC-PTSD criteria were assigned to the severe MHP category, regardless of whether they reported having a diagnosed mental condition. Those with no diagnosed mental health condition, a K10 score of 0-9 and no PC-PTSD criteria were assigned to the no/little category. All others were categorized as "mild/moderate".

Table 1. Component categories of the composite mental health problem measure.

Component Measure	Degree of Mental Health Problem		
	No or Little	**Mild/Moderate**	**Severe**
Self-reported diagnosed mental health condition	No	No or Yes	No or Yes
K10 Score	0-9	10-19	20-40
PC-PTSD (number of criteria)	0	1 or 2	3 or 4

Self-reported diagnosed mental health conditions include mood disorder, anxiety disorder or PTSD.
K10 = Kessler's 10-item measure of psychological distress.
PC-PTSD = Primary care posttraumatic disorder screen.

Socioeconomic and Military Characteristics

Age at survey, sex, military rank at release, years of service, service element (Army, Navy, Air Force), service component (Regular Force, Primary Reserve Force) and years since release from service were ascertained from the Department of National Defense database. Deployment history was not available. Other characteristics were self-reported using questions from Statistics Canada surveys. Income adequacy was measured using quintiles of the ratio of household income to Statistics Canada's 2009 Low Income Measure for number of people [65].

Physical Health and Chronic Pain

Physical health was measured as groups of chronic physical health conditions taken from the Canadian Community Health Survey, using the same preamble as for mental health conditions: musculoskeletal (arthritis or back problems excluding fibromyalgia); cardiovascular (high blood pressure, heart condition or effects of stroke); respiratory (asthma, emphysema, chronic bronchitis or chronic obstructive pulmonary disease); gastrointestinal (intestinal or stomach ulcers, or bowel disorder such as Crohn's disease, ulcerative colitis, irritable bowel syndrome or bowel incontinence); hearing problem; obesity; diabetes; cancer; and neurological (migraine, Alzheimer's disease, effects of traumatic brain injury). Chronic pain was assessed with questions from the Health Utilities Index [66], beginning with the preamble "The next set of questions asks about the level of pain or discomfort you usually experience; They are not about illnesses like colds that affect people for short periods of time" followed by "Are you usually free of pain or discomfort?" Chronic pain was not included in the aggregate measure of chronic physical health conditions.

Measures of Disability, Suicidality and Service Use

Two health-related disability measures were taken from the Canadian Community Health Survey. Sometimes or often having activity restriction in each of four life domains was assessed with "Does a long-term physical condition or mental condition or health problem reduce the amount or the kind of activity you can do at … home, school, work, and other including transportation or leisure?" (often, sometimes or never). Need for assistance with at least one of six basic or instrumental activities of daily living was assessed with "Because of any physical condition or mental condition or health problem, do you need the help of another person with…" (yes or no).

Past-year suicidal ideation was assessed with "Have you ever seriously considered committing suicide or taking your own life? Has this happened in the past 12 months?"

Service utilization questions included past-year contacts with health professionals for physical, emotional or mental health problems, past-year home care services, and being a patient overnight in a hospital, nursing home or convalescent home. Past-year unmet care was assessed by asking whether there was ever a time they felt they needed health care but did not receive it for treatment of a physical health problem or care of an injury, or for a MHP. VAC client status was ascertained by the VAC administrative database [33].

Adjustment to Civilian Life, Life Stress and Perceived Social Support

Ease of adjustment to civilian life was assessed with "In general, how has the adjustment to civilian life been since you were released to civilian life from the Canadian Forces?" with five options ranging from very easy to very difficult. Life stress was assessed with "Thinking about the amount of stress in your life, would you say that most days are...?" with five options ranging from not at all stressful to extremely stressful. Social support was measured with the 10-item Social Provisions Scale [39] producing scores ranging from 10 to 40. A score of less than 29 was used to indicate low perceived social support based on prior analysis in this survey population [29].

Statistical Analysis

Weighted rather than sample data were used to represent the sampled population. The complex stratified survey design required weights for individual respondents calculated by Statistics Canada that incorporated the unequal probabilities of selection, eligibility, non-response, and sharing. Weighted population estimates and associated 95% confidence intervals (CI) were expressed as percentages calculated using Stata/IC version 13 from individual respondent weights provided by Statistics Canada. Kendall's Tau B was used to assess correlation of the MHP composite with measures of mental and physical health.

Odds ratios were calculated from weighted data by ordinal logistic regression using Stata/IC version 13 with update 2014 of the gologit2 module [67]. A key advantage of ordinal versus binary regression is that it assesses odds of having mental health problems

across all three arbitrary degrees of mental health problems in the proposed composite measure. Higher odds at each level would be evidence of a severity gradient. The module conducted tests of proportionality of odds for no/little MHPs versus moderate or severe MHPs relative to the odds of no/little or moderate MHPs versus severe MHPs at the autofit p = 0.01 level. The module returns a single OR if the proportionality assumptions were met and different ORs if the proportionality assumptions were not met. Analyses were conducted on respondents with complete data and data were missing in only 1-4% of cases in the regressions. CIs were calculated with Taylor series linearization. Proportional elliptical Euler diagrams were drawn with eulerAPE.jar 2.0.3 [68].

Results

Table 2 shows characteristics of the study population. Respondents were surveyed on average 7.1 years since release from service (range 0.6 to 15.2 years). Mean age was 43.5 years (range 18-78), most were men, and most were married. The majority had graduated from high school or had post-secondary education other than a university degree, and three quarters were employed. The majority had been in the Army and had held non-commissioned member ranks at release and 6% had been deployed reservists. Nearly half had served more than 20 years, however about 21% had released as recruits or officer cadets. A third (34%) were participating in VAC programs.

Table 2. Odds ratios for mental health problems by socioeconomic and military characteristics.

Characteristic	Mental Health Problems (Sample Size, Weighted Population Estimate as %)				Mental Health Problems UOR[1] (95% C.I.[2])
	No/Little	Mild/Moderate	Severe	Total	
Total	2020, 61.3	721, 22.3	473, 16.4	3214, 100.0	--
Age					
18-29	251, 19.0	69, 14.5	37, 10.1	357, 16.6	1.0 (0.7-1.4)
30-39	446, 21.0	174, 24.9	88, 20.1	708, 21.7	1.6* (1.2-2.2)
40-49	421, 21.6	171, 24.4	167, 37.7	759, 24.9	2.1** (1.6-2.5)
50-59	580, 27.6	214, 26.9	148, 26.8	942, 27.3	1.5* (1.1-2.0)
60-78	322, 10.8	93, 9.2	33, 5.2	448, 9.5	Ref.
Sex					
Male	1722, 86.6	588, 84.3	397, 85.5	2707, 85.9	Ref.
Female	298, 13.4	133, 15.7	76, 14.5	507, 14.1	1.1 (0.9-1.5)
Marital status					
Married/common-law	1634, 77.7	538, 69.9	310, 63.9	2482, 73.7	Ref.
Widow/separated/divorced	133, 7.1	73, 10.4	78, 19.2	284, 9.8	2.5*** (1.9-3.4)
Single/never married	253, 15.2	110, 19.7	85, 16.9	448, 16.5	1.4* (1.1-1.8)
Highest education attained					
Less than high school	68, 4.3	36, 6.3	33, 5.9	137, 5.0	2.2*** (1.5-3.3)
High school	711, 41.5	246, 39.4	181, 45.2	1138, 41.6	1.7*** (1.3-2.1)
Post-secondary not degree	627, 34.1	255, 39.4	186, 39.0	1068, 36.1	1.8*** (1.5-2.3)
University degree	613, 20.1	180, 14.9	72, 10.0	865, 17.3	Ref.

Characteristic	Mental Health Problems (Sample Size, Weighted Population Estimate as %)				Mental Health Problems UOR[1] (95% C.I.[2])
	No/Little	Mild/Moderate	Severe	Total	
Employment status					
Employed	1555, 79.9	500, 67.0	255, 51.9	2310, 72.4	Ref.
Not Employed	465, 20.1	221, 33.0	218, 48.1	904, 27.6	2.7*** (2.2-3.3)
Income adequacy (quintile)					
Lowest 1	302, 20.0	149, 27.2	133, 35.2	584, 24.1	2.3*** (1.8-3.1)
2	360, 19.5	140, 21.3	114, 25.5	614, 20.9	2.0*** (1.5-2.6)
3	391, 20.0	132, 18.2	74, 16.5	597, 19.0	1.3 (1.0-1.8)
4	435, 22.0	143, 18.7	60, 12.4	638, 19.7	1.1 (0.8-1.5)
Highest 5	422, 18.5	115, 14.6	55, 10.4	592, 16.3	Ref.
Last military rank					
Officer	680, 23.1	184, 16.7	71, 9.1	935, 19.3	Ref.
Non-Commissioned Member	1340, 76.9	537, 83.3	402, 91	2279, 80.7	1.9*** (1.6-2.3)
Service branch (element)					
Air Force	588, 30.5	197, 29.4	92, 20.0	877, 28.5	Ref.
Navy	351, 17.0	105, 14.5	66, 15.2	522, 16.2	1.1 (0.8-1.4)
Army	1081, 52.5	419, 56.1	315, 64.8	1815, 55.3	1.4*** (1.2-1.8)
Service Component					
Regular Force	1451, 94.1	500, 93.6	353, 95.4	2304, 94.2	Ref.
Reserve Class C	569, 5.9	221, 6.4	120, 4.6	910, 5.8	0.9 (0.8-1.1)
Years of service					
< 2	241, 23.0	66, 18.3	31, 11.9	338, 20.1	Ref.
2-9	389, 20.0	155, 23.6	94, 21.0	638, 21.0	1.7*** (1.2-2.3)
10-19	327, 10.1	130, 12.5	114, 24.2	571, 12.9	2.6*** (1.8-3.7)
≥20	1063, 46.9	370, 45.7	234, 42.9	1667, 46.0	1.4** (1.1-1.9)
Years since release from service					
0-4	818, 36.6	291, 38.3	196, 37.9	1305, 37.2	Ref.
5-9	761, 35.8	288, 37.9	182, 38.4	1231, 36.7	1.0 (0.8-1.3)
10-15	441, 27.6	142, 23.9	95, 23.8	678, 26.2	0.8 (0.7-1.0)

[1]UOR = unadjusted odds ratio.
[2]C.I. = Confidence interval.
***p<0.001

Table 3 shows that 23.4% had a diagnosed mental health condition, 12.3% had a moderate to severe level of psychological distress (K10 = 15-40), and 13.9% had probable PTSD (PC-PTSD = 3-4 criteria met). The mean K10 score was 5.6_(SD = 7.3) and the mean PC-PTSD score was 0.7 (SD = 1.3).

Table 3. Prevalences of diagnosed conditions, K10 psychological distress categories and number of PC-PTSD criteria.

Characteristic	Population Estimate Weighted % (95% CI)
Diagnosed mental health condition Any	23.4 (21.6-25.4)
Mood disorder	16.8 (15.2-18.6)
PTSD	12.7 (11.3-14.3)
Anxiety disorder	10.9 (9.6-12.4)
K10 Psychological distress	
No/little 0-9	79.2 (77.3-81.0)
Mild 10-14	8.5 (7.3-9.8)
Moderate 15-19	4.8 (3.9-5.9)
High 20-40	7.5 (6.4-8.8)
PC-PTSD (number of criteria)	
0	68.5 (66.4-70.6)
1	9.8 (8.5-11.2)
2	7.8 (6.7-9.2)
3	6.0 (5.0-7.2)
4	7.9 (6.7-9.1)

CI = confidence interval

Composite Segments and Prevalence of Mental Health Problems

Table 4 shows composite segments of the 38.7% (95% CI 36.6-40.9) who had any MHP and demonstrates the overlaps between the three component measures. Most (61.3%, 59.1-63.4) were in the no/little MHP category, 22.3% (20.5-24.3) were in the mild/moderate category and 16.4% (14.8-18.1) were in the severe category. About half (52.2%, 47.5-57.0) of the mild/moderate and a quarter (23.0%, 18.7-28.0) of the severe categories reported none of the diagnosed mental health conditions. Conversely, of the 23.4% with a diagnosed condition, 34.5% (30.1-39.2) were in the K10 no/little psychological distress category (score 0-9) and 24.7% (20.9-29.0) had no PC-PTSD criteria. Proportional Euler diagrams demonstrating the segments in **Table 4** are graphically shown in **Figure 1** (any MHP) and **Figure 2** (severe category).

Table 4. Component population segments in the mental health problem composite variable.

Mental Health Problems	Diagnosed Condition		K10 Score			PC-PTSD Criteria			Sample Size, Weighted Percent, 95% Cl
	No	Yes	No/ Little 0-9	Mild/ Moderate 10-19	Severe 20-40	0	1 or 2	3 or 4	
No/Little	+		+			+			2020, 61.3
									Subtotal: 2020, 61.3
Mild/ Moderate	+		+				+		284, 7.8
	+			+		+			79, 1.5
	+			+			+		46, 2.3
		+	+			+			111, 3.6
		+	+				+		76, 2.8
		+		+		+			55, 1.1
		+		+			+		70, 3.2
									Subtotal: 721, 22.3
Severe	+		+					+	65, 1.9
	+			+				+	37, 1.3
	+				+			+	11. 0.2
	+				+	+			7, 0.3
	+				+		+		5. 0.1
	+		Missing					+	5, 0.2
		+	+					+	46. 1.4
		+		+				+	111, 4.0
		+			+	+			22, 0.9
		+			+		+		29, 1.2
		+			+			+	135, 4.9
									Subtotal: 473, 16.4
									Total: 3214, 100.0

Figure 1. Proportional Euler diagram of the contributions of the component measures to the mental health problem composite measure.

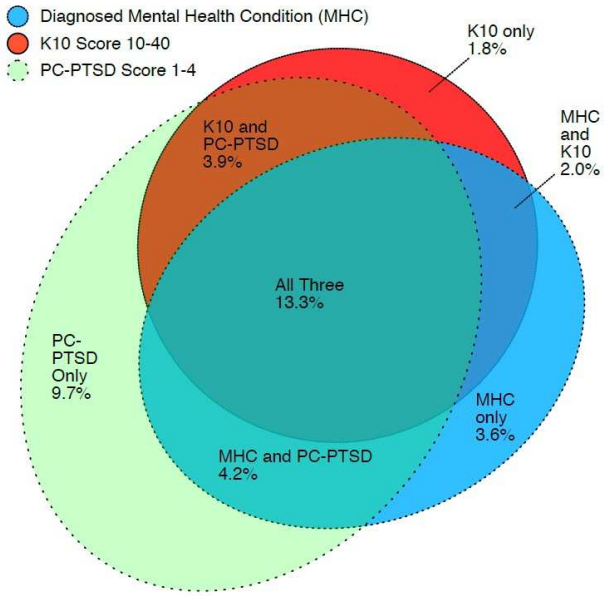
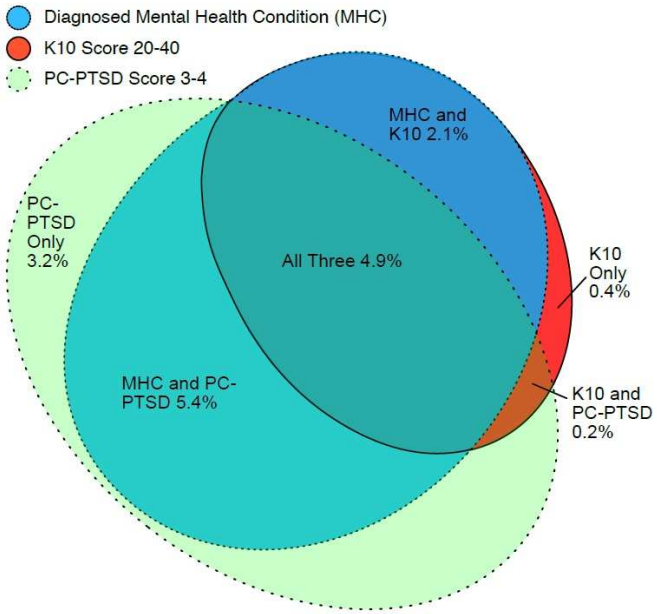


Figure 2. Proportional Euler diagram of the contributions of the component measures to the severe category of the mental health problem composite measure.



Associations with Socioeconomic and Military Characteristics

Table 2 shows univariate associations of the composite MHP variable with socioeconomic and military characteristics. Odds of having MHPs were higher for the middle age groups, unmarried marital status, lower education, not being employed and lower income. They were also higher for non-commissioned member ranks and Army service. MHPs were not associated with service component or years since release from service. UORs (unadjusted odds ratios) were proportional in all cases (shown in table) except the UORs for no/little or mild/moderate MHP versus severe were 2.7 (2.1-3.7) for non-commissioned member ranks and 3.7 (2.5-5.4) for 10-19 years of service, all significant at $p<0.001$ (not shown in table).

Associations with Health, Functioning, Stress, Social Support and Service Use Measures

Table 5 shows that the composite MHP variable had moderate to strong univariate associations with measures of general mental health, physical health, chronic pain, disability, life stress, social support, ease of adjustment to civilian life and suicidal ideation. Strength of association was highest for mental health measures (self-rated mental health and SF-12 MCS) and suicidal ideation and was lower for physical health than for mental health measures. UORs were proportional in all cases (shown in table) except the UORs for no/little or mild/moderate MHP versus severe were 56.9 (37.1-87.2) for fair self-rated mental health, 60.4 (42.6-85.6) for MCS < 40, 4.4 (3.3-6.0) for three or more physical health conditions, and 10.8 (7.2-16.2) for past-year suicidal ideation; all significant at $p<0.001$ (not shown in table).

There were four additional findings of note in other descriptive analysis. (1) The prevalence of any MHP (39%) was similar to the prevalences of good, fair or poor self-rated mental health (38%) and SF-12 MCS < 50 (33%), and the composite captured 96% of those with fair/poor self-rated mental health and 97% of those with below average MCS (MCS < 45). (2) There was a high degree of comorbidity of physical health conditions in those with mental conditions: 90% of the 23% with a diagnosed mental condition had a comorbid physical condition as did 70.8% (68.7-72.9) of those with any MHP (mild/moderate or severe categories combined). Comorbidity of chronic physical health conditions was correlated with MHP severity, rising from 62% in those with no/little MHP, to 80% in those with mild/moderate to 90% in those with severe, and the UOR indicated a moderately strong univariate association with chronic physical conditions (3.5). The prevalence of physical health condition multimorbidity (2 or more conditions) was 18.4% (14.8-22.6%) in the moderate category and highest (52.8%, 47.2-58.3%) in the severe. (3) The presence of a MHP was more strongly correlated with mental than physical health measures: Kendall's Tau B was 0.6 for both self-rated mental health and SF-12 MCS and 0.2 for both the presence of any chronic physical health condition and SF-12 PCS (all significant at $p<0.001$). (4) Of those with past-year suicidal ideation, the majority (62%) was in the severe MHP category and only 4% had no/little MHP.

Table 5. Odds ratios for mental health problems by health, disability, stress and social support measures.

Correlate	Mental Health Problems (Sample Size, Weighted Population Estimate as %)				Mental Health Problems UOR[1] (95% C.I.[2])
	No/Little	Mild/ Moderate	Severe	Total	
Total	2020, 61.3	721, 22.3	473, 16.4	3214, 100.0	--
Self-rated mental health					
Excellent	851, 41.0	99, 11.3	19, 3.7	969, 28.3	Ref.
Very good	859, 42.9	216, 27.4	57, 9.5	1133, 33.9	2.3*** (1.7-3.2)
Good	289, 15.2	267, 39.0	118, 27.2	674, 22.5	11.4*** (8.3-15.8)
Fair	18, 0.8	116, 18.6	159, 34	293, 10.2	157.3*** (82.3-300.7)
Poor	3, 0.1	22, 3.7	118, 25.7	143, 5.1	225.3*** (124.7-407.1)
SF-12 Mental Component Summary					
≥ 55	1348, 66.4	219, 29.3	35, 6.8	1602, 48.5	Ref.
50-54	442, 22.8	132, 16.5	36, 6.9	610, 18.8	1.9*** (1.4-2.5)
45-49	154, 7.6	117, 17.9	46, 10.4	317, 10.3	6.6*** (4.8-9.2)
40-44	50, 2.4	92, 11.5	56, 11.8	198, 5.9	16.6*** (11.1-24.7)
< 40	17, 0.8	155, 24.8	287, 64.1	459, 16.4	163.1*** (80.1-332.1)
Chronic physical health condition					
No	726, 38.4	135, 20.5	37, 9.1	898, 29.4	Ref.
Yes	1230, 61.6	569, 79.5	432, 90.9	2231, 70.6	3.5***(2.78-4.45)
Comorbidity of chronic physical health conditions					
0	726, 38.4	135, 20.5	37, 9.1	898, 29.4	Ref.
1	648, 32.3	200, 29.1	111, 22.3	959, 29.9	0.5*** (0.4-0.6)
2	342, 17.4	201, 27.6	117, 25.1	660, 21.0	1.9*** (1.5-2.4)
3 or more	240, 11.9	168, 22.8	204, 43.5	612, 19.7	3.2*** (2.5-4.2)
Chronic pain or discomfort					
No	1580, 77.9	423, 57.7	155, 37.0	2158, 66.7	Ref.
Yes	440, 22.1	298, 42.3	317, 63.0	1055, 33.3	3.9*** (3.2, 4.7)
Restriction of activity major life domains					
Never	1344, 67.8	244, 32.8	60, 14.8	1648, 51.2	Ref.
Sometimes	472, 22.7	221, 31.7	123, 26.4	816, 25.3	3.6*** (2.8-4.5)
Often	201, 9.6	256, 35.5	290, 58.8	747, 23.4	12.8*** (10.1-16.4)
Need for assistance with at least one ADL					
No	1873, 92.6	534, 71.4	222, 47.2	2629, 80.4	Ref.
Yes	147, 7.4	186, 28.6	251, 52.8	584, 19.6	7.7*** (6.2-9.6)
Activities prevented by chronic pain/discomfort					
None	1675, 82.9	453, 61.3	166, 38.2	2294, 70.8	Ref.
A few	139, 6.9	73, 10.7	55, 10.6	267, 8.3	2.5*** (1.9-3.5)
Some	128, 6.5	98, 13.3	94, 20.1	320, 10.2	4.3*** (3.2-5.8)
Most	76, 3.8	97, 14.7	157, 31.0	330, 10.7	9.1*** (6.9-12.0)
Life stress most days					
Not at all or not very	899, 46.0	176, 27.0	57, 11.5	1132, 36.1	Ref.
A bit	823, 39.9	350, 49.1	167, 35.9	1340, 41.3	2.5***(2.0, 3.15)
Quite a bit or extremely	295, 14.1	194, 23.9	249, 52.6	738, 22.6	5.8***(4.5, 7.6)
Perceived Social Support					
Not low	1926, 94.4	588, 79.1	287, 59.0	2801, 85.2	Ref.
Low	94, 5.6	133, 20.9	186, 41.0	413, 14.8	7.4*** (5.7-9.5)
Adjustment to Civilian Life					
Easy	1523, 72.7	326, 41.7	94, 18.1	1943, 56.8	Ref.

Correlate	Mental Health Problems (Sample Size, Weighted Population Estimate as %)				Mental Health Problems UOR[1] (95% C.I.[2])
	No/Little	Mild/ Moderate	Severe	Total	
Neither	283, 16.0	127, 18.8	77, 14.5	487, 16.3	2.5*** (1.9, 3.3)
Difficult	212, 11.3	268, 39.6	302, 67.4	782, 26.8	10.9*** (8.7, 13.7)
Past-year suicidal ideation					
No	2013, 99.6	667, 89.8	351, 75.0	3031, 93.4	Ref.
Yes	7, 0.4	52, 10.2	116, 25.0	175, 6.6	52.4*** (19.0-144.8)

[1]UOR = unadjusted odds ratio.
[2]C.I. = Confidence interval.
***p<0.001

Table 6 shows moderate to strong correlations of the MHP measure with measures of service use, particularly mental health-specific variables. UORs were proportional in all cases (shown in table) except the UORs for no/little or mild/moderate MHP versus severe were 17.0 (9.4- 30.7) for perceived unmet need for a mental health care, significant at p<0.001 (not shown in table).

Table 6. Odds ratios for mental health problems by service utilization measures.

Correlate	(Sample Size, Weighted Population Estimate as %)				Mental Health Problems UOR[1] (95% C.I.)
	No/Little	Mild/ Moderate	Severe	Total	
Total	2020, 61.3	721, 22.3	473, 16.4	3214, 100.0	--
Patient overnight in a hospital, nursing home, or convalescent home					
Yes	83, 4.1	71, 11.4	63, 15.1	217, 7.5	3.14*** (2.33, 4.23)
No	1937, 95.9	649, 88.6	410, 84.9	2996, 92.5	Ref.
Past year consult with family doctor, general practitioner or pediatrician					
Yes	1442, 66.3	596, 79.7	396, 84.2	2434, 72.2	2.27*** (1.80, 2.86)
No	578, 33.7	125, 20.3	77, 15.8	780, 27.8	Ref.
Past year consult with other medical doctor (surgeon, allergist, orthopedist, gynecologist/urologist or psychiatrist)					
Yes	519, 23.4	304, 43.0	257, 51.3	1080, 32.3	2.79*** (2.32, 3.36)
No	1500, 76.6	417, 57.0	216, 48.7	2133, 67.7	Ref.
Past year consult with nurse					
Yes	175, 9.2	112, 14.5	113, 23.6	400, 12.8	2.34*** (1.80, 3.05)
No	1844, 90.8	609, 85.5	360, 76.4	2813, 87.2	Ref.
Past year consult with psychologist					
Yes	50, 2.4	106, 15.3	184, 38.1	340, 11.2	10.74*** (8.12, 14.19)
No	1970, 97.6	615, 84.7	288, 61.9	2873, 88.8	Ref.
Past year consult with social worker or counsellor					
Yes	43, 1.6	58, 8.1	95, 22.1	196, 6.4	8.71*** (6.19, 12.25)
No	1977, 98.4	663, 91.9	378, 77.9	3018, 93.6	Ref.
Past year felt need for health care and did not receive it					
Yes	142, 6.9	134, 20.3	194, 42.2	470, 15.6	5.97*** (4.67, 7.64)
No	1877, 93.1	586, 79.7	277, 57.8	2740, 84.4	Ref.
Past year felt need for health care and did not receive it for a physical health problem or injury					
Yes	107, 5.3	81, 11.9	120, 24.7	308, 9.9	4.04*** (3.02, 5.41)
No	1911, 94.7	639, 88.1	350, 75.3	2900, 90.1	Ref.
Past year felt need for health care and did not receive it for a mental health problem					
Yes	4, 0.0	25, 3.7	62, 14.8	91, 3.3	209.27*** (75.59, 579.6)
No	2014, 100	695, 96.3	408, 85.2	3117, 96.7	Ref.
Past year home care services					
Yes	142, 7.0	114, 15.3	165, 31.3	421, 12.8	4.10*** (3.18, 5.28)
No	1878, 93.0	607, 84.7	308, 68.7	2793, 87.2	Ref.
VAC Client					
Yes	418, 21.1	319, 47.3	318, 66.8	1055, 34.4	4.80*** (3.97,5.80)
No	1602, 78.9	402, 52.7	155, 33.2	2159, 65.6	Ref.

[1]UOR = unadjusted odds ratio.
[2]C.I. = Confidence interval.
***p<0.001

Discussion

The objectives of this study were to derive and assess a composite of brief mental health measures available in the 2013 LASS to describe the extent of MHPs and related needs in this Veteran population. The findings extend the literature by demonstrating the derivation, utility and validity of combining brief mental health survey measures into a composite. The composite gave a comprehensive picture of the extent of MHPs that included not just Veterans with diagnosed conditions, but also those with undiagnosed and subthreshold states across a spectrum of severity and likelihood of service needs. MHP severity categories were associated in expected ways with measures of mental and physical health, disability, stress, social support and service use, which is evidence of criterion validity.

Prevalence of Mental Health Problems

The composite MHP measure yielded a more complete and practical picture of mental health in the Veteran population for policy and program planners than was previously available using single brief measures. The composite prevalence (38.7%) was larger than prior estimates using individual measures: 24.3% for self-reported diagnosed conditions, 21.1% for K10 score > 9, 31.5% for PC-PTSD criteria of 1-4 and 14.0% for 3-4 criteria [3,29]. We found no studies using similar composite mental health measures in other Veteran populations. However, the finding that the prevalence of diagnosed or serious mental disorders alone underestimates MHP prevalence or mental health service need is consistent with studies using other composite approaches in other populations including, in CAF serving personnel, finding perceived need for mental health care was associated with factors beyond CIDI diagnostic criteria for common mental disorders in serving CAF personnel [21] and finding a much larger proportion with a psychosocial difficulty than those meeting threshold diagnostic criteria [25]. World Mental Health Survey (WMH) analysts used a combination of the Sheehan Disability Scale, the Global Assessment of Functioning scale and the presence/absence of suicidal ideation to categorize the severity of diagnostic categories based on CIDI symptom measures combined with measures of receiving mental health treatment [26]. In another WMH study, a composite of self-reported diagnosis, self-reported treatment and suggestive symptoms found that the composite prevalence of depression was much larger than for self-reported diagnosis alone [12]. The findings in this study emphasize the importance of using multiple mental health measures in population surveys or clinical screening to detect those who might benefit from mental health assessment. For example, an evaluation of brief measures in serving Australian Army personnel found that the combination of both K10 and a PTSD screener was more likely to capture those needing mental health assessment than either measure alone, in part because some did not have high K10 scores but met PTSD screening criteria [31].

The finding that some respondents only met criteria for a mild/moderate or severe MHP by one of the three component measures could be explained by those with mental illness being undiagnosed or, if diagnosed, then in recovery or remission. Some with PTSD might not have had significant K10 scores if they had little comorbid depression or

anxiety. The finding that a number of respondents in the severe category did not report diagnosed mental health conditions but met criteria in the other two instruments is consistent with prior evidence that self-report of diagnosed conditions underestimates the prevalence of diagnosed mental health conditions ascertained by clinical records [7,10,49].

Utility of the Composite Measure

These findings provide policy and program planners with a heuristic view of the numbers of Veterans needing support services, and demonstrate that they have a hierarchy of needs that could be met with a hierarchy of services. The majority of Veterans in this study were doing well: few of the 61% with no/little MHP had fair/poor self-rated mental health, poor mental health-related quality of life (MCS), activity limitations, suicidal ideation, mental health service utilization or perceived unmet need for mental health care. This group had much lower likelihood of multimorbidity of chronic physical health conditions, difficult adjustment to civilian life and unmet need for mental health care than those with MHPs, suggesting that needs for this category were mainly for maintenance of good mental health and well-being.

The substantial number who met MHP criteria using the component measure (39%) did not all require the same supports. The 22% with mild/moderate MHPs were distributed across a range of degrees of health, functioning and service use, indicating a variety of states such as recovering from a more severe condition, needing diagnosis and treatment, or simply needing monitoring. Although many in this potentially precarious middle group might not need active treatment, they probably are more likely to require a degree of monitoring for clinical changes or changes in life circumstances that could be associated with worsening mental health. The 16% meeting severe MHP criteria had high rates of poor health, physical health multimorbidity, difficulty functioning and past-year suicidal ideation and contained the majority who reported a difficult adjustment to civilian life, which previous research demonstrates is a subpopulation with high needs for effective services [24,68].

The finding that severe MHP was highly correlated with perceived unmet need for mental health care is consistent with findings in the general Canadian population, where higher prevalence of chronic health conditions was associated with higher likelihood of perceiving unmet need [24]. It is likely that there are greater opportunities to perceive unmet need when health problems are more significant [24]. In a prior LASS 2013 analysis there were a variety of reasons, including personal choices (being too busy to seek care, stigma, thought care would be inadequate), availability (long waiting times, lack of local services or physician thought care not necessary) and accessibility (cost) [29].

These findings are consistent with strong evidence from worldwide studies that while the numbers of persons with MHPs who require treatment are straining resources, many who should be treated are not, but not all need formal treatment. In the World Mental Health surveys, many more serious cases did not receive mental health care while many non-

cases did, and while early treatment of mild cases might be cost effective, more information is needed to identify those who should be treated [26]. In a longitudinal U.S general population survey, about half of those meeting diagnostic criteria for mental disorders remitted without formal treatment; nonetheless, the reasons for this are not clear, and this finding does not preclude the need for early diagnosis of those with subthreshold cases [23]. In the study of serving CAF personnel deployed in support of the Afghanistan mission, about half of those with a mental health problem had related occupational dysfunction (about a third of them among those not meeting criteria for mental disorders) [25].

This study found evidence of several types of validity for the composite measure, including a strong correlation with the self-rated mental health and SF-12 MCS general mental health measures (construct validity) and stronger correlations with those two mental health measures than the presence of chronic physical health conditions and SF-12 physical component summary measures of physical health (discriminant validity). Although the composite identified almost all who reported poor self-rated mental health and low MCS (concurrent validity), the composite also identified MHPs in a portion of those with very good or excellent self-rated mental health or above average SF-12 MCS and, conversely, the two general mental health measures identified some who did not meet MHP criteria. This lack of complete congruence is not surprising, given that both self-rated mental health and MCS probably measure more than just the presence of symptoms and diagnosed conditions, and some with diagnosed conditions likely are in remission or have been treated. Furthermore, there is evidence that respondents consider more than just psychological symptoms and related functional impacts in answers to the general mental health instruments [52,52,60]. The study also found moderate to strong correlations across the ordinal MHP categories with a variety of factors including socioeconomic and military characteristics, physical health comorbidity, disability, life stress, suicidal ideation and service use in ways expected from world-wide research using other mental health measures (criterion validity) [1,2,17,21,58,69].

Strengths and Limitations

This study evaluated the utility of a composite of commonly used brief mental health survey measures designed to measure the extent of both the three most common mental disorders in Veterans and civilian populations (self-reported diagnosed mood disorders, anxiety disorders and PTSD) as well as subthreshold symptom states associated with poor functioning, all important information for designing mental health services [9]. The survey dataset allowed for evaluating the composite measure against a broad range of health, well-being and service use measures. Veteran identity and some sociodemographic and military characteristics were objectively determined through data linkage. The response rate was good and the sample was statistically representative of all CAF deployed Reserve and Regular Force Veterans who had released since 1998 and were living in the general Canadian population, including those not participating in VAC programs.

The composite measure was developed through expert consensus within the author group

because we could not identify a more rigorous, empirical approach to determine optimal number of levels for the composite measure or optimal ways of combining the components and optimal cut-offs for each component measure. Data available for assessment of criterion validity were self-reported. Nevertheless, we were able to show that the composite measure had evidence of construct, concurrent, discriminant and convergent validity. Most importantly, there was evidence of criterion validity in that the composite clearly was associated with a broad range of mental health-related factors of interest to agencies supporting Veterans, factors that can be either determinants or outcomes of mental health problems. The cut-offs used for the K10 and PC-PTSD instruments have not yet been evaluated among CAF Veterans; however they are similar to those found for serving CAF personnel [20] and Australian and U.S. military and civilian populations [40,44]. Choice of component measures was limited to those used in the survey and the applicability of this composite measure to other populations is uncertain, especially given that the available PTSD measure is not in wide use in population health surveys. Nonetheless, the study demonstrated the advantages of combining measures. The study was not designed to evaluate for era effects, for example era-specific differences in mental health services and changes in perceptions of mental health or stigma, although there was no association between MHP and years since release from service. Finally, the findings are representative only of Veterans released since 1998, not the larger population of Veterans who have released in previous years; however the mental health of military personnel transitioning to civilian life is of great interest worldwide.

Conclusions

This study demonstrated a practical method for combining three brief mental health survey measures of CAF Veterans from among those available in the 2013 Life After Service Survey to aid in communicating a comprehensive picture of the extent and impacts of common MHPs in the CAF Veteran population to policy and program managers and service providers, which is an important first step in clarifying and responding to needs [13]. The findings confirm prior research showing that assessing population mental health by single brief measures or diagnosed conditions alone is insufficient [12,13,18,19,21-23,25]. The study found that while a considerable number of recent Veterans have MHPs, they have varying degrees and types need that could be met with stepped levels of intensity of service options [23]. The study found evidence of construct, concurrent, discriminant and criterion validity. The finding that Veterans reporting difficult adjustment to civilian life were concentrated in the severe MHP category supports the need for strong mental health and well-being services during military-civilian transition. These findings from LASS 2013 establish a baseline for the longitudinal phase of the Life After Service Studies which begins with LASS 2016.

List of Abbreviations

CAF – Canadian Armed Forces
CI – 95% confidence interval
CIDI – Composite International Diagnostic Interview
DSM – Diagnostic and Statistical Manual
K10 – Kessler's 10-item measure of psychological distress
LASS – Life After Service Surveys
MHP – Mental health problem
MHC – Self-reported diagnosed mental health condition (mood disorder, anxiety disorder, or PTSD).
MCS – SF-12 mental component summary
PC-PTSD – Primary Care Posttraumatic stress disorder screener
PTSD – Posttraumatic stress disorder
SF-12 – QualityMetrics 12-item Short-Form Health Survey
VAC – Veterans Affairs Canada
UOR – unadjusted odds ratio
WHO ICD – World Health Organization International Classification of Diseases

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Authors' contributions

JMT conceived the study and drafted the manuscript including preparation of the figures. JMT, LVT, MAZ, DF, SD and MJS planned the initial approach to the paper. All authors contributed to the design of the composite measure including final choice of the indicators. JMT, MAZ, DF and SD planned the validation approach. LVT, MJS and SD participated in the survey design. JMT, LVT and MJS planned the statistical analyses. MJS compiled the dataset and performed the data analyses. All authors commented on the manuscript drafts, participated in the interpretation of findings, assisted in identifying implications and have read and approved the final manuscript.

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Ethics approval and consent to participate

Ethical approval was provided by Statistics Canada and survey respondents provided informed consent.

Availability of data and material

The 2013 *Life After Service Survey* data is available through Statistics Canada's network of Research Data Centers. Details of the dataset and application process are found at: http://www.statcan.gc.ca/eng/rdc/network.

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