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Does Screening Shorten Delays to Care for Post-Deployment Mental Disorders in Military Personnel?: A Longitudinal Retrospective Cohort Study.

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Abstract

Objective: To determine whether post-deployment screening is associated with a shorter delay to diagnosis and care among individuals identified with a deployment-related mental disorder.

Design: Retrospective cohort study.

Setting: Canadian military population.

Participants: The cohort consisted of personnel (n=28,460) with a deployment within the 2009 to 2014 timeframe. A stratified random sample (n=3004) was selected for medical chart review. We restricted our analysis to individuals who had an opportunity to undergo screening and were subsequently diagnosed with a mental disorder that a clinician indicated was deployment-related (n=1157).

Interventions: Post-deployment health screening.

Main Outcome Measure: The outcome was delay to diagnosis and care, the latency from individuals' deployment return to their mental disorder diagnosis date. Cox proportional hazards regression assessed screening's influence on this outcome.

Results: 74.4 % of the study population had screened. Overall, the median delay to care was 766 days, 578 days among screeners and 928 days among non-screeners—a 350 day difference. Cox regression indicated that screeners had a significantly shorter delay to care (adjusted HR (aHR), 1.43 [95%CI, 1.11 to 1.86]). Screening findings had a substantial influence on delay to care. Identification of a mental health concern, whether a 'major' concern (aHR, 3.36 [95%CI, 2.38 to 4.73]) or a 'minor' concern (aHR, 1.46 [95%CI, 1.08 to 1.99]), and a recommendation for mental health services follow-up (aHR, 2.35 [95%CI, 1.73–3.21]) were strongly associated with shorter delays to care relative to non-screeners.

Conclusions: Reduced delays to care are anticipated to lead to beneficial outcomes for both the individual and military organisation. We found that screening shortened the delay to care for mental disorders that were deployment-related. Future work will further explore this screening's components and optimisation strategies.

Strengths and limitations of this study

- The study used a clearly defined population with clear definitions for the temporally related exposure, a post-deployment mental health screening, and outcome, a mental disorder diagnosis that was determined to be deployment service-related.
- The primary study limitation relates to it being retrospective and as such, it is reliant on the information that was available.
- The study showed that routine post-deployment screening among military personnel can shorten the delay to care for deployment-related mental disorders; however, this metric, a shorter delay to care, is a proxy for expected beneficial outcomes (ie, symptom improvement, occupational retention, treatment cost-reduction, reduced risk of further impairments, and quality of life).

INTRODUCTION

Military personnel encounter unique experiences during their service and some experiences, particularly those encountered on deployment, can increase individuals' vulnerability to developing mental health problems.[1-5] While effective mental health care is available, many service members with a mental health problem do not seek out needed services and only a small proportion do so in a timely manner.[6, 7] Barriers to treatment seeking have been extensively studied among military personnel in Canada and other countries.[7-9] For instance, a failure to perceive a need for care, stigma, negative beliefs about mental disorders and associated treatments, concern over potential negative career consequences, and systemic issues such as lengthy wait times and poor accessibility have been reported.[10, 11] Prior research among Canadian Armed Forces (CAF) personnel had identified a failure to perceive a need for care as their most prevalent barrier, reported by 84% to 97% of personnel depending on the care considered.[12] In addition to barriers, a number of mental health care-seeking facilitators have also been identified, features that have a positive influence on barriers to care, such as the presence of a supportive organisational climate, social support, and educational programmes that promote mental illness awareness and treatment seeking.[11]

A number of countries have reinforced their military mental health systems in an effort to address these barriers and assist their personnel.[13-15] For example, the CAF expanded its outpatient mental health system in an effort to reduce physical barriers to care[15] and it introduced a resilience and mental health training programme to promote recognition of mental health services need, treatment seeking, and stigma reduction.[16] The CAF, and other countries such as the US and Australia, has also introduced post-deployment health screening as a response to the growing awareness of the relatively high prevalence of post-deployment mental health concerns.[7, 17] This screening was initiated to reduce barriers and facilitate earlier care-seeking.[16] Additionally, screening in Canada has been designed to

provide feedback, guidance, education and advice on the post-deployment reintegration process, and to reduce stigma surrounding mental illness. Overall, screening aims to shorten delays to care in those with a need, a result that has been linked with a number of beneficial individual and organisational outcomes.[18-21]

Accordingly, screening offers a theoretical value to service members but the available research on its putative value is somewhat inconclusive. Observational studies suggest a triage and care provision benefit from screening, as researchers have generally noted that a significant proportion of those who screen positive for mental health problems do initiate follow-up mental health services,[22-24] but it is unknown whether those screening positive would have received equivalent and timely mental health care had they not screened. We identified a single randomised controlled study that compared a screening regimen relative to a 'non-screened' control. The authors reported that past-year mental health services use among participants who screened positive 6 to 12 weeks after deployment-return was comparable to those in the 'non-screened' group who would have been positive screeners and generally, identified screening to be ineffective.[25] However, the method by which screening was implemented was substantially different from the approach used in Canada and elsewhere, limiting its generalisability.

The present study was designed to examine the effectiveness of the CAF approach to post-deployment screening within the context of the Canadian military mental health system. The primary objective is to determine whether screening is associated with a shorter delay to diagnosis and subsequent care among individuals who had been diagnosed with a mental disorder that was determined to be deployment service-related.

METHODS

Post-deployment screening in the Canadian Armed Forces

The CAF introduced post-deployment health screening in 2002 and currently service members who deploy for 60 days or longer on operations to most international locations are to complete screening 90–180 days following their deployment return. The screening process makes use of a questionnaire that assesses for health concerns using standardized instruments.[26-30] Completed questionnaires are reviewed by a mental health professional who, following the conduct of a semi-structured interview, makes recommendations for follow-up care. Further details on the screening process can be found elsewhere.[31]

Study population and Sampling

This study used a retrospective cohort study design. The cohort consisted of all CAF personnel (n=28,460) who had a deployment within the 01-January-2009 to 31-December-2014 timeframe. A stratified random sample consisting of 3004 individuals was selected for medical chart review. The study was powered to discern a delay to care difference of at least 50 days between screened and non-screened individuals with 85% power when employing a log-rank test. Sample size per stratum was determined using a Neymann optimal allocation approach.[32] Further details on the sampling process can be found elsewhere.[31]

The analysis in this paper was restricted to the sampled individuals who had the opportunity to undergo screening and were subsequently diagnosed with a mental disorder that a clinician indicated was deployment service-related (n=1157). While medical records were reviewed for 2997 individuals in the sample (i.e., 7 from the sample were inaccessible), 2598 had a deployment that required screening and, of these, 1240 individuals had a mental disorder that was deployment-related (18.2%; 95%CI: 16.6-

19.8). An additional 83 individuals were excluded because they had minimal opportunity to undergo screening; that is, their diagnosis occurred during deployment (unweighted n=6, weighted %=0.2) or <90 days after return (unweighted n=77, weighted %= 6.3) which is before the 90–180 day post-deployment screening period. These individuals are not the target of post-deployment screening even though some did screen (i.e., 58 after diagnosis and 3 before). More specifically, service members with persistent mental health concerns following their deployment are instructed to seek services and not wait to be screened; screening was designed to facilitate care-seeking in those with a need for care but who are hesitant or perceive a barrier to care-seeking. Nevertheless, the current screening policy mandates the screening of all eligible service members as part of its surveillance objective, even if they had already sought care.

Data collection

Deployment details came from deployment tasking (extract date: 30-Mar-2016), deployment-related pay (extract date: 30-Mar-2016), and human resources (extract date: 01-Aug-2017) administrative databases. Mental disorder diagnoses, diagnosis date, mental disorder history, and clinician-identified attributions to service (ie, see outcome measure) were abstracted from medical records over the period of 06-Feb-2017 to 01-May-2018. Screening data were obtained from the medical record review and this was supplemented with electronic data from the screening programme (extract date: 01-Aug-2012). Additional data on sociodemographic and military characteristics were obtained from human resources administrative data (extract date: 01-Aug-2017).

Outcome measure

The outcome was delay to care for individuals diagnosed with a mental disorder that was determined by a clinician to be deployment service-related, hereafter referred to as deployment-related mental disorder. This delay to care was defined as the latency from individuals' most recent deployment return date to their mental disorder diagnosis date. In some instances individuals received more than one mental health diagnostic assessment. For these individuals the date of diagnosis was taken from the first assessment but other details were taken from the more recent assessment. The deployment return date was a proxy for symptom onset and services need in those with a subsequent mental disorder that was determined to be deployment-related. While it is possible that an unknown number of our study participants could have had undiagnosed or subclinical mental health problems prior to deployment, this number is expected to be small. Additionally, military personnel in the CAF undergo a health and occupational screening prior to their official deployment approval which has the potential to identify pre-deployment mental health concerns.

We chose delay to care for a mental disorder diagnosis over other mental health indicators of need and delayed services use because it is incontrovertible that such disorders require professional help. While some individuals may have received some form of care prior to their mental disorder diagnosis, definitive treatment of the disorder can't be provided until a diagnosis is confirmed.

Deployment-related attribution: Almost all participants received a mental disorder diagnosis at one the CAFs Operational Trauma and Stress Support Centres. The mental health diagnostic assessments at these centres are highly structured. Clinicians conducting these assessments collect a personal history that includes military and deployment experiences and ultimately, when a diagnosis is made an attribution is also typically indicated. This attribution was used to determine whether or not a diagnosed mental disorder was deployment-related in those with such an assessment. Similarly, in the few situations in which individuals only had mental health diagnostic assessments that occurred outside

of these centres, a deployment-related attribution was assigned to a diagnosis only when this was indicated in the medical record.

Screening covariates of interest

Screening status: The primary covariate of interest was completion of a required screening. A completed screening occurred only when service members completed both the questionnaire and subsequent interview with a mental health professional, as determined by documentation in the medical record. The interview date determined the date of screening completion. Non-screeners were determined by the absence of screening documentation. Additionally, 44 individuals (3.0%) who screened after they were diagnosed were assigned a non-screening status and handled the same as other non-screening individuals.

Screening findings: Screened individuals were further categorized based on the interviewer's impressions recorded in the medical record:

1) Type of concern indicated, categorized as 'major' or 'minor' mental health concerns, physical health concerns (but no mental health concerns), 'other' concerns (but no mental or physical health concerns), or none;
2) Mental health concern indicated, categorized as 'major' concerns, 'minor' concerns only, or none;
3) Any follow-up care recommended (i.e., general practitioner, mental health, psychosocial, or 'other'), categorized as present/absent; and
4) Mental health follow-up care recommended, categorized as present/absent.

Mental health concerns included PTSD symptoms, depressive symptoms, anxiety symptoms, or substance use. Physical health concerns included post-concussive symptoms or other physical health issues. 'Other' concerns included family/ marital problems, workplace conflict, or 'other' concerns.

Potentially confounding covariates

Based on previous research,[6, 33-37] the potential confounders that we identified for this study included: mental disorder diagnosis-related variables; sex; age (19 to 24, 25 to 34, 35 to 44 or 45 to 60 years); service (Army, Navy, or Air Force); component (Regular or Reserve Force); rank category (Junior Non-commissioned Member [JNCM], Senior NCM [SNCM], or Officer); combat arms military trade/occupation; years of service (≤ 4, 5 to 9, 10 to 19, or ≥ 20 years); marital status (married/ common law, divorced/separated/widowed, or single - never married); and first official language (English or French). Deployment-related information was also assessed and these covariates included deployment location (Afghanistan or 'other'), post-deployment era (2009-2011, 2012-2014 or 2015-2017), and deployment length (≤180days, >180days). Variable categorizations were based on the data's distribution and previous work with this population.

The mental disorder diagnosis-related covariates included indications in the medical record of a past mental disorder diagnosis, specifics on the recent post-deployment mental disorder diagnosis, and the presence of a general medical condition that was deemed relevant to the recent mental disorder. Among the 1157 individuals with a mental disorder diagnosis that was deployment-related, DSM-IV was predominantly specified as the classification used (n = 773) but DSM-V was used for some (n = 32) and for others, it was unspecified (n = 352).

Both the past mental disorder and relevant general medical condition covariates were captured as 'present' or 'none indicated'. The recent post-deployment mental disorder diagnoses were categorized into 6 groups: 3 single diagnosis categories of PTSD, depressive disorder (i.e., major depression or dysthymic disorder), or single 'other' disorder, and 3 comorbid categories of PTSD and depressive disorder only, all other comorbid combinations with PTSD, and any other non-PTSD comorbid combination, which could include depressive disorders. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders, and substance-induced disorders.

Statistical analysis

The data were analyzed using SAS for Windows, version 9.4 (SAS Institute Inc., North Carolina). We applied the sample design weights to determine descriptive and regression statistics and Taylor Series Linearization[37] was used to generate the associated standard error estimates and 95% confidence intervals (CIs). There were no missing values among the assessed covariates.

We used time-to-event analysis methods. Zero-time was defined as the most recent deployment return date prior to diagnosis; the median deployment return date was 21-November-2010, ranging from 16-January-2009 to 17-July-2015. Event-time was the diagnosis date of individuals' deployment -related mental disorder; the median diagnosis date was 01-May-2013, ranging from 23-June-2009 to 15-December-2017. Among those who completed screening before diagnosis, the median diagnosis date was 26-April-2013, ranging from 31-August-2009 to 15-December-2017 and among non-screeners the median diagnosis date was 17-June-2013, ranging from 23-June-2009 to 03-October-2017. No individuals were censored.

The covariates for post-deployment era, screening status, and screening findings were handled as time-dependent. Diagnosis-related covariates were captured at individuals' date of diagnosis. The

remaining covariates were assessed relative to deployment return date; however, marital status was assessed on the human resources administrative data extract date, the only option.

Extended Kaplan-Meier methods[38] generated event probabilities for screening status as a time-dependent covariate. Cox regression assessed delay to care differences for covariates and results were expressed as hazard ratios (HRs) and their 95% CIs. Initially, Cox regressions assessed the unadjusted relationship between each potential confounder and delay to care; covariates with a Wald test p-value <0.25 were retained. The primary screening-associated covariates of interest were individually forced into a regression model that included these retained potential confounders. Regression diagnostic plots were reviewed with respect to the proportional hazards assumption.[39]

Patient and public involvement

CAF service members, patients and/ or the public were not involved in developing the research question, the study design or in the conduct of the study. The findings from this study and the larger research project will be shared with CAF service members and other interested stakeholders through targeted conference venues, CAF community newsletters or communiques and other venues.

RESULTS

Study population characteristics

Table 1 summarizes, overall and by screening status, the sociodemographic, military, and clinical characteristics among the study population. Overall, the diagnoses were predominantly PTSD (ie, 69.7%), either alone or comorbid, 36.2% had a general medical condition that was deemed relevant to their mental disorder, and 9.8% had a past mental health problem. Individuals were predominantly

English speaking, married, male, Regular Force members, in the Junior NCM rank category, and in Army service. At deployment return, the mean age of individuals was 34 years, just over half had less than 10 years of military service, and the majority were in non-combat arms occupations.

74.4 % (95%CI: 71.1–77.8) of the study population had screened (Table 1). Additionally, the distribution of the covariates for age, marital status, years of military service, service type, combat arms occupation, deployment location, and mental disorder case-mix differed by screening status.

Delay to care

Individuals who returned from deployment and had a subsequent mental disorder diagnosis that was deployment-related comprised the study population and their diagnosis date was the end-point for our delay to care calculation. The median delay to care for each of our covariates and their unadjusted hazard ratios (HR's) are summarized in Table 2. In our analysis HR's are analogous to relative care-seeking rates and a HR above 1.0 implies a shorter delay to care.

The unadjusted HR's suggest that a shorter delay to care was associated with females, non-Afghanistan deployments, the 2015–2017 post-deployment period, certain diagnoses, presence of a relevant general medical conditions, and screeners (Table 2). Additionally, the unadjusted HR's suggest that the delay was generally shorter for older (ie, 45–60) individuals and those who were single; however, the Wald chi-square test p-values for the age and marital status covariates were greater than 0.05 (ie, 0.074 and 0.110, respectively). The covariates for first official language, rank, years of military service, component, service, combat arms occupation, and deployment length were dropped from the final assessment model because they had Wald chi-square test p-values ≥0.25.

Post-deployment screening

Extended Kaplan-Meier curves were generated to characterize delay to care by screening status (Figure 1); these curves incorporate this covariate's time-varying nature.[38] Noting that all individuals had a mental disorder diagnosis, this figure quantifies the cumulative proportion of diagnoses that were identified as time increases. The slopes of these curves equate to the rate at which care-seeking occurs and early curve separation was observed. Early on, diagnoses, or care-seeking, occurred at a much faster rate among screeners and this faster rate, as exemplified by this curve's steeper slope, continued until approximately 2 years post-deployment. In comparison, the cumulative fraction diagnosed among non-screeners only became comparable to that of screeners at approximately 3 to 5 years post-deployment. Moreover, while the median delay to care was 766 days overall, these curves reveal a median delay of 578 days among screeners and 928 days among non-screeners (Figure 1), a 350 day difference.

Looking a little more closely at the temporal sequence of events from individuals' deployment return to screening and from screening to subsequent mental disorder diagnosis provides some insight into screening's influence on delay to care (Table 3). The median latency from deployment return to screening was 151 days overall and this median varied very little with screening findings. In contrast, and as expected, the median latency from screening to diagnosis was shorter when a 'major' concern was identified and when follow-up care was recommended, particularly when these were for mental health problems; however, the median latency from screening to diagnosis was much longer (i.e., approximately 1000 days) when these findings were absent.

Moreover, we noted a few inconsistent observations among the screening findings. Of those that were eventually diagnosed with a deployment-related mental disorder (and had been screened post-deployment) 41.8% had no mental health concerns identified at screening and 69.8% had no recommendation for mental health services follow-up. Additionally, 36.2% of those with an identified 'major' mental health concern at screening did not have a mental health services follow-up

recommendation and this was not influenced by indications that individuals were already in some form of care for their concern.

Cox proportional hazards regression results

The final multivariable model that assessed the screening covariates (Table 4) indicated that delay to care was significantly shorter for screeners (adjusted HR (aHR), 1.43 [95%CI, 1.11–1.86]). More specifically, certain screening findings resulted in a shorter delay to care relative to non-screeners. Identification of a mental health concern, whether a 'major' concern (aHR, 3.36 [95%CI, 2.38–4.73]) or a 'minor' concern (aHR, 1.46 [95%CI, 1.08–1.99]), resulted in a shorter delay to care, but more pronounced with 'major' concern identification. Similarly, delay to care was shorter for individuals with a recommendation for mental health service follow-up (aHR, 2.35 [95%CI, 1.73–3.21]). In contrast, screened individuals with no identified mental health concern during screening (aHR, 0.98 [95%CI, 0.72–1.33]) and those without a recommendation for mental health service follow-up (aHR, 1.20 [95%CI, 0.91–1.59]) had delays to care that were comparable to non-screeners.

Additionally, the screening process also captures information on non-mental health concerns. In the absence of an identified mental health concern (i.e., among those with an eventual mental disorder diagnosis), an indication of a physical health concern (aHR, 1.13 [95%CI, 0.81–1.58]) or other, non-physical health concern (aHR, 0.76 [95%CI, 0.45–1.29]) resulted in delays to (mental health) care that were comparable to non-screeners.

Moreover, among the covariates included as potential confounders, delay to care was determined to be generally shorter for individuals who were older (45–60 years), single, whose post-deployment era was more recent (2015–2017), whose diagnosis was not PTSD alone, and whose diagnosis identified a relevant general medical condition to be present (Table 4). Individuals whose

deployment location was not Afghanistan had a marginally significant shorter delay to care ($0.05 < p \leq 0.10$).

DISCUSSION

Key findings

The primary objective of this study was to determine whether the CAFs post-deployment screening programme shortened the delay to diagnosis and care for individuals with a mental disorder that was deployment-related. We found that screening shortened this delay by almost a year relative to non-screeners. After controlling for potential confounders, screened individuals had a delay to care that was 43% shorter. Additionally, the screening findings had a substantial impact on this observed effect. The screening interviewers' identification of a 'major' mental health concern and/or their recommendation of mental health services follow-up (both proxy measures of symptom severity) were strongly associated with a shortened delay to diagnosis and care.

Comparison with other research

There has been limited research on the value of conducting routine post-deployment screening in military populations, and what has been published provides mixed results regarding a tangible benefit. Screening in the US military consists of an initial post-deployment health assessment shortly after a deployment ends and a second assessment 90–180 days after deployment return.[24] This latter assessment is similar to screening in Canada and it similarly makes use of standardized screening questionnaires and a meeting with a health care provider. There are a few studies from the US that report on care-seeking after service members screen positive for concerns.[23, 24, 40] One study, assessing service members who completed screening in 2005–2006, identified that 61% of screened individuals

who were referred for a mental health assessment were seen within 90 days (50.5% within 30 days) and, additionally, 74% of participants who accessed mental health care had not been referred,[40] possibly primed to a need for services as a result of screening even though they screened negative. Another US study assessed a large Army Reserve population that completed screening after a 2008–2011 service release.[23] The authors reported that follow-up care was more likely among members who screened positive for PTSD and depression. A third US study assessed a population that released from service after Sept 11, 2001 and sought care in 2004–2006.[24] The authors reported that while only 45% underwent screening, 61% screened positive for mental health problems but only 46% of those with a positive screen had a mental health clinic visit scheduled within 30 days of the screen. However, when the follow-up period was extended beyond 90 days this increased to 73% of positive screeners who had a mental health appointment compared with only 32% among negative or non-screeners. Taken together, these findings suggest that a positive screening in the US leads to expedited mental health care, but it is unknown whether individuals who received services following screening would have sought such care in a comparable timeframe had they not screened. Additionally, these findings suggest that some negative screeners will still seek mental health services, but it is unknown how their delay to care compares to those not screened. Moreover, none of these studies explicitly examined whether or not screening had a beneficial effect of shortening delay to diagnosis and care for those with a deployment-related mental disorder compared to an unscreened group with a comparable need.

A recently published report that assessed post-deployment screening among Royal Marines and Army personnel in the UK after their return from deployment to Afghanistan raises some doubt about the value of screening. The study used a cluster randomised controlled trial to assess post-deployment screening that offered tailored help-seeking advice relative to a 'non-screened' control group that received general mental health advice.[25] The authors reported that past-year mental health services use among participants who screened positive 6–12 weeks after deployment-return was comparable to

services use in the 'non-screened' group and generally, identified screening to be ineffective. Specifically, 33% of the 207 individuals that screened positive and 36% of the 129 individuals in the control group who would have been considered positive screens reported a past-year mental health services use during follow-up. It is difficult to extrapolate these findings to the Canadian context because of the non-comparable way screening was operationalized in the study. These differences include the screening method employed (eg, the short time-to-screening relative to deployment-return, the sole use of self-administered instruments), the sometimes short and variable follow-up period (ie, 10–24 months after screening), and the low number with an apparent need for mental health services (ie, low power to detect differences). Consequently, the UK findings do little to inform on the value of Canada's post-deployment screening programme within its system of care.

In contrast, our study is the first to demonstrate a substantial reduction in the delay to diagnosis of post-deployment mental disorders that were deployment-related through mass screening. As expected, this effect was driven by the outcome of screening. When service members had an apparent need for mental health services, a positive screening resulted in a shorter delay to care relative to non-screeners; however, individuals who screened negative did not have this benefit.

Limitations

The primary limitation of our study relates to it being a retrospective observational study and its reliance on administrative data. It is possible that, although we assessed and controlled for several potential confounders, other unmeasured characteristics that were associated with screening status may have had an influence on our findings. Additionally, we limited our investigation to individuals with a mental disorder diagnosis that was deployment-related, raising the possibility of limited generalisability to screened individuals with mental health concerns that were not related to a prior deployment. While it's possible that some individuals with non-deployment related disorders may have

had care management facilitated by screening, the study was not designed to assess this. Finally, it is possible that some deployment-related attribution errors were made; however, clinicians in the CAFs mental health system, particularly those in the Operational Trauma and Stress Support Centres, routinely evaluate for such an attribution during the diagnostic assessment and it is expected that any errors would have been randomly distributed between screened and non-screened groups.

Interpretation

The CAFs post-deployment screening programme, with its focus on facilitating early care-seeking, has been in operation since 2002 yet there has been very little data available to assess whether it has had an influence on care-seeking. In the intervening period the CAF has attempted to remove barriers to seeking mental health care by building a comprehensive outpatient mental health clinical programme and it addressed stigma through a variety of programmes such as the Road to Mental Readiness.[16] Some have questioned whether post-deployment screening has outlived its usefulness in this augmented setting—could these other efforts facilitate earlier care-seeking without screening. Indeed, we did observe that a small fraction of individuals were diagnosed either prior to the recommended screening window (6.5%) or prior to the eventual completion of their mandatory screening (3.0%). However, the collective prevalence of this early care-seeking that occurred before screening was sufficiently low in the study population that its occurrence does not negate our observed screening benefit.

We found that screening shortened the delay to a definitive mental disorder diagnosis and this is aligned with the primary objective of post-deployment screening; however, there is little evidence available that quantifies what an optimal delay threshold should be in order to improve clinical outcomes. Nonetheless, several beneficial individual and organisational outcomes have been implied or found to be associated with shorter delays to care: a greater likelihood of symptom improvement,[18]

more favourable occupational outcomes,[19] reduced health services costs,[20] and a reduced risk of individuals developing additional health problems and impairments to interpersonal and work-related functioning.[21] Such benefits are consequential and reinforce the value of screening.

Our findings also reinforce what has been proposed by others, that the net effectiveness of a screening programme is largely dependent on a series of events occurring as planned.[22] The core components of what has been proposed includes: 1) a target group that is sufficiently compliant with screening; 2) participants that are able to recognise and honestly disclose their symptoms and impairments during screening; 3) screening tools that have good sensitivity and specificity; 4) clinicians that accurately interpret the screening tools and participants' reported symptoms to make sound follow-up recommendations; and 5) participants that follow through, adhering to the recommended services. At this point we have not determined whether all of these components of the CAFs programme are performing as intended. However, it is highly likely that some of them are not. For example, compliance with the screening requirement is suboptimal. A related study found that only 67% of members returning from deployment completed a screening, and only 43% did so within the recommended post-deployment timeframe. We also observed some incongruence between the assessment results and follow-up recommendations: 36.2% of those with a 'major' mental health concern identified at screening had no mental health services follow-up recommended by clinicians who conducted the screening interview, yet this could not be explained by individuals already being in some form of mental health care at the time of screening. This warrants a closer examination of clinician decisions that are made as a result of a service member's screening interview, specifically regarding their follow-up recommendations; if screening identifies an issue but there is no follow-up recommended by the clinician then screening falls short of its intended benefit of optimally shortening the delay to care.

The implementation of any large scale health intervention will be imperfect. Consequently, our findings reflect the operationalisation of a post-deployment screening programme in real world conditions. Benefits associated with a shortened delay to care are anticipated (ie, symptom improvement, occupational retention, treatment cost-reduction, reduced risk of further impairments, and quality of life) but this is reliant on an unbroken series of screening events occurring as planned. Moreover, the full potential of such a programme can only be realised when all of its components function as intended. Further work that delves into these elements and their optimisation is warranted.

Conclusions

The CAF and other military organisations have invested in post-deployment screening programmes in an effort to reduce delays to mental health care. These reductions are anticipated to result in beneficial outcomes for both the individual and the military organisation. Our study found that screening shortened the delay to diagnosis for mental disorders that were deployment-related by almost one year. Further work to investigate optimising the screening process and its individual components is warranted.

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Contributors: DB had full access to all data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. DB is the guarantor and principal investigator of the study. DB wrote the initial draft of the manuscript and both DB and BG contributed to the interpretation of the

results as well as the writing and revising of the manuscript. DB and BG have read and agree with the manuscript's final content.

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Transparency: The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any relevant discrepancies from the study (and, if relevant, registered) have been explained.

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Table 1: Summary of Sociodemographic, Military and Clinical Characteristics by Screening Status.

	Not Screened		Screened		Overall	
	Sample n/ Weighted N	% (95% CI)	Sample n/ Weighted N	% (95% CI)	Sample n/ Weighted N	% (95% CI)
Age category[a]						
19-24	20/ 34	3.2 (2.0 to 4.3)	94/ 539	17.3 (12.0 to 22.6)	114/ 573	13.[illegible] (9.7 to 17.7)
25-34	169/ 386	36.1 (29.0 to 43.2)	287/ 1372	44.0 (38.0 to 50.0)	456/ 1758	42.[illegible] (37.2 to 46.8)
35-44	186/ 407	38.0 (30.8 to 45.2)	225/ 870	27.9 (23.6 to 32.2)	411/ 1277	30.[illegible] (26.7 to 34.3)
45-60	107/ 243	22.7 (15.6 to 29.8)	69/ 336	10.8 (7.0 to 14.6)	176/ 579	13.[illegible] (10.5 to 17.2)
Sex						
Female	49/ 85	8.0 (6.0 to 10.0)	74/ 302	9.7 (6.5 to 12.8)	123/ 388	9.[illegible] (6.9 to 11.6)
Male	433/ 985	92.0 (90.0 to 94.0)	601/ 2815	90.3 (87.2 to 93.5)	1034/ 3799	90.[illegible] (88.4 to 93.1)
First official language						
English	333/ 736	68.8 (63.1 to 74.5)	464/ 2197	70.5 (65.0 to 76.0)	797/ 2934	70.[illegible] (65.8 to 74.4)
French	149/ 334	31.2 (25.5 to 36.9)	211/ 920	29.5 (24.0 to 35.0)	360/ 1253	29.[illegible] (25.6 to 34.2)
Marital status[a]						
Married/ common law	360/ 826	77.2 (71.4 to 83.0)	449/ 1978	63.5 (57.6 to 69.4)	809/ 2805	67.[illegible] (62.3 to 71.7)
Divorces/separated/ widowed	53/ 91	8.5 (5.9 to 11.1)	77/ 260	8.3 (6.1 to 10.6)	130/ 351	8.[illegible] (6.6 to 10.2)
Single	69/ 153	14.3 (9.0 to 19.6)	149/ 879	28.2 (22.4 to 34.0)	218/ 1032	24.[illegible] 20.1 to 29.2)
Rank category[b]						
JNCM	286/ 647	60.4 (53.2 to 67.7)	456/ 2167	69.5 (64.5 to 74.6)	742/ 2814	67.[illegible] (63.0 to 71.5)
SNCM	125/ 243	22.7 (18.0 to 27.4)	159/ 667	21.4 (17.0 to 25.8)	284/ 910	21.[illegible] (18.3 to 25.2)
Officer	71/ 180	16.9 (10.1 to 23.6)	60/ 283	9.1 (5.4 to 12.8)	131/ 463	11.[illegible] (7.7 to 14.4)
Years of military service[a]						
<5 years	30/ 74	6.9 (2.1 to 11.7)	147/ 936	30.0 (24.7 to 35.3)	177/ 1010	24.[illegible] (19.9 to 28.3)
5 to 9 years	135/ 340	31.8 (24.3 to 39.3)	224/ 870	27.9 (23.2 to 32.6)	359/ 1210	28.[illegible] (24.8 to 33.0)
10 to 19 years	192/ 408	38.1 (31.3 to 44.9)	200/ 826	26.5 (21.7 to 31.3)	392/ 1234	29.[illegible] (25.6 to 33.4)
≥20 years	125/ 248	23.2 (17.4 to 29.0)	104/ 485	15.5 (11.3 to 19.8)	229/ 733	17.[illegible] (14.0 to 21.0)
Component						
Regular Force	456/ 996	93.1 (88.2 to 98.0)	639/ 2819	90.4 (86.0 to 94.9)	1095/ 3815	91.[illegible] (87.6 to 94.6)
Reserve Force	26/ 74	6.9 (2.0 to 11.8)	36/ 298	9.6 (5.1 to 14.0)	62/ 372	8.[illegible] (5.4 to 12.4)
Service[a]						
Army	328/ 801	74.9 (70.0 to 79.8)	562/ 2701	86.7 (83.5 to 89.8)	890/ 3502	83.[illegible] (81.1 to 86.2)
Air Force	91/ 155	14.5 (10.9 to 18.1)	92/ 351	11.3 (8.2 to 14.3)	183/ 506	12.[illegible] (9.7 to 14.5)
Navy	63/ 114	10.6 (7.4 to 13.9)	21/ 65	2.1 (1.3 to 2.9)	84/ 179	4.[illegible] (3.3 to 5.2)
Combat arms occupation[a]						
No	385/ 843	78.8 (72.9 to 84.6)	416/ 1921	61.6 (55.5 to 67.8)	801/ 2764	66.[illegible] (61.2 to 70.9)
Yes	97/ 227	21.2 (15.4 to 27.1)	259/ 1196	38.4 (32.2 to 44.5)	356/ 1423	34.[illegible] (29.1 to 38.8)
Deployment location[a]						
Other	74/ 188	17.5 (11.3 to 23.8)	13/ 44	1.4 (0.7 to 2.1)	87/ 232	5.[illegible] (3.7 to 7.4)
Afghanistan	408/ 882	82.5 (76.2 to 88.7)	662/ 3073	98.6 (97.9 to 99.3)	1070/ 3955	94.[illegible] (92.6 to 96.3)
Deployment length						
≤180 days	149/ 311	29.1 (22.6 to 35.5)	137/ 693	22.2 (16.8 to 27.7)	286/ 1005	24.[illegible] (19.7 to 28.3)

>180 days	333/ 759	70.9 (64.5 to 77.4)	538/ 2424	77.8 (72.3 to 83.2)	871/ 3182	76.6 (71.7 to 80.3)
A past mental health problem						
No	416/ 927	86.6 (81.6 to 91.7)	607/ 2851	91.5 (88.5 to 94.4)	1023/ 3778	90.7 (87.6 to 92.8)
Yes	66/ 143	13.4 (8.3 to 18.4)	68/ 266	8.5 (5.6 to 11.5)	134/ 409	9.3 (7.2 to 12.4)
Disorder Case-mix[a,c]						
Depressive disorder Only	24/ 40	3.8 (2.5 to 5.0)	42/ 227	7.3 (3.9 to 10.6)	66/ 267	6.2 (3.8 to 8.9)
'Other' mix-no PTSD	50/ 146	13.7 (7.0 to 20.3)	68/ 341	10.9 (6.8 to 15.1)	118/ 487	11.6 (8.1 to 15.2)
PTSD Only	75/ 214	20.0 (13.0 to 27.0)	113/ 624	20.0 (15.1 to 24.9)	188/ 838	20.6 (15.9 to 24.1)
PTSD and depressive disorder only	121/ 251	23.4 (17.2 to 29.6)	120/ 417	13.4 (10.5 to 16.3)	241/ 668	16.6 (13.2 to 18.7)
PTSD and 'other' mix	162/ 328	30.7 (24.5 to 36.8)	257/ 1083	34.8 (29.1 to 40.5)	419/ 1411	33.2 (29.2 to 38.2)
Single 'other'	50/ 91	8.5 (5.8 to 11.2)	75/ 425	13.6 (9.0 to 18.3)	125/ 515	12.4 (8.7 to 15.9)
Any PTSD						
No	124/ 277	25.9 (19.1 to 32.7)	185/ 993	31.8 (26.0 to 37.7)	309/ 1270	30.8 (25.7 to 35.0)
Yes	358/ 793	74.1 (67.3 to 80.9)	490/ 2124	68.2 (62.3 to 74.0)	848/ 2917	69.2 (65.0 to 74.3)
DSM IV or V						
IV	334/ 625	58.4 (50.9 to 66.0)	439/ 1759	56.4 (51.1 to 61.8)	773/ 2385	57.2 (52.7 to 61.2)
V	10/ 15	1.4 (0.8 to 2.1)	22/ 118	3.8 (1.1 to 6.5)	32/ 133	3.2 (1.2 to 5.2)
Not specified	138/ 429	40.1 (32.5 to 47.7)	214/ 1240	39.8 (34.1 to 45.4)	352/ 1669	39.5 (35.4 to 44.3)
Relevant general medical condition indicated						
No	255/ 671	62.7 (56.7 to 68.7)	381/ 2003	64.2 (59.2 to 69.3)	636/ 2673	63.7 (59.9 to 67.8)
Yes	227/ 399	37.3 (31.3 to 43.3)	294/ 1114	35.8 (30.7 to 40.8)	521/ 1514	36.3 (32.2 to 40.1)
Post-deployment screening status						
Not screened					482/ 1070	25.1 (22.2 to 28.9)
Screened					675 /3117	74.9 (71.1 to 77.8)

[a]Significant at P≤0.05

[b]Significant at 0.05<P≤0.10

[c]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

Table 2: Median delay to care for assessed sociodemographic, military and clinical characteristics and their unadjusted association with delay to care.

	Sample n/ weighted N	Median delay (days) to care (inter-quartile range)	Wald chi-square P-value	Unadjusted HR (95% CI)	HR p-value
Age category[b]					
19-24	114/ 573	642 (401 to 1397)	0.0741	0.82 (0.56 to 1.19)	0.2901
25-34	456/ 1758	783 (381 to 1490)		0.66 (0.47 to 0.92)	0.0150
35-44	411/ 1277	815 (333 to 1654)		0.70 (0.50 to 0.99)	0.0429
45-60	176/ 579	709 (261 to 959)		Reference	
Sex[a]					
Female	123/ 388	437 (190 to 1027)	0.0118	1.41 (1.08 to 1.85)	0.0118
Male	1034/ 3799	829 (369 to 1521)		Reference	
First official language					
English	797/ 2934	739 (328 to 1475)	0.539	Reference	
French	360/ 1253	852 (406 to 1511)		0.93 (0.75 to 1.17)	0.539
Marital status					
Married/ common law	809/ 2805	908 (342 to 1624)	0.1103	Reference	
Divorces/separated/ widowed	130/ 351	642 (302 to 1268)		1.24 (0.90 to 1.70)	0.1995
Single	218/ 1032	636 (376 to 1220)		1.32 (1.00 to 1.74)	0.0518
Rank category					
JNCM	742/ 2814	773 (379 to 1497)	0.8911	Reference	
SNCM	284/ 910	830 (340 to 1427)		1.07 (0.79 to 1.45)	0.658
Officer	131/ 463	630 (224 to 1269)		1.06 (0.68 to 1.64)	0.7995
Years of military service					
<5 years	177/ 1010	849 (406 to 1425)	0.4003	0.81 (0.56 to 1.16)	0.2463
5 to 9 years	359/ 1210	754 (384 to 1568)		0.76 (0.54 to 1.07)	0.1216
10 to 19 years	392/ 1234	843 (326 to 1554)		0.76 (0.53 to 1.09)	0.1348
≥20 years	229/ 733	540 (262 to 1248)		Reference	
Component					
Regular Force	1095/ 3815	816 (368 to 1497)	0.6939	Reference	0.6939
Reserve Force	62/ 372	406 (190 to 891)		1.16 (0.55 to 2.45)	
Service					
Army	890/ 3502	782 (362 to 1476)	0.9669	Reference	
Air Force	183/ 506	727 (349 to 1521)		1.01 (0.77 to 1.31)	0.9599
Navy	84/ 179	489 (203 to 1074)		1.09 (0.56 to 2.11)	0.7957
Combat arms occupation					
No	801/ 2764	743 (320 to 1459)	0.7807	Reference	
Yes	356/ 1423	805 (404 to 1546)		0.96 (0.75 to 1.25)	0.7807
Deployment location[a]					
Other	87/ 232	719 (341 to 1160)	0.0497	Reference	
Afghanistan	1070/ 3955	769 (345 to 1476)		0.80 (0.64 to 1.00)	0.0497
Deployment length					
≤180 days	286/ 1005	847 (442 to 1476)	0.4996	Reference	

>180 days	871/ 3182	741 (329 to 1447)		0.92 (0.73 to 1.16)	0.4996
Post-deployment era[a,c]					
2009-2011			0.0002	Reference	
2012-2014				0.87 (0.67 to 1.14)	0.3131
2015-2017				1.65 (1.08 to 2.53)	0.0211
A past mental health problem					
No	1023/ 3778	796 (368 to 1476)	0.1329	Reference	
Yes	134/ 409	589 (202 to 1347)		1.30 (0.92 to 1.84)	0.1329
Disorder Case-mix[a,e]					
Depressive disorder only	66/ 267	669 (276 to 1182)	0.0016	1.66 (1.10 to 2.52)	0.0172
'Other' mix-no PTSD	118/ 487	635 (352 to 1181)		1.47 (0.83 to 2.59)	0.1898
PTSD only	188/ 838	1127 (603 to 2018)		Reference	
PTSD and depressive disorder	241/ 668	825 (312 to 1289)		1.62 (1.29 to 2.02)	<.0001
PTSD and 'other' mix	419/ 1411	652 (341 to 1392)		1.45 (1.09 to 1.92)	0.0099
Single 'other'	125/ 515	563 (317 to 1219)		1.29 (0.82 to 2.03)	0.2761
Any PTSD					
No	309/ 1270	636 (327 to 1188)	0.5961	Reference	
Yes	848/ 2917	860 (370 to 1536)		0.92 (0.68 to 1.24)	0.5961
Relevant general medical condition indicated[a]					
No	636/ 2673	959 (449 to 1829)	<.0001	Reference	
Yes	521/ 1514	456 (260 to 947)		2.44 (2.03 to 2.95)	<.0001
Post-deployment screening status[a,c]					
Not screened	482/ 1070	928[d] (465 to 1547)	0.0345	Reference	
Screened	675 /3117	578[d] (209 to 1300)		1.33 (1.02 to 1.73)	0.0345

[a]Significant at P≤0.05

[b]Significant at 0.05<P≤0.10

[c]Handled as a time-dependent covariate.

[d]The median delay to care for post-deployment screening was taken from the Kaplan-Meier event probabilities that were generated taking into account this covariate's time-dependent nature.

[e]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

Table 3: Post-deployment screening summary findings and latency from deployment return to screening relative and screening to mental disorder diagnosis for screened individuals in the study population.

				Deployment return to screening (days)		Screening to diagnosis (days)	
	Sample n/ Weighted N	%	95% CI	Median	Inter-quartile range	Median	Inter-quartile range
Post-deployment screening status							
Not screened	482/ 1070	25.6	22.2 to 28.9	-	-	-	-
Screened	675/ 3117	74.4	71.1 to 77.8	151	121 to 187	603	193 to 1302
Overall	1157/ 4187	100		-	-	-	-
Mental health concern indicated							
'Major' concern	198/ 788	25.3	20.4 to 30.1	146	116 to 180	148	54 to 356
'Minor' only	220/ 1026	32.9	27.1 to 38.7	160	127 to 200	515	177 to 1288
None	257/ 1304	41.8	35.7 to 47.9	148	119 to 170	1097	581 to 1792
Mental health or other concern							
'Major' concern	293/ 1214	38.9	33.3 to 44.5	156	123 to 193	212	65 to 643
'Minor' only	221/ 1004	32.2	26.5 to 37.9	144	122 to 199	768	298 to 1413
None	161/ 899	28.9	22.8 to 34.9	150	119 to 166	1045	611 to 1612
Concern type indicated							
'Major' mental health concern	198/ 788	25.3	20.4 to 30.1	146	116 to 180	148	54 to 356
'Minor' mental health concern only	220/ 1026	32.9	27.1 to 38.7	160	127 to 200	515	177 to 1288
Physical health concern (no mental health)	71/ 297	9.5	6.2 to 12.9	132	126 to 195	1094	484 to 1417
'Other' concern (no mental or physical)	25/ 108	3.4	1.3 to 5.6	128	96 to 169	1623	869 to 1958
None	161/ 899	28.9	22.8 to 34.9	150	119 to 166	1045	611 to 1612
Any follow-up indicated							
Yes	392/ 1689	54.2	48.2 to 60.1	154	125 to 193	285	96 to 811
No	283/ 1428	45.8	39.9 to 51.8	149	118 to 174	1046	548 to 1567
Any mental health follow-up indicated							
Yes	222/ 940	30.2	24.8 to 35.5	155	121 to 193	230	71 to 618
No	453/ 2177	69.8	64.5 to 75.2	149	121 to 180	826	343 to 1524

Table 4: Proportional hazards modelling results for the assessment of the influence of post-deployment screening status and specific screening findings on delay to care.

	Adjusted HR[a]	95% CI	p-value
Age category			
19-24	0.81	(0.56 to 1.16)	0.2462
25-34	0.68	(0.52 to 0.88)	0.0043
35-44	0.76	(0.59 to 0.97)	0.0261
45-60	Reference		
Sex			
Female	1.25	(0.95 to 1.64)	0.1114
Male	Reference		
Marital status			
Married/ common law	Reference		
Divorces/separated/ widowed	1.24	(0.95 to 1.63)	0.1206
Single	1.32	(1.02 to 1.71)	0.0375
Deployment location			
Other	Reference		
Afghanistan	0.78	(0.59 to 1.03)	0.0782
Post-deployment era[b]			
2009 – 2011	Reference		
2012 – 2014	0.96	(0.74 to 1.24)	0.7623
2015 – 2017	2.00	(1.31 to 3.06)	0.0013
A past mental health problem			
No	Reference	(0.86 to 1.57)	0.3318
Yes	1.16		
Disorder case-mix[c]			
Depressive disorder only	1.47	(0.96 to 2.26)	0.0761
'Other' mix-no PTSD	1.50	(0.95 to 2.37)	0.0802
PTSD only	Reference		
PTSD and depressive disorder	1.49	(1.17 to 1.90)	0.0011
PTSD and 'other' mix	1.37	(1.06 to 1.78)	0.0166
Single 'other'	1.40	(0.92 to 2.15)	0.1178
Relevant general medical condition indicated			
No	Reference		
Yes	2.36	(1.94 to 2.87)	<.0001
Post-deployment screening status[b]			
Not screened	Reference		
Screened	1.43	(1.11 to 1.86)	0.0067
Screening findings			
Mental health concern indicated[b]			
'Major' concern	3.36	(2.38 to 4.73)	<.0001
'Minor' concern only	1.46	(1.08 to 1.99)	0.0152
None	0.98	(0.72 to 1.33)	0.8975
Not screened	Reference		

Mental health or other concern[b]			
'Major' concern	2.33	(1.73 to 3.13)	<.0001
'Minor' only	1.30	(0.97 to 1.74)	0.0750
None	1.01	(0.72 to 1.41)	0.9746
Not screened	Reference		
Concern type indicated[b]			
'Major' mental health concern	3.37	(2.39 to 4.75)	<.0001
'Minor' mental health concern only	1.47	(1.08 to 2.00)	0.0136
Physical health concern (no mental health)	1.13	(0.81 to 1.58)	0.4719
'Other' concern (no mental or physical health)	0.76	(0.45 to 1.29)	0.3049
None	0.97	(0.69 to 1.38)	0.8771
Not screened	Reference		
Any follow-up indicated[b]			
Yes	2.05	(1.55 to 2.71)	<.0001
No	1.04	(0.78 to 1.40)	0.7889
Not screened	Reference		
Any mental health follow-up indicated[b]			
Yes	2.35	(1.73 to 3.21)	<.0001
No	1.20	(0.91 to 1.59)	0.1912
Not screened	Reference		

[a]Adjusted for: age category, sex, marital status, deployment location, post-deployment era, a past mental health problem, disorder case-mix and relevant general medical condition. Covariates dropped from consideration: first official language, rank category, years of military service, component, service, combat arms occupation and deployment length.

[b]Handled as a time-dependent covariate.

[c]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

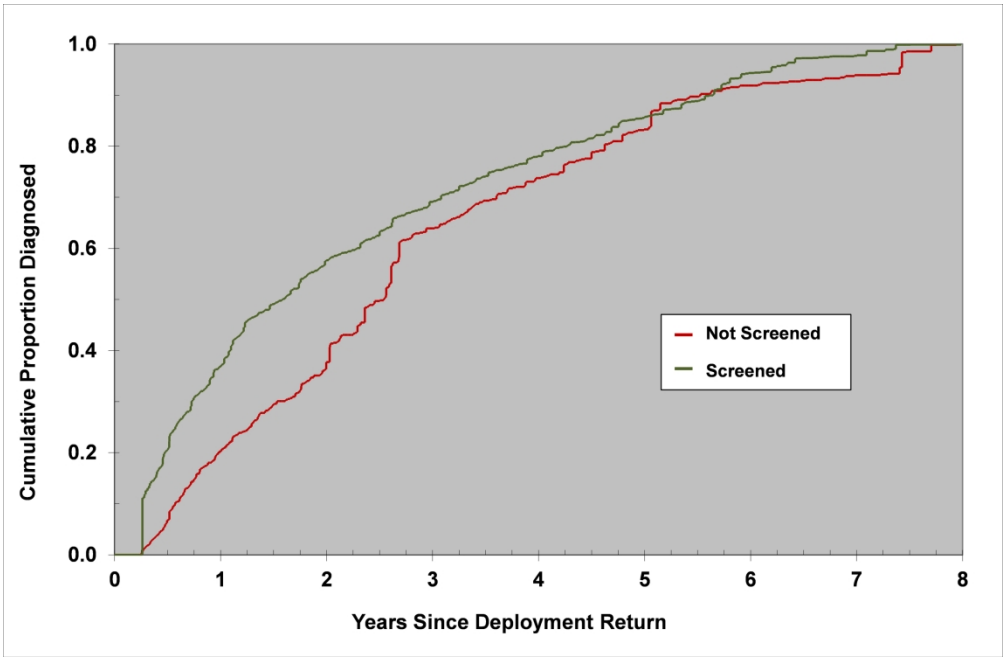

Figure 1: Cumulative proportion of mental disorder diagnoses that were identified among service members with a mental disorder that was deemed deployment service-related as time since deployment return increased; plotted by post-deployment screening status.

236x154mm (300 x 300 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6-7
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-10
Bias	9	Describe any efforts to address potential sources of bias	10-12
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-12
		(*b*) Describe any methods used to examine subgroups and interactions	11-12
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	6-7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12-13; and Table 1
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) Summarise follow-up time (eg, average and total amount)	13; Table 2
Outcome data	15*	Report numbers of outcome events or summary measures over time	13; Table 2
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and	13, 15-

		their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	16; Table 4 Table 4 14-16
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18-19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-19 and 21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.

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Does Screening Shorten Delays to Care for Post-Deployment Mental Disorders in Military Personnel?: A Longitudinal Retrospective Cohort Study.

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Does Screening Shorten Delays to Care for Post-Deployment Mental Disorders in Military Personnel?: A Longitudinal Retrospective Cohort Study.

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Abstract

Objective: To determine whether post-deployment screening is associated with a shorter delay to diagnosis and care among individuals identified with a deployment-related mental disorder.

Design: Retrospective cohort study.

Setting: Canadian military population.

Participants: The cohort consisted of personnel (n=28,460) with a deployment within the 2009 to 2014 timeframe. A stratified random sample (n=3004) was selected for medical chart review. We restricted our analysis to individuals who had an opportunity to undergo screening and were subsequently diagnosed with a mental disorder that a clinician indicated was deployment-related (n=1157).

Interventions: Post-deployment health screening.

Main Outcome Measure: The outcome was delay to diagnosis and care, the latency from individuals' deployment return to their mental disorder diagnosis date. Cox proportional hazards regression assessed screening's influence on this outcome.

Results: 74.4 % of the study population had screened. Overall, the median delay to care was 766 days, 578 days among screeners and 928 days among non-screeners—a 350 day difference. Cox regression indicated that screeners had a significantly shorter delay to care (adjusted HR (aHR), 1.43 [95%CI, 1.11 to 1.86]). Screening findings had a substantial influence on delay to care. Identification of a mental health concern, whether a 'major' concern (aHR, 3.36 [95%CI, 2.38 to 4.73]) or a 'minor' concern (aHR, 1.46 [95%CI, 1.08 to 1.99]), and a recommendation for mental health services follow-up (aHR, 2.35 [95%CI, 1.73–3.21]) were strongly associated with shorter delays to care relative to non-screeners.

Conclusions: Reduced delays to care are anticipated to lead to beneficial outcomes for both the individual and military organisation. We found that screening was associated with a shortened delay to care for mental disorders that were deployment-related. Future work will further explore this screening's components and optimisation strategies.

Strengths and limitations of this study

- The study used a clearly defined population with clear definitions for the temporally related exposure, a post-deployment mental health screening, and the outcome, latency/ delay to a mental disorder diagnosis that was determined to be deployment service-related.
- The delay to care outcome was a proxy for other outcomes, where shorter delays equated to better proxy outcomes (ie, symptom improvement, occupational retention, treatment cost-reduction, reduced risk of further impairments, and quality of life).
- Several potential confounding variables were considered for their influence on the outcome in the proportional hazards regression.
- The primary study limitation relates to it being retrospective and as such, it is reliant on the information that was available.
- The investigation was restricted to individuals with a mental disorder diagnosis that was deployment-related, raising the possibility of limited generalisability.

INTRODUCTION

Military personnel encounter unique experiences during their service and some experiences, particularly those encountered on deployment, can increase individuals' vulnerability to developing mental health problems.[1-5] While effective mental health care is available, many service members with a mental health problem do not seek out needed services and only a small proportion do so in a timely manner.[6, 7] Barriers to treatment seeking have been extensively studied among military personnel in Canada and other countries.[7-9] For instance, a failure to perceive a need for care, stigma, negative beliefs about mental disorders and associated treatments, concern over potential negative career consequences, and systemic issues such as lengthy wait times and poor accessibility have been reported.[10, 11] Prior research among Canadian Armed Forces (CAF) personnel had identified a failure to perceive a need for care as their most prevalent barrier, reported by 84% to 97% of personnel depending on the care considered.[12] In addition to barriers, a number of mental health care-seeking facilitators have also been identified, features that have a positive influence on barriers to care, such as the presence of a supportive organisational climate, social support, and educational programmes that promote mental illness awareness and treatment seeking.[11]

A number of countries have reinforced their military mental health systems in an effort to address these barriers and assist their personnel.[13-15] For example, the CAF expanded its outpatient mental health system in an effort to reduce physical barriers to care[15] and it introduced a resilience and mental health training programme to promote recognition of mental health services need, treatment seeking, and stigma reduction.[16] The CAF, and other countries such as the US and Australia, has also introduced post-deployment health screening as a response to the growing awareness of the relatively high prevalence of post-deployment mental health concerns.[7, 17] This screening was initiated to reduce barriers and facilitate earlier care-seeking.[16] Additionally, screening in Canada has been designed to

provide feedback, guidance, education and advice on the post-deployment reintegration process, and to reduce stigma surrounding mental illness. Overall, screening aims to shorten delays to care in those with a need, a result that has been linked with a number of beneficial individual and organisational outcomes.[18-21]

Accordingly, screening offers a theoretical value to service members but the available research on its putative value is somewhat inconclusive. Observational studies suggest a triage and care provision benefit from screening, as researchers have generally noted that a significant proportion of those who screen positive for mental health problems do initiate follow-up mental health services,[22-24] but it is unknown whether those screening positive would have received equivalent and timely mental health care had they not screened. We identified a single randomised controlled study that compared a screening regimen relative to a 'non-screened' control. The authors reported that past-year mental health services use among participants who screened positive 6 to 12 weeks after deployment-return was comparable to those in the 'non-screened' group who would have been positive screeners and generally, identified screening to be ineffective.[25] However, the method by which screening was implemented was substantially different from the approach used in Canada and elsewhere, limiting its generalisability.

The present study was designed to examine the effectiveness of the CAF approach to post-deployment screening within the context of the Canadian military mental health system. The primary objective is to determine whether screening is associated with a shorter delay to diagnosis and subsequent care among individuals who had been diagnosed with a mental disorder that was determined to be deployment service-related.

METHODS

Post-deployment screening in the Canadian Armed Forces

The CAF introduced post-deployment health screening in 2002 and currently service members who deploy for 60 days or longer on operations to most international locations are to complete screening 90–180 days following their deployment return. The screening process makes use of a questionnaire that assesses for health concerns using standardized instruments.[26-30] Completed questionnaires are reviewed by a mental health professional who, following the conduct of a semi-structured interview, makes recommendations for follow-up care. Further details on the screening process can be found elsewhere.[31]

Study population and Sampling

This study used a retrospective cohort study design. The cohort consisted of all CAF personnel (n=28,460) who had a deployment within the 01-January-2009 to 31-December-2014 timeframe. A stratified random sample consisting of 3004 individuals was selected for medical chart review. The study was powered to discern a delay to care difference of at least 50 days between screened and non-screened individuals with 85% power when employing a log-rank test. Sample size per stratum was determined using a Neymann optimal allocation approach.[32] Further details on the sampling process can be found elsewhere.[31]

The analysis in this paper was restricted to the sampled individuals who had the opportunity to undergo screening and were subsequently diagnosed with a mental disorder that a clinician indicated was deployment service-related (n=1157). While medical records were reviewed for 2997 individuals in the sample (i.e., 7 from the sample were inaccessible), 2598 had a deployment that required screening and, of these, 1240 individuals had a mental disorder that was deployment-related (18.2%; 95%CI: 16.6-

19.8). An additional 83 individuals were excluded because they had minimal opportunity to undergo screening; that is, their diagnosis occurred during deployment (unweighted n=6, weighted %=0.2) or <90 days after return (unweighted n=77, weighted %= 6.3) which is before the 90–180 day post-deployment screening period. These individuals are not the target of post-deployment screening even though some did screen (i.e., 58 after diagnosis and 3 before). More specifically, service members with persistent mental health concerns following their deployment are instructed to seek services and not wait to be screened; screening was designed to facilitate care-seeking in those with a need for care but who are hesitant or perceive a barrier to care-seeking. Nevertheless, the current screening policy mandates the screening of all eligible service members as part of its surveillance objective, even if they had already sought care.

Data collection

Deployment details came from deployment tasking (extract date: 30-Mar-2016), deployment-related pay (extract date: 30-Mar-2016), and human resources (extract date: 01-Aug-2017) administrative databases. Mental disorder diagnoses, diagnosis date, mental disorder history, and clinician-identified attributions to service (ie, see outcome measure) were abstracted from medical records over the period of 06-Feb-2017 to 01-May-2018. Screening data were obtained from the medical record review and this was supplemented with electronic data from the screening programme (extract date: 01-Aug-2012). Additional data on sociodemographic and military characteristics were obtained from human resources administrative data (extract date: 01-Aug-2017).

Outcome measure

The outcome was delay to care for individuals diagnosed with a mental disorder that was determined by a clinician to be deployment service-related, hereafter referred to as deployment-related mental disorder. This delay to care was defined as the latency from individuals' most recent deployment return date to their mental disorder diagnosis date. In some instances individuals received more than one mental health diagnostic assessment. For these individuals the date of diagnosis was taken from the first assessment but other details were taken from the more recent assessment. The deployment return date was a proxy for symptom onset and services need in those with a subsequent mental disorder that was determined to be deployment-related. While it is possible that an unknown number of our study participants could have had undiagnosed or subclinical mental health problems prior to deployment, this number is expected to be small. Additionally, military personnel in the CAF undergo a health and occupational screening prior to their official deployment approval which has the potential to identify pre-deployment mental health concerns.

We chose delay to care for a mental disorder diagnosis over other mental health indicators of need and delayed services use because it is incontrovertible that such disorders require professional help. While some individuals may have received some form of care prior to their mental disorder diagnosis, definitive treatment of the disorder can't be provided until a diagnosis is confirmed.

Deployment-related attribution: Almost all participants received a mental disorder diagnosis at one the CAFs Operational Trauma and Stress Support Centres. The mental health diagnostic assessments at these centres are highly structured. Clinicians conducting these assessments collect a personal history that includes military and deployment experiences and ultimately, when a diagnosis is made an attribution is also typically indicated. This attribution was used to determine whether or not a diagnosed mental disorder was deployment-related in those with such an assessment. Similarly, in the few situations in which individuals only had mental health diagnostic assessments that occurred outside

of these centres, a deployment-related attribution was assigned to a diagnosis only when this was indicated in the medical record.

Screening covariates of interest

Screening status: The primary covariate of interest was completion of a required screening. A completed screening occurred only when service members completed both the questionnaire and subsequent interview with a mental health professional, as determined by documentation in the medical record. The interview date determined the date of screening completion. Non-screeners were determined by the absence of screening documentation. Additionally, 44 individuals (3.0%) who screened after they were diagnosed were assigned a non-screening status and handled the same as other non-screening individuals.

Screening findings: Screened individuals were further categorized based on the interviewer's impressions recorded in the medical record:

1) Type of concern indicated, categorized as 'major' or 'minor' mental health concerns, physical health concerns (but no mental health concerns), 'other' concerns (but no mental or physical health concerns), or none;
2) Mental health concern indicated, categorized as 'major' concerns, 'minor' concerns only, or none;
3) Any follow-up care recommended (i.e., general practitioner, mental health, psychosocial, or 'other'), categorized as present/absent; and
4) Mental health follow-up care recommended, categorized as present/absent.

Mental health concerns included PTSD symptoms, depressive symptoms, anxiety symptoms, or substance use. Physical health concerns included post-concussive symptoms or other physical health issues. 'Other' concerns included family/ marital problems, workplace conflict, or 'other' concerns.

Potentially confounding covariates

Based on previous research,[6, 33-37] the potential confounders that we identified for this study included: mental disorder diagnosis-related variables; sex; age (19 to 24, 25 to 34, 35 to 44 or 45 to 60 years); service (Army, Navy, or Air Force); component (Regular or Reserve Force); rank category (Junior Non-commissioned Member [JNCM], Senior NCM [SNCM], or Officer); combat arms military trade/occupation; years of service (≤ 4, 5 to 9, 10 to 19, or ≥ 20 years); marital status (married/ common law, divorced/separated/widowed, or single - never married); and first official language (English or French). Deployment-related information was also assessed and these covariates included deployment location (Afghanistan or 'other'), post-deployment era (2009-2011, 2012-2014 or 2015-2017), and deployment length (≤180days, >180days). Variable categorizations were based on the data's distribution and previous work with this population.

The mental disorder diagnosis-related covariates included indications in the medical record of a past mental disorder diagnosis, specifics on the recent post-deployment mental disorder diagnosis, and the presence of a general medical condition that was deemed relevant to the recent mental disorder. Among the 1157 individuals with a mental disorder diagnosis that was deployment-related, DSM-IV was predominantly specified as the classification used (n = 773) but DSM-V was used for some (n = 32) and for others, it was unspecified (n = 352).

Both the past mental disorder and relevant general medical condition covariates were captured as 'present' or 'none indicated'. The recent post-deployment mental disorder diagnoses were categorized into 6 groups: 3 single diagnosis categories of PTSD, depressive disorder (i.e., major depression or dysthymic disorder), or single 'other' disorder, and 3 comorbid categories of PTSD and depressive disorder only, all other comorbid combinations with PTSD, and any other non-PTSD comorbid combination, which could include depressive disorders. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders, and substance-induced disorders.

Statistical analysis

The data were analyzed using SAS for Windows, version 9.4 (SAS Institute Inc., North Carolina). We applied the sample design weights to determine descriptive and regression statistics and Taylor Series Linearization[37] was used to generate the associated standard error estimates and 95% confidence intervals (CIs). There were no missing values among the assessed covariates.

We used time-to-event analysis methods. Zero-time was defined as the most recent deployment return date prior to diagnosis; the median deployment return date was 21-November-2010, ranging from 16-January-2009 to 17-July-2015. Event-time was the diagnosis date of individuals' deployment -related mental disorder; the median diagnosis date was 01-May-2013, ranging from 23-June-2009 to 15-December-2017. Among those who completed screening before diagnosis, the median diagnosis date was 26-April-2013, ranging from 31-August-2009 to 15-December-2017 and among non-screeners the median diagnosis date was 17-June-2013, ranging from 23-June-2009 to 03-October-2017. No individuals were censored.

The covariates for post-deployment era, screening status, and screening findings were handled as time-dependent. Diagnosis-related covariates were captured at individuals' date of diagnosis. The

remaining covariates were assessed relative to deployment return date; however, marital status was assessed on the human resources administrative data extract date, the only option.

Extended Kaplan-Meier methods[38] generated event probabilities for screening status as a time-dependent covariate. Cox regression assessed delay to care differences for covariates and results were expressed as hazard ratios (HRs) and their 95% CIs. Initially, Cox regressions assessed the unadjusted relationship between each potential confounder and delay to care; covariates with a Wald test p-value <0.25 were retained. The primary screening-associated covariates of interest were individually forced into a regression model that included these retained potential confounders. Regression diagnostic plots were reviewed with respect to the proportional hazards assumption.[39]

Patient and public involvement

CAF service members, patients and/ or the public were not involved in developing the research question, the study design or in the conduct of the study. The findings from this study and the larger research project will be shared with CAF service members and other interested stakeholders through targeted conference venues, CAF community newsletters or communiques and other venues.

RESULTS

Study population characteristics

Table 1 summarizes, overall and by screening status, the sociodemographic, military, and clinical characteristics among the study population. Overall, the diagnoses were predominantly PTSD (ie, 69.7%), either alone or comorbid, 36.2% had a general medical condition that was deemed relevant to their mental disorder, and 9.8% had a past mental health problem. Individuals were predominantly

English speaking, married, male, Regular Force members, in the Junior NCM rank category, and in Army service. At deployment return, the mean age of individuals was 34 years, just over half had less than 10 years of military service, and the majority were in non-combat arms occupations.

74.4 % (95%CI: 71.1–77.8) of the study population had screened (Table 1). Additionally, the distribution of the covariates for age, marital status, years of military service, service type, combat arms occupation, deployment location, and mental disorder case-mix differed by screening status.

Delay to care

Individuals who returned from deployment and had a subsequent mental disorder diagnosis that was deployment-related comprised the study population and their diagnosis date was the end-point for our delay to care calculation. The median delay to care for each of our covariates and their unadjusted hazard ratios (HR's) are summarized in Table 2. In our analysis HR's are analogous to relative care-seeking rates and a HR above 1.0 implies a shorter delay to care.

The unadjusted HR's suggest that a shorter delay to care was associated with females, non-Afghanistan deployments, the 2015–2017 post-deployment period, certain diagnoses, presence of a relevant general medical conditions, and screeners (Table 2). Additionally, the unadjusted HR's suggest that the delay was generally shorter for older (ie, 45–60) individuals and those who were single; however, the Wald chi-square test p-values for the age and marital status covariates were greater than 0.05 (ie, 0.074 and 0.110, respectively). The covariates for first official language, rank, years of military service, component, service, combat arms occupation, and deployment length were dropped from the final assessment model because they had Wald chi-square test p-values ≥0.25.

Post-deployment screening

Extended Kaplan-Meier curves were generated to characterize delay to care by screening status (Figure 1); these curves incorporate this covariate's time-varying nature.[38] Noting that all individuals had a mental disorder diagnosis, this figure quantifies the cumulative proportion of diagnoses that were identified as time increases. The slopes of these curves equate to the rate at which care-seeking occurs and early curve separation was observed. Early on, diagnoses, or care-seeking, occurred at a much faster rate among screeners and this faster rate, as exemplified by this curve's steeper slope, continued until approximately 2 years post-deployment. In comparison, the cumulative fraction diagnosed among non-screeners only became comparable to that of screeners at approximately 3 to 5 years post-deployment. Moreover, while the median delay to care was 766 days overall, these curves reveal a median delay of 578 days among screeners and 928 days among non-screeners (Figure 1), a 350 day difference.

Looking a little more closely at the temporal sequence of events from individuals' deployment return to screening and from screening to subsequent mental disorder diagnosis provides some insight into screening's influence on delay to care (Table 3). The median latency from deployment return to screening was 151 days overall and this median varied very little with screening findings. In contrast, and as expected, the median latency from screening to diagnosis was shorter when a 'major' concern was identified and when follow-up care was recommended, particularly when these were for mental health problems; however, the median latency from screening to diagnosis was much longer (i.e., approximately 1000 days) when these findings were absent.

Moreover, we noted a few inconsistent observations among the screening findings. Of those that were eventually diagnosed with a deployment-related mental disorder (and had been screened post-deployment) 41.8% had no mental health concerns identified at screening and 69.8% had no recommendation for mental health services follow-up. Additionally, 36.2% of those with an identified 'major' mental health concern at screening did not have a mental health services follow-up

recommendation and this was not influenced by indications that individuals were already in some form of care for their concern.

Cox proportional hazards regression results

The final multivariable model that assessed the screening covariates (Table 4) indicated that delay to care was significantly shorter for screeners (adjusted HR (aHR), 1.43 [95%CI, 1.11–1.86]). More specifically, certain screening findings were associated with a shorter delay to care relative to non-screeners. Identification of a mental health concern, whether a 'major' concern (aHR, 3.36 [95%CI, 2.38–4.73]) or a 'minor' concern (aHR, 1.46 [95%CI, 1.08–1.99]), resulted in a shorter delay to care, but more pronounced with 'major' concern identification. Similarly, delay to care was shorter for individuals with a recommendation for mental health service follow-up (aHR, 2.35 [95%CI, 1.73–3.21]). In contrast, screened individuals with no identified mental health concern during screening (aHR, 0.98 [95%CI, 0.72–1.33]) and those without a recommendation for mental health service follow-up (aHR, 1.20 [95%CI, 0.91–1.59]) had delays to care that were comparable to non-screeners.

Additionally, the screening process also captures information on non-mental health concerns. In the absence of an identified mental health concern (i.e., among those with an eventual mental disorder diagnosis), an indication of a physical health concern (aHR, 1.13 [95%CI, 0.81–1.58]) or other, non-physical health concern (aHR, 0.76 [95%CI, 0.45–1.29]) resulted in delays to (mental health) care that were comparable to non-screeners.

Moreover, among the covariates included as potential confounders, delay to care was determined to be generally shorter for individuals who were older (45–60 years), single, whose post-deployment era was more recent (2015–2017), whose diagnosis was not PTSD alone, and whose diagnosis identified a relevant general medical condition to be present (Table 4). Individuals whose

deployment location was not Afghanistan had a marginally significant shorter delay to care ($0.05 < p \leq 0.10$).

DISCUSSION

Key findings

The primary objective of this study was to determine whether the CAFs post-deployment screening programme was associated with a shortened delay to diagnosis and care for individuals with a mental disorder that was deployment-related. We found that this delay was shorter by almost a year among screeners relative to non-screeners. After controlling for potential confounders, screened individuals had a delay to care that was 43% shorter. Additionally, the screening findings had a substantial influence on this observed effect. The screening interviewers' identification of a 'major' mental health concern and/or their recommendation of mental health services follow-up (both proxy measures of symptom severity) were strongly associated with a shortened delay to diagnosis and care.

Comparison with other research

There has been limited research on the value of conducting routine post-deployment screening in military populations, and what has been published provides mixed results regarding a tangible benefit. Screening in the US military consists of an initial post-deployment health assessment shortly after a deployment ends and a second assessment 90–180 days after deployment return.[24] This latter assessment is similar to screening in Canada and it similarly makes use of standardized screening questionnaires and a meeting with a health care provider. There are a few studies from the US that report on care-seeking after service members screen positive for concerns.[23, 24, 40] One study, assessing service members who completed screening in 2005–2006, identified that 61% of screened individuals

who were referred for a mental health assessment were seen within 90 days (50.5% within 30 days) and, additionally, 74% of participants who accessed mental health care had not been referred,[40] possibly primed to a need for services as a result of screening even though they screened negative. Another US study assessed a large Army Reserve population that completed screening after a 2008–2011 service release.[23] The authors reported that follow-up care was more likely among members who screened positive for PTSD and depression. A third US study assessed a population that released from service after Sept 11, 2001 and sought care in 2004–2006.[24] The authors reported that while only 45% underwent screening, 61% screened positive for mental health problems but only 46% of those with a positive screen had a mental health clinic visit scheduled within 30 days of the screen. However, when the follow-up period was extended beyond 90 days this increased to 73% of positive screeners who had a mental health appointment compared with only 32% among negative or non-screeners. Taken together, these findings suggest that a positive screening in the US leads to expedited mental health care, but it is unknown whether individuals who received services following screening would have sought such care in a comparable timeframe had they not screened. Additionally, these findings suggest that some negative screeners will still seek mental health services, but it is unknown how their delay to care compares to those not screened. Moreover, none of these studies explicitly examined whether or not screening had a beneficial effect of shortening delay to diagnosis and care for those with a deployment-related mental disorder compared to an unscreened group with a comparable need.

A recently published report that assessed post-deployment screening among Royal Marines and Army personnel in the UK after their return from deployment to Afghanistan raises some doubt about the value of screening. The study used a cluster randomised controlled trial to assess post-deployment screening that offered tailored help-seeking advice relative to a 'non-screened' control group that received general mental health advice.[25] The authors reported that past-year mental health services use among participants who screened positive 6–12 weeks after deployment-return was comparable to

services use in the 'non-screened' group and generally, identified screening to be ineffective. Specifically, 33% of the 207 individuals that screened positive and 36% of the 129 individuals in the control group who would have been considered positive screens reported a past-year mental health services use during follow-up. It is difficult to extrapolate these findings to the Canadian context because of the non-comparable way screening was operationalized in the study. These differences include the screening method employed (eg, the short time-to-screening relative to deployment-return, the sole use of self-administered instruments), the sometimes short and variable follow-up period (ie, 10–24 months after screening), and the low number with an apparent need for mental health services (ie, low power to detect differences). Consequently, the UK findings do little to inform on the value of Canada's post-deployment screening programme within its system of care.

In contrast, our study is the first to demonstrate a substantial reduction in the delay to diagnosis of deployment-related mental disorders that was associated with mass screening. As expected, this effect was driven by the outcome of screening. When service members had an apparent need for mental health services, a positive screening was associated with a shorter delay to care relative to non-screeners; however, individuals who screened negative did not have this benefit.

Limitations

The primary limitation of our study relates to it being a retrospective observational study and its reliance on administrative data. It is possible that, although we assessed and controlled for several potential confounders, other unmeasured characteristics that were associated with screening status may have had an influence on our findings. For example, although post-deployment screening is mandatory (but not fully enforced) it is possible that individuals with more symptomology had received greater encouragement to screen and consequently, such individuals may have been more motivated to seek care. However, a fraction of the motivated care-seekers with high symptomology would have been

directed to care rather than initially screening and among those who screened, such individuals would have still benefitted from screening as the means that aided their expedited care-seeking.

Additionally, we limited our investigation to individuals with a mental disorder diagnosis that was deployment-related, raising the possibility of limited generalisability to screened individuals with mental health concerns that were not related to a prior deployment. While it's possible that some individuals with non-deployment related disorders may have had care management facilitated by screening, the study was not designed to assess this. Finally, it is possible that some deployment-related attribution errors were made; however, clinicians in the CAFs mental health system, particularly those in the Operational Trauma and Stress Support Centres, routinely evaluate for such an attribution during the diagnostic assessment and it is expected that any errors would have been randomly distributed between screened and non-screened groups.

Interpretation

The CAFs post-deployment screening programme, with its focus on facilitating early care-seeking, has been in operation since 2002 yet there has been very little data available to assess whether it has had an influence on care-seeking. In the intervening period the CAF has attempted to remove barriers to seeking mental health care by building a comprehensive outpatient mental health clinical programme and it addressed stigma through a variety of programmes such as the Road to Mental Readiness.[16] Some have questioned whether post-deployment screening has outlived its usefulness in this augmented setting—could these other efforts facilitate earlier care-seeking without screening. Indeed, we did observe that a small fraction of individuals were diagnosed either prior to the recommended screening window (6.5%) or prior to the eventual completion of their mandatory screening (3.0%). However, the collective prevalence of this early care-seeking that occurred before

screening was sufficiently low in the study population that its occurrence does not negate our observed screening benefit.

We found that screening was strongly associated with a shortened delay to a definitive mental disorder diagnosis and this is aligned with the primary objective of post-deployment screening; however, there is little evidence available that quantifies what an optimal delay threshold should be in order to improve clinical outcomes. Nonetheless, several beneficial individual and organisational outcomes have been implied or found to be associated with shorter delays to care: a greater likelihood of symptom improvement,[18] more favourable occupational outcomes,[19] reduced health services costs,[20] and a reduced risk of individuals developing additional health problems and impairments to interpersonal and work-related functioning.[21] Such benefits are consequential and reinforce the value of screening.

Our findings also reinforce what has been proposed by others, that the net effectiveness of a screening programme is largely dependent on a series of events occurring as planned.[22] The core components of what has been proposed includes: 1) a target group that is sufficiently compliant with screening; 2) participants that are able to recognise and honestly disclose their symptoms and impairments during screening; 3) screening tools that have good sensitivity and specificity; 4) clinicians that accurately interpret the screening tools and participants' reported symptoms to make sound follow-up recommendations; and 5) participants that follow through, adhering to the recommended services. At this point we have not determined whether all of these components of the CAFs programme are performing as intended. However, it is highly likely that some of them are not. For example, compliance with the screening requirement is suboptimal. A related study found that only 67% of members returning from deployment completed a screening, and only 43% did so within the recommended post-deployment timeframe. We also observed some incongruence between the

assessment results and follow-up recommendations: 36.2% of those with a 'major' mental health concern identified at screening had no mental health services follow-up recommended by clinicians who conducted the screening interview, yet this could not be explained by individuals already being in some form of mental health care at the time of screening. This warrants a closer examination of clinician decisions that are made as a result of a service member's screening interview, specifically regarding their follow-up recommendations; if screening identifies an issue but there is no follow-up recommended by the clinician then screening falls short of its intended benefit of optimally shortening the delay to care.

The implementation of any large scale health intervention will be imperfect. Consequently, our findings reflect the operationalisation of a post-deployment screening programme in real world conditions. Benefits associated with a shortened delay to care are anticipated (ie, symptom improvement, occupational retention, treatment cost-reduction, reduced risk of further impairments, and quality of life) but this is reliant on an unbroken series of screening events occurring as planned. Moreover, the full potential of such a programme can only be realised when all of its components function as intended. Further work that delves into these elements and their optimisation is warranted.

Conclusions

The CAF and other military organisations have invested in post-deployment screening programmes in an effort to reduce delays to mental health care. These reductions are anticipated to result in beneficial outcomes for both the individual and the military organisation. Our study found that screening was associated with a shortened delay to diagnosis for mental disorders that were deployment-related; the median delay was shorter by almost one year. Further work to investigate optimising the screening process and its individual components is warranted.

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Contributors: DB had full access to all data in the study and takes responsibility for the integrity of the data and accuracy of the data analysis. DB is the guarantor and principal investigator of the study. DB wrote the initial draft of the manuscript and both DB and BG contributed to the interpretation of the results as well as the writing and revising of the manuscript. DB and BG have read and agree with the manuscript's final content.

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Data sharing: No additional data available.

Transparency: The lead author (the manuscript's guarantor) affirms that the manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any relevant discrepancies from the study (and, if relevant, registered) have been explained.

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Figure 1: Cumulative proportion of mental disorder diagnoses that were identified as time since deployment return increased, and by post-deployment screening status, among service members with a mental disorder that was deemed deployment service-related.

Table 1: Summary of Sociodemographic, Military and Clinical Characteristics by Screening Status.

	Not Screened		Screened		Overall	
	Sample n/ Weighted N	% (95% CI)	Sample n/ Weighted N	% (95% CI)	Sample n/ Weighted N	% (95% CI)
Age category[a]						
19-24	20/ 34	3.2 (2.0 to 4.3)	94/ 539	17.3 (12.0 to 22.6)	114/ 573	13.[illegible] (9.7 to 17.7)
25-34	169/ 386	36.1 (29.0 to 43.2)	287/ 1372	44.0 (38.0 to 50.0)	456/ 1758	42.[illegible] (37.2 to 46.8)
35-44	186/ 407	38.0 (30.8 to 45.2)	225/ 870	27.9 (23.6 to 32.2)	411/ 1277	30.[illegible] (26.7 to 34.3)
45-60	107/ 243	22.7 (15.6 to 29.8)	69/ 336	10.8 (7.0 to 14.6)	176/ 579	13.[illegible] (10.5 to 17.2)
Sex						
Female	49/ 85	8.0 (6.0 to 10.0)	74/ 302	9.7 (6.5 to 12.8)	123/ 388	9.[illegible] (6.9 to 11.6)
Male	433/ 985	92.0 (90.0 to 94.0)	601/ 2815	90.3 (87.2 to 93.5)	1034/ 3799	90.[illegible] (88.4 to 93.1)
First official language						
English	333/ 736	68.8 (63.1 to 74.5)	464/ 2197	70.5 (65.0 to 76.0)	797/ 2934	70.[illegible] (65.8 to 74.4)
French	149/ 334	31.2 (25.5 to 36.9)	211/ 920	29.5 (24.0 to 35.0)	360/ 1253	29.[illegible] (25.6 to 34.2)
Marital status[a]						
Married/ common law	360/ 826	77.2 (71.4 to 83.0)	449/ 1978	63.5 (57.6 to 69.4)	809/ 2805	67.[illegible] (62.3 to 71.7)
Divorces/separated/ widowed	53/ 91	8.5 (5.9 to 11.1)	77/ 260	8.3 (6.1 to 10.6)	130/ 351	8.[illegible] (6.6 to 10.2)
Single	69/ 153	14.3 (9.0 to 19.6)	149/ 879	28.2 (22.4 to 34.0)	218/ 1032	24.[illegible] 20.1 to 29.2)
Rank category[b]						
JNCM	286/ 647	60.4 (53.2 to 67.7)	456/ 2167	69.5 (64.5 to 74.6)	742/ 2814	67.[illegible] (63.0 to 71.5)
SNCM	125/ 243	22.7 (18.0 to 27.4)	159/ 667	21.4 (17.0 to 25.8)	284/ 910	21.[illegible] (18.3 to 25.2)
Officer	71/ 180	16.9 (10.1 to 23.6)	60/ 283	9.1 (5.4 to 12.8)	131/ 463	11.[illegible] (7.7 to 14.4)
Years of military service[a]						
<5 years	30/ 74	6.9 (2.1 to 11.7)	147/ 936	30.0 (24.7 to 35.3)	177/ 1010	24.[illegible] (19.9 to 28.3)
5 to 9 years	135/ 340	31.8 (24.3 to 39.3)	224/ 870	27.9 (23.2 to 32.6)	359/ 1210	28.[illegible] (24.8 to 33.0)
10 to 19 years	192/ 408	38.1 (31.3 to 44.9)	200/ 826	26.5 (21.7 to 31.3)	392/ 1234	29.[illegible] (25.6 to 33.4)
≥20 years	125/ 248	23.2 (17.4 to 29.0)	104/ 485	15.5 (11.3 to 19.8)	229/ 733	17.[illegible] (14.0 to 21.0)
Component						
Regular Force	456/ 996	93.1 (88.2 to 98.0)	639/ 2819	90.4 (86.0 to 94.9)	1095/ 3815	91.[illegible] (87.6 to 94.6)
Reserve Force	26/ 74	6.9 (2.0 to 11.8)	36/ 298	9.6 (5.1 to 14.0)	62/ 372	8.[illegible] (5.4 to 12.4)
Service[a]						
Army	328/ 801	74.9 (70.0 to 79.8)	562/ 2701	86.7 (83.5 to 89.8)	890/ 3502	83.[illegible] (81.1 to 86.2)
Air Force	91/ 155	14.5 (10.9 to 18.1)	92/ 351	11.3 (8.2 to 14.3)	183/ 506	12.[illegible] (9.7 to 14.5)
Navy	63/ 114	10.6 (7.4 to 13.9)	21/ 65	2.1 (1.3 to 2.9)	84/ 179	4.[illegible] (3.3 to 5.2)
Combat arms occupation[a]						
No	385/ 843	78.8 (72.9 to 84.6)	416/ 1921	61.6 (55.5 to 67.8)	801/ 2764	66.[illegible] (61.2 to 70.9)
Yes	97/ 227	21.2 (15.4 to 27.1)	259/ 1196	38.4 (32.2 to 44.5)	356/ 1423	34.[illegible] (29.1 to 38.8)
Deployment location[a]						
Other	74/ 188	17.5 (11.3 to 23.8)	13/ 44	1.4 (0.7 to 2.1)	87/ 232	5.[illegible] (3.7 to 7.4)
Afghanistan	408/ 882	82.5 (76.2 to 88.7)	662/ 3073	98.6 (97.9 to 99.3)	1070/ 3955	94.[illegible] (92.6 to 96.3)
Deployment length						
≤180 days	149/ 311	29.1 (22.6 to 35.5)	137/ 693	22.2 (16.8 to 27.7)	286/ 1005	24.[illegible] (19.7 to 28.3)

>180 days	333/ 759	70.9 (64.5 to 77.4)	538/ 2424	77.8 (72.3 to 83.2)	871/ 3182	76.6 (71.7 to 80.3)
A past mental health problem						
No	416/ 927	86.6 (81.6 to 91.7)	607/ 2851	91.5 (88.5 to 94.4)	1023/ 3778	90.7 (87.6 to 92.8)
Yes	66/ 143	13.4 (8.3 to 18.4)	68/ 266	8.5 (5.6 to 11.5)	134/ 409	9.3 (7.2 to 12.4)
Disorder Case-mix[a,c]						
Depressive disorder Only	24/ 40	3.8 (2.5 to 5.0)	42/ 227	7.3 (3.9 to 10.6)	66/ 267	6.2 (3.8 to 8.9)
'Other' mix-no PTSD	50/ 146	13.7 (7.0 to 20.3)	68/ 341	10.9 (6.8 to 15.1)	118/ 487	11.6 (8.1 to 15.2)
PTSD Only	75/ 214	20.0 (13.0 to 27.0)	113/ 624	20.0 (15.1 to 24.9)	188/ 838	20.6 (15.9 to 24.1)
PTSD and depressive disorder only	121/ 251	23.4 (17.2 to 29.6)	120/ 417	13.4 (10.5 to 16.3)	241/ 668	16.6 (13.2 to 18.7)
PTSD and 'other' mix	162/ 328	30.7 (24.5 to 36.8)	257/ 1083	34.8 (29.1 to 40.5)	419/ 1411	33.2 (29.2 to 38.2)
Single 'other'	50/ 91	8.5 (5.8 to 11.2)	75/ 425	13.6 (9.0 to 18.3)	125/ 515	12.4 (8.7 to 15.9)
Any PTSD						
No	124/ 277	25.9 (19.1 to 32.7)	185/ 993	31.8 (26.0 to 37.7)	309/ 1270	30.8 (25.7 to 35.0)
Yes	358/ 793	74.1 (67.3 to 80.9)	490/ 2124	68.2 (62.3 to 74.0)	848/ 2917	69.2 (65.0 to 74.3)
DSM IV or V						
IV	334/ 625	58.4 (50.9 to 66.0)	439/ 1759	56.4 (51.1 to 61.8)	773/ 2385	57.2 (52.7 to 61.2)
V	10/ 15	1.4 (0.8 to 2.1)	22/ 118	3.8 (1.1 to 6.5)	32/ 133	3.2 (1.2 to 5.2)
Not specified	138/ 429	40.1 (32.5 to 47.7)	214/ 1240	39.8 (34.1 to 45.4)	352/ 1669	39.5 (35.4 to 44.3)
Relevant general medical condition indicated						
No	255/ 671	62.7 (56.7 to 68.7)	381/ 2003	64.2 (59.2 to 69.3)	636/ 2673	63.8 (59.9 to 67.8)
Yes	227/ 399	37.3 (31.3 to 43.3)	294/ 1114	35.8 (30.7 to 40.8)	521/ 1514	36.2 (32.2 to 40.1)
Post-deployment screening status						
Not screened					482/ 1070	25.1 (22.2 to 28.9)
Screened					675 /3117	74.9 (71.1 to 77.8)

[a]Significant at P≤0.05

[b]Significant at 0.05<P≤0.10

[c]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

Table 2: Median delay to care for assessed sociodemographic, military and clinical characteristics and their unadjusted association with delay to care.

	Sample n/ weighted N	Median delay (days) to care (inter-quartile range)	Wald chi-square P-value	Unadjusted HR (95% CI)	HR p-value
Age category[b]					
19-24	114/ 573	642 (401 to 1397)	0.0741	0.82 (0.56 to 1.19)	0.2901
25-34	456/ 1758	783 (381 to 1490)		0.66 (0.47 to 0.92)	0.0150
35-44	411/ 1277	815 (333 to 1654)		0.70 (0.50 to 0.99)	0.0429
45-60	176/ 579	709 (261 to 959)		Reference	
Sex[a]					
Female	123/ 388	437 (190 to 1027)	0.0118	1.41 (1.08 to 1.85)	0.0118
Male	1034/ 3799	829 (369 to 1521)		Reference	
First official language					
English	797/ 2934	739 (328 to 1475)	0.539	Reference	
French	360/ 1253	852 (406 to 1511)		0.93 (0.75 to 1.17)	0.539
Marital status					
Married/ common law	809/ 2805	908 (342 to 1624)	0.1103	Reference	
Divorces/separated/ widowed	130/ 351	642 (302 to 1268)		1.24 (0.90 to 1.70)	0.1995
Single	218/ 1032	636 (376 to 1220)		1.32 (1.00 to 1.74)	0.0518
Rank category					
JNCM	742/ 2814	773 (379 to 1497)	0.8911	Reference	
SNCM	284/ 910	830 (340 to 1427)		1.07 (0.79 to 1.45)	0.658
Officer	131/ 463	630 (224 to 1269)		1.06 (0.68 to 1.64)	0.7995
Years of military service					
<5 years	177/ 1010	849 (406 to 1425)	0.4003	0.81 (0.56 to 1.16)	0.2463
5 to 9 years	359/ 1210	754 (384 to 1568)		0.76 (0.54 to 1.07)	0.1216
10 to 19 years	392/ 1234	843 (326 to 1554)		0.76 (0.53 to 1.09)	0.1348
≥20 years	229/ 733	540 (262 to 1248)		Reference	
Component					
Regular Force	1095/ 3815	816 (368 to 1497)	0.6939	Reference	0.6939
Reserve Force	62/ 372	406 (190 to 891)		1.16 (0.55 to 2.45)	
Service					
Army	890/ 3502	782 (362 to 1476)	0.9669	Reference	
Air Force	183/ 506	727 (349 to 1521)		1.01 (0.77 to 1.31)	0.9599
Navy	84/ 179	489 (203 to 1074)		1.09 (0.56 to 2.11)	0.7957
Combat arms occupation					
No	801/ 2764	743 (320 to 1459)	0.7807	Reference	
Yes	356/ 1423	805 (404 to 1546)		0.96 (0.75 to 1.25)	0.7807
Deployment location[a]					
Other	87/ 232	719 (341 to 1160)	0.0497	Reference	
Afghanistan	1070/ 3955	769 (345 to 1476)		0.80 (0.64 to 1.00)	0.0497
Deployment length					
≤180 days	286/ 1005	847 (442 to 1476)	0.4996	Reference	

>180 days	871/ 3182	741 (329 to 1447)		0.92 (0.73 to 1.16)	0.4996
Post-deployment era[a,c]					
2009-2011			0.0002	Reference	
2012-2014				0.87 (0.67 to 1.14)	0.3131
2015-2017				1.65 (1.08 to 2.53)	0.0211
A past mental health problem					
No	1023/ 3778	796 (368 to 1476)	0.1329	Reference	
Yes	134/ 409	589 (202 to 1347)		1.30 (0.92 to 1.84)	0.1329
Disorder Case-mix[a,e]					
Depressive disorder only	66/ 267	669 (276 to 1182)	0.0016	1.66 (1.10 to 2.52)	0.0172
'Other' mix-no PTSD	118/ 487	635 (352 to 1181)		1.47 (0.83 to 2.59)	0.1898
PTSD only	188/ 838	1127 (603 to 2018)		Reference	
PTSD and depressive disorder	241/ 668	825 (312 to 1289)		1.62 (1.29 to 2.02)	<.0001
PTSD and 'other' mix	419/ 1411	652 (341 to 1392)		1.45 (1.09 to 1.92)	0.0099
Single 'other'	125/ 515	563 (317 to 1219)		1.29 (0.82 to 2.03)	0.2761
Any PTSD					
No	309/ 1270	636 (327 to 1188)	0.5961	Reference	
Yes	848/ 2917	860 (370 to 1536)		0.92 (0.68 to 1.24)	0.5961
Relevant general medical condition indicated[a]					
No	636/ 2673	959 (449 to 1829)	<.0001	Reference	
Yes	521/ 1514	456 (260 to 947)		2.44 (2.03 to 2.95)	<.0001
Post-deployment screening status[a,c]					
Not screened	482/ 1070	928[d] (465 to 1547)	0.0345	Reference	
Screened	675 /3117	578[d] (209 to 1300)		1.33 (1.02 to 1.73)	0.0345

[a]Significant at P≤0.05

[b]Significant at 0.05<P≤0.10

[c]Handled as a time-dependent covariate.

[d]The median delay to care for post-deployment screening was taken from the Kaplan-Meier event probabilities that were generated taking into account this covariate's time-dependent nature.

[e]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

Table 3: Post-deployment screening summary findings and latency from deployment return to screening relative and screening to mental disorder diagnosis for screened individuals in the study population.

				Deployment return to screening (days)		Screening to diagnosis (days)	
	Sample n/ Weighted N	%	95% CI	Median	Inter-quartile range	Median	Inter-quartile range
Post-deployment screening status							
Not screened	482/ 1070	25.6	22.2 to 28.9	-	-	-	-
Screened	675/ 3117	74.4	71.1 to 77.8	151	121 to 187	603	193 to 1302
Overall	1157/ 4187	100		-	-	-	-
Mental health concern indicated							
'Major' concern	198/ 788	25.3	20.4 to 30.1	146	116 to 180	148	54 to 356
'Minor' only	220/ 1026	32.9	27.1 to 38.7	160	127 to 200	515	177 to 1288
None	257/ 1304	41.8	35.7 to 47.9	148	119 to 170	1097	581 to 1792
Mental health or other concern							
'Major' concern	293/ 1214	38.9	33.3 to 44.5	156	123 to 193	212	65 to 643
'Minor' only	221/ 1004	32.2	26.5 to 37.9	144	122 to 199	768	298 to 1413
None	161/ 899	28.9	22.8 to 34.9	150	119 to 166	1045	611 to 1612
Concern type indicated							
'Major' mental health concern	198/ 788	25.3	20.4 to 30.1	146	116 to 180	148	54 to 356
'Minor' mental health concern only	220/ 1026	32.9	27.1 to 38.7	160	127 to 200	515	177 to 1288
Physical health concern (no mental health)	71/ 297	9.5	6.2 to 12.9	132	126 to 195	1094	484 to 1417
'Other' concern (no mental or physical)	25/ 108	3.4	1.3 to 5.6	128	96 to 169	1623	869 to 1958
None	161/ 899	28.9	22.8 to 34.9	150	119 to 166	1045	611 to 1612
Any follow-up indicated							
Yes	392/ 1689	54.2	48.2 to 60.1	154	125 to 193	285	96 to 811
No	283/ 1428	45.8	39.9 to 51.8	149	118 to 174	1046	548 to 1567
Any mental health follow-up indicated							
Yes	222/ 940	30.2	24.8 to 35.5	155	121 to 193	230	71 to 618
No	453/ 2177	69.8	64.5 to 75.2	149	121 to 180	826	343 to 1524

Table 4: Proportional hazards modelling results for the assessment of the influence of post-deployment screening status and specific screening findings on delay to care.

	Adjusted HR[a]	95% CI	p-value
Age category			
19-24	0.81	(0.56 to 1.16)	0.2462
25-34	0.68	(0.52 to 0.88)	0.0043
35-44	0.76	(0.59 to 0.97)	0.0261
45-60	Reference		
Sex			
Female	1.25	(0.95 to 1.64)	0.1114
Male	Reference		
Marital status			
Married/ common law	Reference		
Divorces/separated/ widowed	1.24	(0.95 to 1.63)	0.1206
Single	1.32	(1.02 to 1.71)	0.0375
Deployment location			
Other	Reference		
Afghanistan	0.78	(0.59 to 1.03)	0.0782
Post-deployment era[b]			
2009 – 2011	Reference		
2012 – 2014	0.96	(0.74 to 1.24)	0.7623
2015 – 2017	2.00	(1.31 to 3.06)	0.0013
A past mental health problem			
No	Reference	(0.86 to 1.57)	0.3318
Yes	1.16		
Disorder case-mix[c]			
Depressive disorder only	1.47	(0.96 to 2.26)	0.0761
'Other' mix-no PTSD	1.50	(0.95 to 2.37)	0.0802
PTSD only	Reference		
PTSD and depressive disorder	1.49	(1.17 to 1.90)	0.0011
PTSD and 'other' mix	1.37	(1.06 to 1.78)	0.0166
Single 'other'	1.40	(0.92 to 2.15)	0.1178
Relevant general medical condition indicated			
No	Reference		
Yes	2.36	(1.94 to 2.87)	<.0001
Post-deployment screening status[b]			
Not screened	Reference		
Screened	1.43	(1.11 to 1.86)	0.0067
Screening findings			
Mental health concern indicated[b]			
'Major' concern	3.36	(2.38 to 4.73)	<.0001
'Minor' concern only	1.46	(1.08 to 1.99)	0.0152
None	0.98	(0.72 to 1.33)	0.8975
Not screened	Reference		

Mental health or other concern[b]			
'Major' concern	2.33	(1.73 to 3.13)	<.0001
'Minor' only	1.30	(0.97 to 1.74)	0.0750
None	1.01	(0.72 to 1.41)	0.9746
Not screened	Reference		
Concern type indicated[b]			
'Major' mental health concern	3.37	(2.39 to 4.75)	<.0001
'Minor' mental health concern only	1.47	(1.08 to 2.00)	0.0136
Physical health concern (no mental health)	1.13	(0.81 to 1.58)	0.4719
'Other' concern (no mental or physical health)	0.76	(0.45 to 1.29)	0.3049
None	0.97	(0.69 to 1.38)	0.8771
Not screened	Reference		
Any follow-up indicated[b]			
Yes	2.05	(1.55 to 2.71)	<.0001
No	1.04	(0.78 to 1.40)	0.7889
Not screened	Reference		
Any mental health follow-up indicated[b]			
Yes	2.35	(1.73 to 3.21)	<.0001
No	1.20	(0.91 to 1.59)	0.1912
Not screened	Reference		

[a]Adjusted for: age category, sex, marital status, deployment location, post-deployment era, a past mental health problem, disorder case-mix and relevant general medical condition. Covariates dropped from consideration: first official language, rank category, years of military service, component, service, combat arms occupation and deployment length.

[b]Handled as a time-dependent covariate.

[c]Depressive disorder includes either major depression or dysthymic disorder. The 'other' single disorders included non-PTSD anxiety disorders, mood disorders other than major depression and dysthymic disorder, adjustment disorder, somatoform disorder, substance-related disorders and substance-induced disorders; however, the 'other' mix disorders could also include major depression or dysthymic disorder.

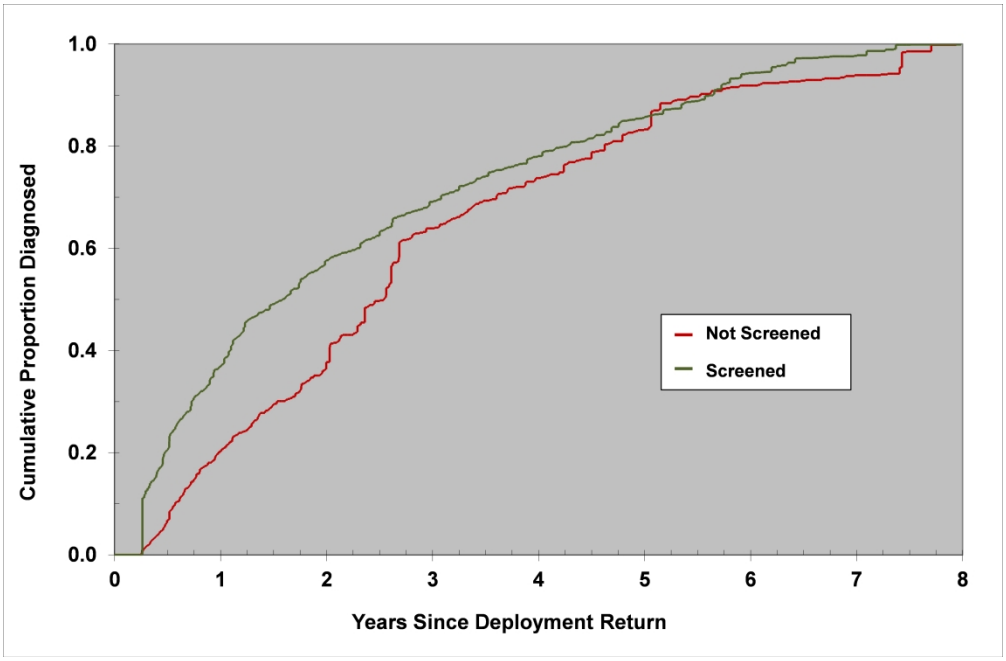

Figure 1: Cumulative proportion of mental disorder diagnoses that were identified among service members with a mental disorder that was deemed deployment service-related as time since deployment return increased; plotted by post-deployment screening status.

236x154mm (600 x 600 DPI)

STROBE Statement—Checklist of items that should be included in reports of ***cohort studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	4-5
Objectives	3	State specific objectives, including any prespecified hypotheses	5
Methods			
Study design	4	Present key elements of study design early in the paper	6-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	6-7
		(*b*) For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7-10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7-10
Bias	9	Describe any efforts to address potential sources of bias	10-12
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	8-12
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-12
		(*b*) Describe any methods used to examine subgroups and interactions	11-12
		(*c*) Explain how missing data were addressed	11
		(*d*) If applicable, explain how loss to follow-up was addressed	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	6-7
		(b) Give reasons for non-participation at each stage	6-7
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	12-13; and Table 1
		(b) Indicate number of participants with missing data for each variable of interest	11
		(c) Summarise follow-up time (eg, average and total amount)	13; Table 2
Outcome data	15*	Report numbers of outcome events or summary measures over time	13; Table 2
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and	13, 15-

		their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included (*b*) Report category boundaries when continuous variables were categorized (*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	16; Table 4 Table 4 14-16
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	18-19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	19-21
Generalisability	21	Discuss the generalisability (external validity) of the study results	18-19 and 21
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	22

*Give information separately for exposed and unexposed groups.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at http://www.strobe-statement.org.