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Mortality rates between treated post-traumatic stress disorder Israeli male veterans compared to non-diagnosed veterans

Joseph Zohar[a,*], Leah Fostick[b], on behalf of The Israeli Consortium on PTSD[1]

[a]*Department of Psychiatry, Sheba Medical Center, Tel Hashomer, and Sackler School of Medicine, Tel Aviv University, Israel*
[b]*Ariel University, Ariel, Israel*

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Abstract
The literature suggests that post-traumatic stress disorder (PTSD) is associated with increased mortality. However, to date, mortality rates amongst veterans diagnosed with post-traumatic stress disorder have not been reported for Israeli veterans, who bear a different profile than veterans from other countries. This study aims to evaluate age-adjusted mortality rates amongst Israeli Defense Forces veterans with and without PTSD diagnosis. The study was carried out in a paired sample design with 2457 male veterans with treated PTSD and 2457 matched male veterans without a PTSD diagnosis. Data on PTSD and non-PTSD veterans was collected from the Rehabilitation Division of the Israeli Ministry of Defense (MOD) and the Israeli Defense Forces' (IDF) special unit for treatment of combat stress reaction. Mortality data were collected from the Ministry of the Interior (MOI) computerized database. Comparison of mortality rates between PTSD and non-PTSD veterans was done using paired observations survival analysis by applying a proportional hazards regression model. Overall no statistically significant difference in mortality rates was found between veterans with treated PTSD and veterans without PTSD. These findings hold even when excluding veterans who died in battle and including non-PTSD veterans who died before their matched PTSD veteran was diagnosed. However, among pairs with similar military jobs PTSD group had significantly less mortality. The results of this large national cohort suggest that treated PTSD is not associated with increased mortality. We submit that the lack of this association represents the "net" pathophysiology of PTSD due to the unique characteristics of the sample.
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*Corresponding author. Tel.: +972 3530 3300; fax: +972 3535 2788.
E-mail address: jzohar@post.tau.ac.il (J. Zohar).

[1]The Israeli Consortium on PTSD includes: J. Zohar (chair), A. Bleich, Z. Kaplan, I. Katz, E. Klein, M. Kotler, A. Ohry, A.Y. Shalev, Z. Weissman

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1. Introduction

Post-traumatic stress disorder (PTSD) is a chronic and disabling disorder characterized by re-experiencing trauma suffered, avoidance of trauma-related stimuli, restricted affect, hypervigilance, and social isolation (American Psychiatric Association, 2013). PTSD has also been found to be linked to considerable physical comorbidity (Schnurr et al., 1998; Schnurr and Green, 2004) and increased all-cause mortality (Sareen et al., 2007) (see Table 1 for a review). Increased suicidal behaviors and attempts have been reported in anxiety disorders (Sareen et al., 2005), including PTSD (Pfeiffer et al., 2009).

To date, the majority of studies investigating mortality rates amongst those diagnosed with PTSD have been conducted on Vietnam combat veterans (Table 1) in comparison either with the general U.S. population (Bullman and Kang, 1994; Johnson et al., 2004), those stationed in Vietnam but serving in non-combat roles (Breslin et al., 1998), or U.S. veterans who did not participate in the Vietnam War (Breslin et al., 1998; Bullman and Kang, 1994; Centers for Disease Control, 1988; Fett et al., 1987; Lawrence et al., 1985; Sareen et al., 2005, 2007; Schnurr and Green, 2004; Thomas et al., 1991; Watanabe et al., 1991; Watanabe and Kang, 1995, 1996). These studies evince several confounding effects which are appropriate to be taken into consideration: (1) a priori differences between the veteran population in such a semi-mandatory conscription system as the U.S. Vietnam draft and the general population; (2) a selection bias reflecting the "healthy veteran" effect – i.e., comparison of mortality rates between a medically-selected group such as veterans and an unselected group such as the general population (Macfarlane et al., 2000; Seltzer and Jablon, 1974; Watanabe and Kang, 1995); and (3) the impact of the high comorbidity of alcohol and drug abuse amongst U.S. veterans with PTSD (Boscarino, 2008a).

The study aim is to evaluate age-adjusted mortality rates and causes of death amongst Israeli Defense Forces (IDF) veterans diagnosed and treated for PTSD in comparison with IDF veterans never diagnosed with PTSD. This cohort potentially differs from those reported in other studies in several ways. Firstly, since military service in Israel is both mandatory and prestigious, Israeli veterans might more accurately represent the general population than other countries where draftees do not come from all walks of life. Secondly, the selection of cohorts of veterans for both the PTSD and comparison groups should enable a better control of the selection bias deriving from the "healthy veteran" effect. Finally, in contrast to the 11% alcohol abstinence and 35% drinkers reported in Europe (Neumark et al., 2007), the Israel National Health Survey reports 40% alcohol abstinence and only 10% drinkers reporting three or more drinking episodes weekly. Since alcohol and drug use are less common in Israel – and thus also in Israeli veterans – this might help to minimize the potentially-confounding effect of these factors on mortality. We therefore propose that this unique sample is well suited for examining the issue of PTSD-related mortality amongst veterans.

2. Experimental procedures

2.1. Data collection

The study was part of a survey designed to analyze and characterize Israeli veterans with PTSD who were referred either to the Rehabilitation Division of the Israeli Ministry of Defense (MOD) or to the Israeli Defense Forces' (IDF) special unit for treatment of combat stress reaction. In the survey – conducted between 2000 and 2001 – all the charts from the seven MOD rehabilitation branches and the single IDF center were screened. In this sample, all index participants were veterans who died between 1957 and 2002. The age of death ranged from 22 to 89. The PTSD veterans experienced a traumatic incident either during their mandatory (age 18–21) or reserve service (age 21–45) between 1948 and 2000. Traumatic experiences included: combat action (81.2%), accidents during routine work or training (5.2%), traffic accidents (6.6%), terror attacks (4.0%), and other events (3.0%). The survey covered all the records relating to any psychiatric diagnoses – 5871 in number, constituting 91% of the existing records of the entire population of those diagnosed with any psychiatric disorder between 1948 and 2000. A diagnosis of PTSD was found for 2463 files. As the number of female veterans in the PTSD group was very low ($n=6$) and their trauma history not combat related, we confined the sample to males. The total number of PTSD files in the current study was 2457, comprising all the files surveyed for male veterans who met the DSM-IV criteria for PTSD. According to power analysis, this sample size is sufficient to detect differences as small as 3% in mortality rates at 93% power.

Although PTSD diagnosis exists in some of the files, it was reevaluated for all by surveyors on the basis of the veterans' charts using DSM-IV criteria (American Psychiatric Association, 1994) – i.e., the person had been exposed to a traumatic event and evidenced at least one symptom of re-experiencing, three avoidance/numbing symptoms, and two symptoms of hyper-arousal. The surveyors were 32 psychology students in the final year of their undergraduate studies, who were given specific training in the diagnosis of PTSD. The surveyors were overseen by senior, well-informed supervisors who reevaluated 50% of the files randomly during the first two months for each surveyor, and 25% at subsequent stages. Inter-rater reliability between the surveyors' and the supervisors' diagnoses was found to be within the acceptable range (kappa=.77). The data were first coded into data sheets and then entered into a computerized database.

Non-PTSD veterans were matched with PTSD veterans in accordance with their draft identification number. To each PTSD participant, a draftee with a sequential army identification number who did not apply to the MOD or IDF centers for either recognition or psychiatric treatment was assigned. This procedure ensured an identical draft period and age/sex correspondence. To some extent it also ensured the matching of other background variables – such as education and socioeconomic characteristics, since soldiers of the same sex, age, and location being drafted in groups. Sequential draft identification numbers also indicate matched physical characteristics, those with similar abilities being placed in the same units.

Veterans with PTSD did not differ from non-PTSD veterans in age, sex, socio-economic status, or draft-board assessment (Zohar et al., 2011). The study cohort was comprised of a total of 2457 male veterans with PTSD and an equal number of matched non-PTSD veterans. The analysis thus included 4914 participants – more cases than in a previous publication (Zohar et al., 2011) due to the fact that no missing data limitations applied to this study.

The analysis was conducted in 2005 and included a snap-shot collection of mortality data obtained from the Ministry of the Interior's (MOI) computerized database which, by law, covers the

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