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BRIEF COMMUNICATION

The impact of posttraumatic stress disorder on upper gastrointestinal investigations in Australian Defence Force veterans: a retrospective review

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Abstract

Veterans with posttraumatic stress disorder (PTSD) commonly exhibit associated gastrointestinal (GI) symptoms. We compared upper GI endoscopy and abdominal ultrasound rates in veterans with and without PTSD. Veterans with PTSD were 77–81% more likely to undergo these procedures than those without PTSD. PTSD symptomatology influences GI investigation rate and more emphasis on clinician and patient education is recommended regarding stress-related gut symptoms.

Posttraumatic stress disorder (PTSD) is a debilitating psychiatric condition that can develop following exposure to a traumatic event and is highly prevalent in Australian veterans.[1]

The psychological effects of PTSD may also be associated with numerous physical comorbidities, including gastrointestinal (GI) conditions such as gastroesophageal reflux, peptic ulcer disease, irritable bowel syndrome (IBS) and fatty liver disease, as shown in Vietnam veterans with PTSD.[2]

Other commonly reported risk factors for gastroesophageal reflux, peptic ulcer disease, IBS and fatty liver disease include poor lifestyle factors, such as obesity, smoking and excess alcohol consumption.[3–5] These poor health behaviours, as well as poor diet and physical inactivity, are more prevalent in veterans than in civilian populations, and veterans are also more likely to be obese than civilian populations.[6] Symptoms that may be present in these conditions include upper abdominal pain, nausea, dyspepsia and vomiting, which impact on the need for investigations with upper endoscopy or abdominal ultrasound (US).

We recently reported that veterans with PTSD were up to 81% more likely to undergo colonoscopy than veterans without PTSD.[7] In light of this observation, we were interested in determining whether a diagnosis of PTSD also impacted the utilisation of upper abdominal investigations in veterans with PTSD and quantifying this impact.

The study was approved by the Departments of Defence and Veterans' Affairs Human Research Ethics Committee, Canberra, Australia (111-19). The Department of Veterans' Affairs (DVA) is a department of the Australian Government that provides support and services for the veteran population, including pathways and funding of care. We reviewed the case records of male ex-service personnel over the age of 50 years who accessed health services funded by DVA (Gold card) from 1 January 2013 until 31 December 2018. The presence or absence of PTSD and the number of endoscopic investigations and abdominal US scans according to the Medical Benefits Schedule item numbers 30473 and 55036 respectively were noted. The presence of other reported medical conditions of anxiety, depression, diabetes, alcohol dependence, obesity, liver disease, gastric malignancy and respiratory disorders was recorded. The number of these procedures conducted on each patient was determined by linking the participant's DVA number with the relevant item numbers.

The number of investigations was regressed on a binary PTSD diagnosis variable (1 if present; 0 otherwise). Controls included binary variables that represent 5-year age categories (age 50–54 years as the reference

Conflict of interest: None.

category) and any coexistence of other medical conditions. A Charlson-type index was constructed as a count of the number of other conditions present (excluding those included as controls). The dependent variable was the total number of endoscopies and abdominal USs. To control for the effects of age and comorbidities, we specified negative binomial (NB) models for each outcome of interest. The results from the estimated NB models are presented as incident rate ratios (IRRs), representing the estimated change in the rate of the dependent variable for a one-unit change in the specific covariate.

The total number of patients in the cohort was 138 471. Of these, 20.23% ($n = 28\,018$) had a diagnosis of PTSD. All patients were men, and 36.6% were in the greater than 75 years of age category, followed by 19.8% of the cohort in the 65- to 69-year age category (Table S1). Of the total cohort, 13.95% ($n = 19\,310$) had undergone at least one endoscopy and 13.74% ($n = 19\,020$) had undergone at least one abdominal US. Procedures were more common in veterans with PTSD than those without: 26.28% (7362/28 018) of veterans with PTSD underwent at least one endoscopy over the 5-year study period, whereas only 10.82% (11 948/110 453) of veterans without PTSD underwent at least one of these procedures. In the 5-year study period, 22.82% (6393/28 018) of veterans with PTSD underwent at least one abdominal US, whereas only 11.43% (12 627/110 453) of veterans without PTSD underwent at least one of these procedures. Of those with PTSD, 24.85% had between one and three endoscopic investigations and 21.65% had between one and three abdominal USs, whereas, of those without PTSD, 10.47% had between one and three endoscopic investigations and 11.05% had between one and three abdominal USs. Table 1 outlines, in incremental categories, the number of procedures for the total cohort and for those with and without PTSD.

The IRRs of primary interest for the two regressions are reported in Table 2, on the effect of PTSD. With the exception of obesity and gastric malignancy for abdominal US, all IRRs are statistically significant and substantially larger than unity, suggesting that PTSD is associated with more endoscopic investigations and abdominal USs, all other things being equal. Although controlling for age and comorbidities as described above, the effect remains empirically large: the IRRs on the PTSD variable are between approximately 1.77 and 1.81, indicating that veterans with PTSD experience endoscopy and abdominal US rates that are 77–81% greater than those without diagnosed PTSD. Furthermore, with the exception of gastric malignancy, it can be seen that upper GI investigations are increasing functions of age up to the age group between 70 and 74 years and also increasing in the presence of most comorbidities.

Discussion

PTSD is commonly associated with GI symptoms, such as upper abdominal pain, nausea, dyspepsia and vomiting, which may require investigations with upper endoscopy and/or abdominal US. This study investigated the impact of PTSD on the upper GI investigation rate in a large cohort of older Australian male veterans and showed that these procedures were much more common in veterans with PTSD than those without. Approximately 24.85% of veterans with PTSD underwent at least one endoscopy, compared with 10.47% of those without PTSD, whereas 21.65% of veterans with PTSD underwent at least one abdominal US, compared with 11.05% of veterans without PTSD. Veterans with PTSD were 77–

Table 1 Number of patients who had X procedures (upper GI endoscopies and abdominal USs), in increasing numerical categories, described for the total cohort and for those with and without PTSD

Number of procedures	Total cohort, $n = 138\,471$	PTSD, $n = 28\,018$	Without PTSD, $n = 110\,453$
Upper GI endoscopies (%)			
0	119 161 (86.05)	20 656 (73.72)	98 505 (89.18)
1–3	18 521 (13.37)	6962 (24.85)	11 559 (10.47)
4–6	654 (0.5)	340 (1.21)	314 (0.28)
7–9	83	36	47
10+	52	24	28
Abdominal ultrasound scans, (%)			
0	119 451 (86.28)	21 625 (77.18)	97 826 (88.57)
1–3	18 275 (13.19)	6066 (21.65)	12 209 (11.05)
4–6	601 (0.43)	247 (0.88)	354 (0.32)
7–9	90	45	45
10+	54	35	19

GI, gastrointestinal; PTSD, posttraumatic stress disorder; US, ultraound.

Table 2 Effect of PTSD and comorbidities on upper GI investigative procedures and abdominal USs among Australian military veterans: IRRs from negative binomial models

Variables	Abdominal US	Upper GI endoscopy
PTSD diagnosis	1.772***	1.808***
	(0.0402)	(0.0393)
Age 55–59 years	1.637***	1.561***
	(0.118)	(0.0944)
Age 60–64 years	2.795***	3.153***
	(0.175)	(0.164)
Age 65–69 years	3.473***	4.163***
	(0.214)	(0.216)
Age 70–74 years	4.469***	5.444***
	(0.289)	(0.299)
Age 75+ years	3.921***	2.858***
	(0.232)	(0.146)
Anxiety	1.329***	1.319***
	(0.0362)	(0.0346)
Depression	1.482***	1.606***
	(0.0465)	(0.0438)
Diabetes	1.267***	1.393***
	(0.0578)	(0.0642)
Alcohol dependency	1.315***	1.190***
	(0.0405)	(0.0333)
Respiratory illness	1.181***	1.137***
	(0.0401)	(0.0411)
Obesity	1.148	1.117
	(0.222)	(0.174)
Liver disease	4.628***	2.484***
	(1.091)	(0.424)
Gastric malignancy	0.964	0.836***
	(0.0461)	(0.0423)
Charlson Index	1.082***	1.126***
	(0.00635)	(0.00645)
Charlson Index squared	0.998***	0.997***
	(0.000417)	(0.000394)
lnalpha	3.067***	2.986***
	(0.0653)	(0.0630)
Constant	0.0374***	0.0352***
	(0.00217)	(0.00171)
Observations	138 465	138 465

Data in parentheses are robust standard errors.

***$P < 0.01$.

GI, gastrointestinal; IRR, incident rate ratio; PTSD, posttraumatic stress disorder; US, ultrasound.

81% more likely to undergo endoscopy and abdominal US than those without a diagnosis of PTSD. This finding is comparable to patterns of utilisation of colonoscopy in this population.[7]

Our results strengthen a large body of evidence demonstrating that individuals with PTSD use medical health services to a greater extent than those without PTSD. In a study examining the medical care costs of Australian Vietnam veterans, Marshall *et al.*[8] found that a diagnosis of PTSD was associated with medical care costs 60% higher than average, which was partly associated with higher treatment costs for physical conditions in those with PTSD and comorbid mental health conditions, such as depression and anxiety. Also similar to our results, major predictors of medical care costs were age and number of reported diagnoses. In a more contemporary study of combat soldiers undertaken postdeployment to Iraq, 16.6% were diagnosed with PTSD. Significant associations were found between PTSD and lower self-ratings of general health, more sick call visits, more missed work days, more physical symptoms and high somatic symptom severity.[9]

A possible explanation for increased upper GI investigations in veterans with PTSD is a bidirectional relationship between PTSD and GI conditions. For those with PTSD and gut symptoms, chronic stress and hyperarousal due to trauma exposure may trigger sympathetic nervous system responses that lead to altered GI motility and symptoms such as cramping and pain.[10] These symptoms may then increase vagal afferent input from the enteric nervous system to the central nervous system, resulting in a positive feedback cycle.[11] There is increasing evidence that trauma-related symptoms are associated with an increased likelihood of developing symptom-based syndromes without identifiable physical causes, such as irritable bowel disease,[12] which often responds poorly to medical treatment. In fact, psychological interventions, such as Mindfulness-Based Stress Reduction, have been shown to reduce IBS, PTSD, depression and GI symptom–specific anxiety in veterans with both PTSD and IBS.[13]

This study has some limitations to be considered. Only male veterans were included in this analysis, as there were so few female veterans in the age group under study; hence, results cannot be generalised to include women. The database did not provide information regarding a veteran's access to endoscopic services, which may influence the uptake and frequency of these services in some individuals, and the study was restricted to veterans entitled to DVA-funded services for all health conditions, whether they were related to military service or not. Our data set did not provide any details on the outcomes of the investigations; hence, our study can only provide information on the link between PTSD and the frequency of investigations. In summary, this study shows that a diagnosis of PTSD has an impact on the utilisation of upper endoscopy services in Australian male veterans, indicating that those with PTSD are 77–81% more likely to undergo these procedures than those without PTSD. This may reflect the ongoing nature and poor response to medical treatment of gut symptoms that often occur in patients with PTSD or, in part, limited clinician awareness of the association between PTSD and gut symptoms. More

clinician and patient education regarding the clinical symptoms of PTSD, further research on the pathophysiological basis of the gut symptoms, as well as an exploration of adjunctive psychological interventions to address these symptoms are recommended.

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Supporting Information

Additional supporting information may be found in the online version of this article at the publisher's web-site:

Table S1. Number and percentage of participants in each age category* for the total cohort of participants, and for those with and without PTSD.